ABSTRACTS OF THE IV LATIN AMERICAN CONGRESS ON BIOMEDICAL ENGINEERING, CLAIB2007, *Bioengineering Solution For Latin America Health*
Margarita Island, Venezuela, September 24th through 28th, 2007

RESUMENES DEL IV CONGRESO LATINOAMERICANO DE INGENIERIA BIOMEDICA, CLAIB2007, *Soluciones de Bioingeniería para la salud en América Latina.*
Isla de Margarita, Venezuela, del 24 al 28 de Septiembre de 2007

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CONFERENCE PROGRAM

Wednesday, September 26						
8:00 - 9:00	Conference Innauguration: Dr. Renato Gusmao - OPS, Presidencia Venezuela, Gobernación Nva. Esparta Chairman: Ricardo Silva, Ricardo Bravo					
9:00 - 10:00	Dr. Makoto Kikuchi, Dr. Ratko Magjarevic, Dr. Shankar M. Krishnan Meet the IFMBE officers - Which direction the IFMBE should go from now. Chairman: Carmen Müller-Karger					
10:00 - 10:30	coffee Break					
	ROOM 1	**ROOM 2**	**ROOM 3**	**ROOM 4**	**ROOM 5**	**POSTER**
	SE -SIG 1 G Gentiletti/ O Yanez	MR-CLI\ S Swaby	MR - HEA Saide Calil	**Student Award** P Bonato/ G Pasariello/ F Azuaje	**SE-CLI 1** EB Rodriguez Denis / R Garcia	
10:30 - 10:45	370			36	402	
10:45 - 11:00	371			73	403	
11:00 - 11:15	369			164	404	
11:15 - 11:30	299			268	103	
11:30 - 11:45	372			339	360	
11:45 - 12:00						
12:00 - 13:45	Lunch					
13:45 - 14:45	Dr. Paolo Bonato, USA, Rehabilitation Engineering, Chairman : Ratko Magjarevic					
14:45 - 15:00	Break					
	ST- SIG 1 F Pessana/ M.Diaz	**ST-IMA 1** J Payan/ A La Cruz	**ST-REH** L Vilcahuaman/ J Folgueras	**Young Investigator** A Hernandez/ J Demongeot/ F Infantosi	**ST- CLI 1** S Llanuza/ R González	FIS (16,27,46,327,328), MAT(144, 359,374,382), HEA(21, 63,123,168,235, 250,262,296,317 , 377, 411)
15:00 - 15:15	60	77	64	102	24	
15:15 - 15:30	140	78	71	151	32	
15:30 - 15:45	222	112	94	210	82	
15:45 - 16:00	244	174	150	238	203	
16:00 - 16:15	277	175	189	301	252	
16:15 - 16:30	304		227	366	393	
16:30 - 17:00	coffee Break					
	ST-INF F Azuaje/ JL Ramirez	**SE-IMA** M Torres-Cisneros / V. Ayala-Ramírez	**ST-INS 1** J Cruz/ G Villegas	**SE - INS** M Cadena / O. Infante	MR-CLI Luis Lara	POSTER AWARDS. BEST STUDENT (192, 143, 211, 341, 354, 86) BEST YOUNG INV. (147, 338, 90,182, 183, 206)
17:00 - 17:15	25	398	14	395		
17:15 - 17:30	307	399	19	396		
17:30 - 17:45	310	400	23	397		
17:45 - 18:00	378	401	380	72		
18:00 - 18:15	96	98	388	108		
20:00	Welcome Cocktail by CORAL					

Thursday, September 27						
8:00 - 9:00	Dr. Pablo Laguna, Spain Biomedical Signal Processing, Chairman: Sara Wong					
9:00 - 10:00	Dr. Alfredo Hernández, France , Physiological Modelling, Chairman: Sara Wong					
10:00 - 10:30	coffee Break					
	ROOM 1	**ROOM 2**	**ROOM 3**	**ROOM 4**	**ROOM 5**	**POSTER**
	ST-SIG2	**ST-IMA 2**	**ST-INS 2**	**ST- MEC 1**	**ST-SIG 3**	
	A Hernández/ M Altuve	R. Medina /J. Demongeot	R Garcia / R. Silva	M Zequera/ D Rodríguez	C González/ O Yanez	CLI (69, 84, 200,315, 410), MOD(31, 39, 160, 213, 240), REH(44,124,125, 413), APP(309, 335)
10:30 - 10:45	7	42	87	89	113	
10:45 - 11:00	165	153	111	142	114	
11:00 - 11:15	201	215	154	185	117	
11:15 - 11:30	202	313	241	278	350	
11:30 - 11:45	204	232	243	325	312	
11:45 - 12:00	292	172	284	345	346	
12:00 - 13:45	Lunch					
13:45 - 14:45	Dr. Natacha DePaola, USA Tissue Engineering , Chairman: Carmen Muller-Karger					
14:45 - 15:00	Break					
	SE-SIG 2	**ST-IMA3**		**ST-MEC 2**	**ST- MAT**	
	G Castellanos/ S Wong	J Mattes/ L Urbano	MR-CLI 2 Alirio Algarra	JC Avila/ C Muller-Karger	N DePaola/ K Noris	
15:00 - 15:15	18	180		105	26	
15:15 - 15:30	148	311		107	138	
15:30 - 15:45	274	347		191	162	
15:45 - 16:00	383	356		344	321	
16:00 - 16:15	391	390		126	364	
16:15 - 16:30	392	300		169	P02	
16:30 - 17:00	coffee Break					
	MR ELE Ana Ma. Ferré	MR APP Susana Llanusa	**ST-INS 3** R Salazar/ A. Somarriba	MR HEA Fernando Morales		MEC(51,68, 118, 130,176, 194, 198, 264, 273, 280, 286, 294, 298, 326, 331, 340, 384, 389,394)
17:00 - 17:15			66			
17:15 - 17:30			93			
17:30 - 17:45			129			
17:45 - 18:00			288			
18:00 - 18:15			297			
20:00	Social Event					

Friday, September 28						
8:00 - 9:00	Dr. Francisco Azuaje, UK Bioinformatics, Chairman: Shankar M. Krishnan					
9:00 - 10:00	Dr. José Luis Ramirez, Venezuela Biotechnology, Genomic, Chairman: Shankar M. Krishnan					
10:00 - 10:30	coffee Break					
	ROOM 1	**ROOM 2**	**ROOM 3**	**ROOM 4**	**ROOM 5**	**POSTER**
	ST-SIG 4	**ST- FIS 1**	**ST -HEA**	**ST-MOD**	**ST-APP 1**	IMA (127, 159, 161, 166, 178, 209, 226, 233, 237, 242, 248, 271, 306, 316, 336) INS (10, 12, 28, 29, 37, 52, 56, 83,190,208,256, 259,302,323,349 ,373,376, 412)
	P Laguna/ JD Diaz	R Silva/ R Rojas	H Villegas/ J Letechipia	C D'Attellis/ C González	A Vilchis/ R Bravo	
10:30 - 10:45	8	30	13	15	43	
10:45 - 11:00	220	33	62	120	50	
11:00 - 11:15	283	76	97	156	59	
11:15 - 11:30	319	163	99	195	152	
11:30 - 11:45	329	322	343	265	186	
11:45 - 12:00	337	332	P01	375	362	
12:00 - 13:45	Lunch					
13:45 - 14:45	Dr. Miguel Cadena, Mexico Bioinstrumentation , Chairman Mónica Huerta					
14:45 - 15:00	Break					
	SE-ELE	**ST-IMA 4**	**ST-INS 4**	**ST-CLI 2**	**ST-APP 2**	SIG (88,100, 134, 145, 146, 158, 177, 179,197,217, 224, 255, 257, 270,275, 282, 285, 290, 333, 348, 353, 361, 367, 387)
	AM Ferré/ F Morales	J. Azpiroz/A Bosnjak	J Folgueras/R. Garcia	A Cruz/ S Calil	R Bravo/ A. Somarribas	
15:00 - 15:15	155	35	41	110	193	
15:15 - 15:30	229	157	48	136	196	
15:30 - 15:45	223	199	57	167	219	
15:45 - 16:00	261	267	61	236	230	
16:00 - 16:15	293	34	67	305	276	
16:15 - 16:30	303	291	95	352	281	
16:30 - 17:00	coffee Break					
17:00 - 18:30	Clousure					

SIG	Biomedical Signal Processing
IMA	Biomedical Imaging & Image Processing
INS	Biomedical Instrumentation
INF	Bioinformatics & Computational Biology
FIS	Biophysics, Medical Physics
MAT	Tissue Engineering; Biomaterials
MEC	Biomechanics, Bio-robotics & Movement Analysis
CLI	Clinical Engineering
ELE	Electromedicine
HEA	Healthcare Information Systems; Telemedicine
TEC	Biotechnology, Genomic, Proteomic
MOD	Physiological Modeling
REH	Neural & Muscular Systems; Rehabilitation Engineering
APP	Appropiate Technology; Education & Innovation
POSTER	Poster Sessions

PREFACIO

La organización del IV Congreso Latinoamericano de Ingeniería Biomédica ha sido para nosotros un gran honor y también una gran responsabilidad. Las ediciones anteriores fueron organizadas por Brasil (2004), Cuba (2001) y México (1998). En esta oportunidad, Venezuela fue el país encargado de organizarlo a través de la Universidad Simón Bolívar. Asumimos el reto porque creemos que en la riqueza de la interdisciplinearidad y que de las ideas emergentes de estos días germinaran las cooperaciones que nos permitirán encontrar soluciones para mejorar la calidad de vida.

Esta es la reunión científica internacional más importante en el área de bioingeniería realizada hasta los momentos en Venezuela, durante estos tres días, se darán cita investigadores de más de 18 países para discutir sobre 317 trabajos repartidos en 34 sesiones técnicas, 5 sesiones especiales y siete mesas redondas. Adicionalmente tendremos la oportunidad de asistir a ocho charlas magistrales dictadas por investigadores de Japon, Estados Unidos, España, Francia, México, Reino Unido y Venezuela, que nos mostraran las tendencias actuales en diferentes áreas de la Ingeniería Biomédica.

La realización de este evento fue posible gracias a la confianza que nos ha otorgado CORAL, al apoyo de IFMBE en la elaboración de las memorias, al respaldo económico del FONACIT y la inconmensurable ayuda de la Universidad Simón Bolívar.

Deseamos que en estos tres días el ambiente sea propicio para consolidar las relaciones científicas y personales, tanto dentro de las sesiones formales del congreso como en los hermosos atardeceres de nuestra Perla del Caribe.

Bienvenidos al CLAIB, Bienvenidos a Margarita!

Comité Organizador

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FOREWORD

Organizing the IV Latin American Congress of Biomedical Engineering has been a great honor for us and also a great responsibility. The previous congresses were organized respectively by Brazil (2004), Cuba (2001) and Mexico (1998).

On this occasion, Venezuela was the country given the responsibility of organizing it through the Simón Bolivar University. We took on the challenge because we believe that the interdisciplinary nature of the congress and the ideas that emerge during these next few days will generate the necessary partnership and cooperation to find solutions to improve the quality of life.

This is the most important international scientific meeting to take place in Venezuela in the area of bioengineering up until now. During these three days, researchers from more than 18 countries will meet to discuss 317 papers given in 34 technical sessions, 5 special sessions and seven round table sessions. Additionally we will have the opportunity to attend eight plenary talks given by well known researchers from the Japan, United States, Spain, France, Mexico, United Kingdom and Venezuela, who will show us current trends in different areas of Biomedical Engineering.

This event was made possible thanks to the trust CORAL has placed in us, the support of IFMBE in the proceeding edition, the financial support of FONACIT and the immeasurable help of the Simón Bolívar University.

We hope that the environment created over these next three days will be propitious to consolidating scientific and personal relationships, in the formal sessions of the congress but also in the beautiful evening sunsets of our Caribbean Pearl.

Welcome to CLAIB, Welcome to Margarita!

The Organizing Committee

CONFERENCE DETAILS

Name:
IV Latin American Congress on Biomedical Engineering

Slogan:
Bioengineering solution for Latin America health

Short name:
CLAIB 2007

Venue:
Isla de Margarita, VENEZUELA
September, 24 – 28, 2007

Editors:
Carmen M. Müller-Karger
Sara Wong
Alexandra La Cruz
Mónica Huerta

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Venezuelan Society of Biomedical Engineering (SOVEB)
www.soveb.org

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Regional Bioengineering Council for Latin America (CORAL),
http://akimpech.izt.uam.mx/coral
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CLAEB's Workshops
Monday 24th & Tuesday 25th
Coordinator: Sara Wong

Clinical Engineering
Luis Lara Estrella
Invited lecturers: Ricardo Silva, Rodrigo Mijares

Movement Analysis & Rehabilitation Engineering
Martha Zequera
Invited lecturers: Diana Rodríguez, Ricardo Bravo

Wireless Medical Technologies & Intelligent monitoring instrumentation
Guillermo Villegas
Invited lecturers: Julio Cruz, Alfredo Hernández

Medical Imaging & Visualization
Gianfranco Passariello
Invited lecturers: Alexandra La Cruz, Julien Mattes, Yohan Payan, Pascal Haigron.

Tissue engineering
Karem Noris
Invited lecturer: Natacha DePaola

Introduction to PACS/RIS
Yuber Delgado

DETALLES DE LA CONFERENCIA

Nombre:
IV Congreso Latinoamericano de Ingeniería Biomédica

Lema:
Soluciones de Bioingeniería para la salud en América Latina

Nombre corto:
CLAIB 2007

Lugar:
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Septiembre, 24 – 28, 2007

Editores:
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En cooperación con:
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Federación Internacional para la Ingeniería Médica y Biológica (IFMBE)
www.ifmbe.org
Sociedad para la Ingeniería en Biología y Medicina (IEEE-EMBS).
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Lunes 24 y martes 25
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Análisis de Movimiento e Ingeniería de Rehabilitación
Martha Zequera
Charlas Invitadas: Diana. Rodríguez, Ricardo Bravo

Tecnología Inalámbrica en Medicina e Instrumentación para el Monitoreo Inteligente
Guillermo Villegas
Charlas Invitadas: Julio Cruz, Alfredo Hernández

Visualización e Imagenología Médica
Gianfranco Passariello
Charlas Invitadas: Alexandra La Cruz, Julien Mattes, Yohan Payan, Pascal Haigron.

Ingeniería de Tejido
Karem Noris
Charla Invitada: Natacha DePaola

Introducción a los sistemas PACS/RIS
Yuber Delgado

CONTENT

WEDNESDAY SEPTEMBER 26TH

8:00 to 9:00, Chairman: Ricardo Silva, Ricardo Bravo

OPENING CEREMONY

Dr Renato Gusmao representante de la OPS, Representante del Gobierno Bolivariano de Venezuela, Representante de la Gobernación de Nueva Esparta.

9:00 to 10:00 AUDITORIUM, PLENARY LECTURE, Chairman: Carmen Müller-Karger

Meet the IFMBE officers - Which direction the IFMBE should go from now, Dr. Makoto Kikuchi, Dr. Ratko Magjarevic, Dr. Shankar M. Krishnan

10:30 to 12:00 TECHNICAL SESSIONS

ROOM 1: SPECIAL SESSION SIG 1, Chairman: Gerardo Gentiletti; Oscar Yáñez

370 Interfaces Cerebro Computadora: Definición, Tipos y Estado Actual

Gerardo G. Gentiletti , Carolina B. Tabernig, Rubén C. Acevedo

Laboratorio de Ingeniería en Rehabilitación e Investigaciones Neuromusculares y Sensoriales, Universidad Nacional de Entre Ríos, Paraná, Argentina

Abstract— The Brain Computer Interfaces (BCI) are an alternative of communication for people with severe motor disabilities. A BCI is a system that does not depend on the brain's normal output pathways of peripheral nerves and muscles. These systems extract information either from EEG activity recorded from the scalp (non invasive) or the activity of individual cortical neurons recorded from implanted electrodes (invasive). In this work a synopsis of the state of the art at world-wide and national level is presented, describing the classes of BCI as well as the used paradigms for their implementation.
Palabras claves— Electroencephalogram, brain computers interfaces, evoked potentials.

371 A Statistical Test for Evaluating the Event-Related Synchronization/Desynchronization and its Potential use in Brain-Computer-Interfaces

A.F.C. Infantosi and A.M.F.L. Miranda de Sá

Federal University of Rio de Janeiro/Biomedical Engineering Program, Rio de Janeiro, Brazil,

Abstract— In the present work, the sampling distribution of a commonly used index for evaluating the Event-Related Synchronization and Desynchronization (ERS/ERD) is derived, based on a direct relationship between it and a statistical test for assessing whether two sample spectra have the same theoretical spectrum. The distribution obtained is closely related to the noncentral F distribution. Based on such sampling distribution, critical values as well as confidence limits for the index may be obtained and hence ERS/ERD can now be evaluated under a statistical basis. An example of the technique was also provided in the EEG signals from 10 normal subjects during intermittent photic stimulation.
Keywords— Event-Related Synchronization, Even-Related Desynchronization, Spectral F test, Brain-Computer Interface.

369 Deteccion de Potenciales Evocados en ´Epoca Unica

E. R. Bojorges-Valdez[1], O. Yáñez-Suárez[1], G.G. Gentiletti[2]

[1]Universidad Autonoma Metropolitana Iztapalapa, LINI, Mexico, [2]Universidad Nacional de Entre R´ıos, LIRINS, Argentina

Abstract— A Single-Trial detection for Evoked Potentials is presented, it was tested with Event Related Potentials (oddball) which are used in the Donchin's Speller. The scheme is based in inner product of registered potentials over

signal subspaces, estimated by principal components analysis. Different combinations of projection coefficients were used as characteristic vectors for a gaussian Support Vector Machine classifier. To assess the scheme performance, the ROC area and accuracy were evaluated. Procedure were tested on 9 healthy subjects. Results suggest that the scheme could be used on line.
Palabras claves— Subespacios, P300, M´

299 Registro de señales de EEG para aplicaciones de Interfaz Cerebro Computadora (ICC) basado en Potenciales Evocados Visuales de Estado Estacionario (PEVEE)

F.Alarid-Escudero, T.Solís-Escalante, E.Melgar, R.Valdés-Cristerna and O.Yáñez-Suárez

Universidad Autónoma Metropolitana/Departamento de Ingeniería Eléctrica, Ciudad de México, México

Abstract— This paper presents an implementation of an effective synchronization between a registration and a stimulation module that form part of a steady state visual evoked potential (SSVEP)-based Brain Computer Interface (BCI). Each of the synchronized modules were created and designed in two different platforms as well as in two different workstations, so a particular objective of this work consisted in finding the best platforms to stimulate and register the EEG in order to create a communication channel and protocol between the two different modules. The resulting synchronization was tested with an existing SSVEP stimulation protocol in one subject. Even though the results were promising, a test on a bigger population is needed.
Palabras clave— Sincronización, EEG, Interfaz Cerebro Computadora, BCI, PEVEE

372 Plataforma Experimental de Interfaz Cerebro Computadora Orientada al Control de Sillas de Ruedas.

M. A. Richard[1] y G. G. Gentiletti[2]

[1]Facultad de Ingeniera/UNER, Oro Verde, Argentina. [2]Universidad Nacional de Entre Ríos, LIRINS, Argentina

Abstract—In this paper is presented the implementation of a Brain-Computer Interface, based in the P300 event related potential response, aimed to command a simulated wheelchair. Is proposed a modification of the original Farwell and Donchin stimulation matrix, introducing new symbols that when intensifying they change from black to red color. These symbols are defined to codify direction and speed of the movement of the simulated wheelchair. The software BCI2000 was used for signal acquisition, stimulation and classification. Preliminary evaluations allow obtaining clears P300 responses, which were able to be easily classified in offline procedures. Also the communication protocol from BCI2000 output, to the wheelchair simulation module was successfully tested.
Palabras claves—BCI, P300, Control, Silla de ruedas.

ROOM 2: ROUND TABLE, MR-CLI, Organizer: Susana Llanusa; Saúl Swaby Wilson

Gestión De Tecnología Biomédica En Situaciones De Desastres.

Eduardo Díaz Rivera, Plácido Morejón,Jorge Castro Medina, Ramiro Concepción Molina, Susana Llanusa; Saúl Swaby Wilson

Abstract—The campaign hospital under disaster conditions: design, deployment and functionality. The Cuban experience in Pakistan and Indonesia. Campaign systems, networks, installations and maintenance organization. The hospital under storm and hurricane conditions: measures to guarantee its operation and the protection of its physical and technological structure. Team work and emerging solutions. Protection of specialized personnel.

ROOM 3: ROUND TABLE, MR-BIOENG, Organizer: Saide Calil

The World Survey on Biomedical Engineering

Makoto Kikuchi, Miguel Cadenas, Yadin David, Fernando Infantosi, Saide Calil

ROOM 4: ORAL STUDENT AWARD, Chairman: Gianfranco Passariello; Paolo Bonato, Francisco Azuaje

36 Programa Código Aberto para Formação de Imagens por Ultra-som

J.P.E. Kimura e E. Costa

Departamento de Engenharia Biomédica da Faculdade de Engenharia Elétrica e de Computação – DEB/FEEC e Centro de Engenharia Biomédica – CEB, UNICAMP, Campinas, SP, Brasil

Abstract— This paper presents an open source software, freeware licensed to compound ultrasound images. The software is multi-platform and was developed using C/C++ programming language and makes use of the graphical interface Qt 4. Bidimensional ultrasound B-Mode images are produced based on radio frequency (RF) signals dataset obtained by pulse-eco technique using ultrasound linear array transducers. Besides classical algorithms, the software incorporates well known synthetic focusing algorithms like SAFT (synthetic aperture focusing technique) and SF (synthetic focusing).
Keywords — open source software, ultrasound, B-Mode, SAFT, SF, linear arrays, transducer

73 Computer-assisted aided Endovascular Navigation: Study of Geometrical Transformations

M. Castro[1,2,3], C. Göksu[1,2], L. Urbano[3], A. Lucas[1,2,4], P. Haigron[1,2]

[1] INSERM, U642, Rennes, F-35000, France , [2] Université de Rennes 1, LTSI, F-35000, France , [3] Grupo de Bioingeniería y Biofísica Aplicada, University Simón Bolívar, Caracas, Venezuela, [4] Service de Chirurgie Vasculaire, CHU-Rennes, Rennes, France

Abstract— Nowadays, more and more minimally invasive vascular interventions require the exact location and orientation of the endovascular tools (i.e., balloon, stent) with respect to the patient in a surgical environment. The implementation of a navigation guidance system able to make this procedure safer and more precise, begin with an image registration between digital subtracted angiography images and a preoperative volume image. In this work, an experimental approach is proposed, consisting in a framework based on the cooperation between the real environment (RE) where the intervention takes place and a patient-specific virtual environment (VE), which contains a virtual operation room including a C-arm model as well as the 3D preoperative patient data. Special attention on the geometrical transformations is considered at the 3D/2D matching stage in order to achieve the 3D tracking of endovascular tools and the simultaneous visualization of related 2D intra- and 3D pre-operative information. With the aim of exploiting the whole available information at the different observation stages through a cooperative approach, this paper focuses on the definition for the different geometrical transformations implied in the 2D/3D matching, as well as on the estimation of the transformation parameters based on the used and combination of different types of data and methods (Calibration, 3D tracking, image registration).
Keywords— Computer-aided surgery systems, endovascular navigation, image registration.

164 Topographical distribution of the somatosensory evoked potential: an objective response detection approach

D.B. Melges, A.F.C. Infantosi and A.M.F. Leite Miranda de Sá

Biomedical Engineering Program/COPPE, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

Abstract— This work aims at investigating the somatosensory evoked potential topographical distribution by applying the Magnitude Squared Coherence (MSC), an Objective Response Detection technique in the frequency domain. The EEG was collected from eight volunteers at derivations according to the 10-20 International System during stimulation of the right posterior tibial nerve. The stimuli were applied at the rate of 5 Hz and with intensity slightly above the motor threshold. Detection was identified based on the null hypothesis of response absence rejection (significance level $\alpha = 0.05$ and $M = 500$). The best percentages of detection were achieved in the parietal and central regions

ipsilateral to the stimulation limb. C4, P4, Cz and Pz were considered the best derivations for SEP monitoring when monopolar derivations are used.
Keywords— Somatosensory evoked potential, Topographic distribution, Magnitude Squared Coherence.

268 Análise de Diferentes Técnicas de Classificação Não-Supervisionada de Batimentos Cardíacos

R.O. Aguiar[1], R. V. Andreão[1], T. F. Bastos Filho[1]

[1] UFES / Departamento de Engenharia Elétrica, Vitória, ES, Brasil

Abstract—This paper presents the comparison between two electrocardiogram (ECG) classification systems which are based on the Dynamic Time Warping (DTW) and K-means algorithms. The DTW has been chosen due to this capacity to align beats of different lengths by a non linear time warping. K-means is a classical self-organizing algorithm very popular in ECG applications because it can cluster efficiently signals by making comparisons among them. The two systems are based on a non supervised approach which divides the heart beats of an ECG recording in two different classes. Experiments were carried out using 34 two-channel recordings of the MIT-BIH Arrhythmia Database. Both systems have shown a very good performance in terms of sensitivity and positive predictivity measures. However, the system based on the DTW has presented some important advantages, since it carries out a full automatic classification, without requiring the manual labeling, and operates on-line, allowing patient monitoring with alarms for cases of arrhythmia.
Palabras claves—Classificador não supervisionado, Dynamic time warping, eletrocardiograma, K-means.

339 Influencia de la piezoelectricidad del colágeno tipo I en la adhesión celular

A. M. Ferreira[1], K. Noris-Suárez[1], A. Bello[1], A. H. Márquez[1], J. L. Feijoo[2] y J. Lira-Olivares[3].

[1] Universidad Simón Bolívar/Dpto. de Biología Celular, Lab. Bioquímica Clínica y Molecular, Caracas, Venezuela. [2] Universidad Simón Bolívar / Dpto. de Ciencia de los Materiales, GPUSB, Caracas, Venezuela.[3] Universidad Simón Bolívar / Centro de Ingeniería de Superficies, CIS, Caracas, Venezuela.

Abstract—Bone healing and growth are controlled by the rate of deposition of hydroxyapatite (HA). This process have been so far accredited to the work of osteoblasts, which are attracted by the electrical dipoles produced either by piezoelectricity, due to deformation of the bone, specially the collagen in it, or due to outside electrical stimuli. The main purpose of this work was to study the influence of the cortical bone collagen piezoelectricity effect, on the osteoblastic cells orientation. To evaluate the cellular adhesion on the cortical bone collagen subject to deformation, bone cells of newborn calvaria's rats were extracted. The bone collagen was prepared and deformed following the specifications described in earlier studies. The results of this study shown that the piezoelectric phenomena of bone collagen promotes the cell's adhesion on the compression side more than tension side compared with undeformed surface. Further studies ascertaining the osteoblastic activity due to the electric field are being advanced.
Palabras claves— hidroxiapatita, colágeno, osteoblastos, piezoelectricidad, tejido oseo.

ROOM 5: SPECIAL SESSION CLI 1, Chairman: Denis Rodríguez; Rodrigo Mijares

402 Modelo de Gestión de Tecnología Biomédica para las Instituciones Prestadoras de Servicio de Salud en el Valle del Cauca

F. Obando, A. Mendez, E. Rodríguez

Universidad Autónoma de Occidente/Ingeniería Biomédica, Cali, Colombia

Abstract -Biomedical Technology Management has been researched through the years, because the importance of the services its quality and security to an effective cost by means of medical equipments.
In Colombia important laws and standards has been development in relation to the regulatory frame of the biomedical technology such as, classification, control of quality, evaluation and acquisition processes, as well as minimal requirements for IPS (Delivering Heath Services Entities) accreditation. However, to the manager of medical technology in the IPS, those processes are confused and difficult to apply, since they not count on standardized procedures or guides nor either do not exist control mechanisms that stimulate their implementation.
Therefore, UAO research group in Clinical Engineering has designed a Model of Biomedical Technology Management to the IPS in the Valle del Cauca, which standardizes the processes of acquisition, installation and use of

the biomedical technologies in order to guarantee its operation with the maximum of benefits, quality and security to reasonable costs.
The present work present the principal activities carried out in the first stage of the project as well as results reached and finally the propose actions to the following stages are outlined too.
Palabras claves – Ingeniería Clínica, Gestión de Tecnológica Biomédica, Gestión de Equipos Médicos.

403 Penetración de las Tecnologías de la Información en las Realidades Hospitalarias de los Países Latinoamericanos y del Caribe

César Guillermo, Galindo Viaux

Universidad de Valparaíso/Departamento de Ingeniería Biomédica, Valparaíso, Chile

Abstract— The ICT`s has been Technologies that in last years has been entering in the daily activities of people all throught the World. Medicine is not an exeption of these, because there has been an important impact of these Technologies in the last decades these area, telemedicine is an example of these. The Present Study shows the degee of penetration of the ICT in our continent, and the dificulties that exists to make that our countries can have all the virtues of these new elements, and the politics that may help solve them
Palabras claves— TIC, Telemedicina, e-Health,

404 Gestión Tecnológica Clínico-Hospitalaria

E. B. Rodríguez-Denis, M. C. Sánchez, D. Ferro

Facultad de Ingeniería Eléctrica. CUJAE. La Habana, Cuba.

Abstract— The modern society is in a constant search towards increasing the quality and the efficiency of the sanitary systems. Although many strategies and experiences have been applied, the optimal model has been not found.
The application of technology in medicine has played an important role that shall continue in the future. But influence of biomedical technology in the hospital depend of many factors, by this reason is necessary to focus Technology Management in integral manner. In this way, the hospital will be more competitive.
In this paper the authors introduce a methodology for Biomedical Technology Management and show the relationship between different functions from this model.
Palabras claves— technology management; clinical engineering; biomedical technology

103 A Gestão de Tecnologia Médico-Hospitalar como Estratégia da Engenharia Clínica no Atendimento Domiciliar no Brasil

P.S. Avelar, F. Sônego & R. Garcia

IEB-UFSC/ Departamento de Engenharia Elétrica - CTC, Universidade Federal de Santa Catarina, Florianópolis-SC, Brasil

Abstract — Home Care is considered as a strategy for de-hospitalization and humanization of health care. This modality is increased due to epidemiologist profile changes and to new legislation, which aim specially towards aged people primary care and people with physical deficiency. The necessity to keep Home Care as a hospital complement and the difficulty in adjusting the domestic environment for that practice offers Clinical Engineering an opportunity of integration in new health areas. The objective of this paper is to show this oppor-tunity. A platform for Clinical Engineering and Home Care integration is proposed, and that allows through Medical Technology Management activities to get one adequate use of the Home Care technology.
Palabras claves— Clinical Engineering, HealthCare Tech-nology Management, Home Care.

360 La Ingeniería Clínica, una forma de hacer Gestión Tecnológica en el Ámbito Hospitalario

L. Lara-Estrella

Universidad Simón Bolívar/Departamento de Procesos Biológicos, Sección de Bioingeniería, Caracas, Venezuela

Abstract— Since the decade of the sixties, the health care institutions in Venezuelans have suffered a marked and continuous deterioration in their operation, especially regarding their infrastructure and equipment. This is due in part to the lack of an adequate technological management system applied to the health technologies. The objective of this

work is to discuss the concept of technological management applied to the field of the health technologies, and later to describe the organizational structure proposed by the Simon Bolívar University for the installation of Clinical Engineering Departments in Venezuelan hospitals.
Palabras claves— Ingeniería Clínica, Tecnologías Médicas, Gestión Tecnológica.

13:45 to 14:45, AUDITORIUM, PLENARY LECTURE, Chairman: Ratko Magjarevic

The Wearable Revolution in Rehabilitation, Dr. Paolo Bonato, USA

15:00 to 16:30 TECHNICAL SESSIONS

ROOM 1: TECHNICAL SESSION SIG1, Chairman: Franco Pessana; Mary Diaz

60 Obtención Directa de un Índice de Autorregulación de Flujo Sanguíneo Cerebral para Cambios Inducidos de Presión.

M. Chacón[1], R. Contreras[1], G. Acuña[1] and R.B. Panerai[2]

[1] Universidad de Santiago de Chile/Departamento de Ingeniería Informática, Santiago, Chile , [2] University of Leicester /Departments of Cardiovascular Sciences, Leicester, UK

Abstract — The most widely used index to evaluate the Cerebral Autoregulation System is the autoregulatory index ARI proposed by Aaslid and Tiecks. Although it is often used in clinical research and is also included in some commercial equipment it has a major drawback: it exhibits great variability even when used in the same patient. It also produces many false positives. In this work an alternative measurement to the Aaslid-Tiecks ARI directly taken from the thigh cuffs maneuver signals and inspired in the Ziegler-Nichols reaction curve method is presented. This method uses only two parameters to characterize a response to the thigh cuffs maneuver. Once the values of these parameters are obtained, a correspondence between them and the parameters of the Aaslid-Tiecks, ARI, is computed using linear regression. Results from 16 healthy subjects to which 6 different thigh cuffs maneuvers were applied showed that the proposed direct measurement method reduces the variability of the ARI from *30% ± 21%* to *9,7% ± 4,2%* and also significantly reducing the number of false positives.
Palabras claves— Cerebral hemodynamics, Autoregulation index, systems identifications.

140 Compressão Contextual sem Perdas de Eletrocardiogramas utilizando Recursos Reduzidos de Memória

A.R.C. de Souza, J.R.T. Marques, J.A.G. Lima e L.V. Batista

Universidade Federal da Paraíba/Departamento de Informática, Programa de Pós-Graduação em Informática, João Pessoa, Paraíba, *Brasil*

Abstract— The present work presents a new lossless compression method for eletrocardiogram (ECG) signals using a binary version of the prediction by partial matching (PPM) algorithm. Experimental evaluation was made using the bank of ECG records MIT-BIH Arrhythmia Database. The proposed method reached a compression ratio average of 2,5:1, with very modest memory requirements.
Key words— Data compression, electrocardiogram, PPM.

222 Sistema de Tele-Monitoreo Inalámbrico de Eventos Cardiacos para Seguimiento de Arritmias

J. Bustamante, J.F. Sáenz and A.A. Amaya

Universidad Pontificia Bolivariana, Colombia

Abstract— Telemedicine schemes that allow the monitoring of patients with cardiovascular pathologies are an increasing necessity, especially for arrhythmia detection and monitoring. This paper describes the development of a telemonitoring scheme based on GSM/GPRS data transmission technology that emphasizes in the record and transmission of cardiac events. In this scheme the patient wear a small monitoring device which acquire the electrocardiogram (ECG), processes the signal using algorithms for heart rate calculation and seri-ous arrhythmias detection by means of phase space recon-struction; stores the events in a removable memory card; and transmits the

signals if an signal abnormality detection occur. The information is send to a specialized center of cardiovascu-lar monitoring, where it can be evaluated by a physician, who can make a diagnosis without requiring patient displacement. The different components of the system have been validated through different tests confirming their functionality.
Palabras claves— Telemetría Biomédica, Telemedicina, Monitor Electrocardiográfico Ambulatorio, Arritmias Cardiacas.

244 ECG Anomalies Identification Using a Time Series Novelty Detection Technique

A.P. Lemos, C. J. Tierra-Criollo and W.M. Caminhas

Universidade Federal de Minas Gerais/Departamento de Engenharia Elétrica, Belo Horizonte, Brazil

Abstract— This work proposes a methodology for identifying heart anomalies on electrocardiograms using a time series novelty detection technique. Novelties or anomalies on time series can be seen as unexpected values or a sequence of unexpected values when compared to a dataset considered to be normal. The technique uses an autoregressive model to estimate the current value of the time series and compares this value with the observed value, if the difference between these two values exceeds one given threshold; the value is classified as a novelty. To build the thresholds this method uses confidence intervals built upon the probability density function of the forecasting model output. In order to treat anomaly as a sequence of data points a post processing technique is applied to the detector output. Experiments were executed on ECG containing anomalies heart beats and the method was able to detect the anomalies with the false alarm expected.
Keywords— Heart ECG anomalies, novelty detection, AR model, confidence interval.

277 Entrenador eficaz para el desfibrilador-monitor bifásico CARDIODEF 2

Y. Pérez, M. Guillén and J. Folgueras

Instituto Central de Investigación Digital, La Habana, Cuba

Abstract— CARDIOTRAINER is a multimedia intended for the interactive training of medical and paramedical personnel of urgency systems or any other ones using the biphasic defibrillator-monitor CARDIODEF® 2. The trainer allows the trainee to get acquainted with its main characteristics and its operation procedure. It also includes the safety measures to be applied and the necessary procedures to assist a patient with mortal arrhythmias as ventricular fibrillation or with non-immediately mortal ones. Making use of modern multimedia development tools several drills have been implemented, where the trainee must cardiovert or defibrillate a patient, such as it should be done in a real-life case. Drills can be repeated as many times as required in male or female adult patients or in pediatric patients. In the paper the possibilities of the trainer are illustrated using some of the main screens presented to the trainee, and the application results are presented and discussed. It is concluded that CARDIOTRAINER is a valuable training tool for increase the understanding, proficiency and skill of personnel using CARDIODEF® 2.
Palabras claves— cardioversion, defibrillation, defibrillator, trainer, multimedia.

304 Transmisión Optimizada de Electrocardiogramas para Efectos de Clasificación

L.A. Aristizábal [1], W. Ardila[2]

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Abstract— This paper presents a design for optimization of transmission process of ECG signal that will be analyzed remotely for classification. The optimization process is based in the reduction of information that is transfered and the reduction of time in the execution of the application that clasifies. The model presented is tested with an implementation of a client/server application. The client application take the ECG, compress it and transfers it to the remote server application that use the same parameters that used by the client application for compression and with them continue the classification process. This is achived used wavelets for the characterization of ECG signal. The compression results are analyzed in terms PRD reliability (root mean square difference) and compression rates. The signal intelligibility achived after the uncompression process is evaluated with the classification algorithm. The compress rate achived is 84.7 % and 86% of successful for Bayesian classifier.
Palabras claves— Transmisión, Electrocardiogramas, teledignóstico, compresión, clasificación.

ROOM 2: TECHNICAL SESSION IMA 1, Chairman: Johan Payan; Alexandra La Cruz

77 A new 3D Multi-Object Segmentation Method in Cardiac MSCT Imaging using a Multi-Agent Approach

J. Fleureau[1], M. Garreau[1], D. Boulmier[1, 2] and A. Hernández[1]

[1] INSERM U642, Rennes, F-35000, France; Université de Rennes 1, LTSI, Rennes, F-35000, France , [2] Centre Cardio-Pneumologique, CHU Pontchaillou, Rennes, France

Abstract— We propose a new technique for general purpose, semi-interactive and multi-object segmentation in N-dimensional images, applied to the extraction of cardiac structures in MultiSlice Computed Tomography (MSCT) imaging. The proposed approach makes use of a multi-agent scheme combined with a supervised classification methodology allowing the introduction of a priori information and presenting fast computing times. The multi-agent system is organized around a communicating agent which manages a population of situated agents which segment the image through cooperative and competitive interactions. The proposed technique has been tested on several patient data sets. Some typical results are finally presented and discussed.
Keywords— Cardiac Imaging, MSCT, 3D Segmentation, Multi-Agent System, Supervised Classification

78 An approach to coronary vessels detection in X-ray rotational angiography

A. Bravo[1], R. Medina[2], M. Garreau[3,4], M. Bedossa[5], C. Toumoulin[3,4] and H. Le Breton[3,4,5]

Abstract— An unsupervised clustering framework for automatic detection of coronary vessels in bidimensional (2D) X-ray rotational angiography is reported. The proposed approach consists of three consecutive steps: 1) vessel enhancement; 2) initial segmentation based on a simple linkage region growing algorithm; 3) optimization of the initial segmentation using a multiple linkage region growing method. Results obtained after applying this method to monoplane rotational X-ray image sequences are presented.
Keywords— Cardiac images, rotational angiography equipment, coronary vessels, segmentation, unsupervised clustering.

112 Monitoração Fetal Eletrônica por meio de Cardiotocografias utilizando um Sistema baseado em Inteligência Computacional

J.A.L. Marques[1], P.C. Cortez[1], G.A. Barreto[1] e F.E.L. Feitosa[2]

[1] Departamento de Engenharia de Teleinformática, Universidade Federal do Ceará, Fortaleza – CE, Brasil , [2] Maternidade-Escola Assis Chateaubriand, Universidade Federal do Ceará, Fortaleza – CE, Brasil

Abstract— The accurate analysis of the fetal heart rate (FHR) and its correlation with uterine contractions (UC) allows the diagnostic and the anticipation of many problems related to fetal distress and the preservation of his life. This paper presents the results of an hibrid system based on a set of deterministic rules and fuzzy inference system developed to analyze FHR and UC signals collected by cardiotocography (CTG) exams. The studied variables are basal FHR, short and long term FHR variability, transitory accelerations and decelerations, these lasts classified by their type and number of ocurrencies. The system output is a first level diagnostic based on those input variables. The system is developed using the Matlab version 7 script language. The project also supports a multi-institutional agreement between Brazil and Germany, among the UFC - Universidade Federal do Ceará, the TUM - Technische Universität München, and the Trium Analysis Online GmbH. The system validation methodology was based on the knowledge of Brazilian and German obstetricians. The results achieved low false positive rates, classifying a high percentage of normal exams as normal and none suspicious or pathological exams as normal ones. These results allow the projection of the refinement of the proposed system with new input variables and further analysis of other obstetricians.
Keywords— Fetal heart rate, cardiotocography, fuzzy logic, diagnostic, computational intelligence.

174 Estudio Comparativo de Varios Métodos de Segmentación Dinámica 3D para la extracción de Estructuras del Cerebro en Volúmenes de MRI

A. Bosnjak[1], G. Montilla[1], H. Villegas[1], R. Villegas[1], I. Jara[2]

[1] Centro de Procesamiento de Imágenes, Universidad de Carabobo, Valencia. Venezuela , [2] Hospital Metropolitano del Norte, Valencia, Venezuela

Abstract— The segmentation of cerebral structures in medical images has numerous clinical applications. It can provide significant aids for the diagnosis of some pathology. In this work, we propose a comparative study of the new segmentation method based on the theory of deformable models along with the front propagation method, which it can make an semi-automatic segmentation of some cerebral structures. This new methodology for 3D information extraction is based on a processing chain that possesses the following modules: 1) 3D Filtering: the purpose is to preserve the contours of the structures and to smooth the homogeneous areas; several filters were tested and finally an anisotropic diffusion filter was used. 2) 3D Segmentation: this module compare three different methods, and finally proposes a segmentation method based on the front propagation method that allows the making of the reconstruction of the internal walls of the anatomical structures of the brain. 3) The new contribution of this work consists on the 3D visualization of the segmented model. This segmentation procedure is faster than the manual segmentation of images, with the advantage that it allows to use the same patient as anatomical reference, which has more precision than a generic atlas.

Palabras claves— Segmentación 3D, Level Set 3D, Estructuras del cerebro, Procesamiento de Imágenes.

175 Estimación Espacial y Temporal del Movimiento Cardíaco 3D, Utilizando Algoritmos de Flujo Óptico

Antonio Bosnjak, Guillermo Montilla, Hyxia Villegas

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Abstract— This paper proposes a new technique for 3D motion estimation of the left ventricle from a sequence of a heartbeat. Accurate motion estimation of the movement of cardiac walls has been shown to be very important for studying the cardiovascular illnesses. This technique is based on a processing chain from the acquisition to the 3D segmentation of the left ventricle area obtained from each image during the cardiac cycle. With the purpose of estimating the movement of the Left Ventricle we calculate the optical flow starting from a sequence of images using the method proposed by Horn and Schunck [1].
Our work demonstrates the application of Horn and Schunck algorithms for optical flow to estimate the 3D cardiac motion, and proposes to improve the accuracy of estimation by introducing constraints obtained by matching method.

Palabras claves— Ecocardiografía 3D, Flujo óptico, Estimación de Movimiento, Segmentación.

ROOM 3: TECHNICAL SESSION REH, Chairman: Luis Vilcahuaman; Jose Folgueras

64 Mouse Controlado por Sistema de Pressão para Indivíduos Portadores de Tetraplegia

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Abstract – This work describes the development of an equipment directed to handicapped users with severe mobility injury. The equipment makes a man-machine interface capable of recognize the stimulations (blows) and transform them into movements of the mouse's cursor. The signal acquisition is made through of two pressure transducers, located next to the face of the user. The transducer's signals are amplified, converted for digital data and sent to the computer through a microcontroller. The communication between the computer and the equipment is made through an USB port. In the computer, specialized software makes the interpretation of the received data. To allow text edition, the system disposes of a virtual keyboard. The developed system showed user-friendly and efficient, with a great applications in the rehabilitation engineering area.

Keywords – mouse, rehabilitation, engineering, blowing.

71 Peripheral Blood Flow Changes during Motor Imagery

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Abstract— An experimental paradigm was designed to collect the signals related to local blood flow during the two brain states, 'Normal Relaxed with eyes closed' and 'Planning of lifting the right index finger'. Photoplethysmographic (PPG) signals of reflectance type were recorded using the transducer TSD200 connected to the PPG100C amplifier of BIOPAC MP150WSW Data Acquisition System. Signal processing and statistical analyses were done using MATLAB v 7.0 and Analyze-it v 1.73 respectively. The results of the study conducted on 10 healthy right-handed control subjects in the age group of 20-27 years showed a significant reduction in signal amplitude ($p<0.0001$) during 'Planning of movement task' as compared to the normal 'Relaxed' state. Preliminary studies revealed that the proposed method differentiates the changes in peripheral blood flow signals during the two cognitive brain states, which could be easily used as control signals. Apart from suggesting peripheral blood flow measurement as a neurophysiological correlate of volitional actions, the study also recommends the use of the method as a great help towards the design and development of communication devices for the severely handicapped.
Keywords— Photoplethysmography, Peripheral Blood Flow, Motor Imagery, Cognitive Tasks

94 Efeito Do Treinamento Muscular Respiratório Por Meio Do Manovacuômetro E Do Threshold Pep Em Pacientes Hemiparéticos Hospitalizados

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Abstract− Stroke is one of the main causes of morbidity and mortality worldwide. Besides of body movement deficit and bed immobilization, the patients with stroke have shown less respiratory muscle strength, leading to lung mechanics changes which predispose those patients to lung infections and often hospital confinement. The main purpose of the present work is to analyze the efficiency of training of the respiratory muscle power in the patients with stroke, by means of the Threshold™ PEP. The maximum static respiratory pressure and the expiratory peak flow were evaluated using a vacuum manometer and a Peak Flow Asthma Plan, respectively. In order to to train the expiratory muscle system, a Threshold™ PEP was used. 36 patients with stroke in confinement were selected and divided in 2 groups: Group I (trained stroke group) and Group II (control stroke group). The results, obtained in a five days trial, show that the patients submitted to the expiratory muscular training have presented a considerable increase of the maximum respiratory pressure, which may enable a decrease of the complications originated from the respiratory muscular weakness. Furthermore, it has been shown that Threshold™ PEP is an efficient device for supporting the gain of respiratory muscular strength
Keywords− Respiratory muscles, Stroke, Respiratory Training, Pulmonary Infection.

150 Diseño de una Interfaz Flexible y un Módulo de Monitoreo de Actividad de Lenguaje para un Sistema de Comunicación Aumentada y Alternativa

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Abstract— Technology and clinical practice of augmentative and alternative communication (AAC) have experimented profound changes in the last decade due to sophisticated computer-based applications and the concept of evidence-based practice (EBP). EBP is based on communication performance measurement and optimization, and requires a language activity monitor (LAM) as well as an analysis and reporting program. Personalization of AAC systems for optimal performance requires configurable interfaces, because many performance parameters depend on the layout and language organization of the interface. This paper describes the introduction of a configurable interface and a LAM module in the third generation of AAC software developed at the Universidad Iberoamericana, as a platform for multiple AAC clinical products and research applications. The configurable interface was designed to be largely autoadjustable by using parametric design techniques. The design of the LAM module was based on guidelines

proposed by the AAC Institute and provides an innovative visualization tool of the logged events. The new AAC system opens possibilities for research in areas such as language use in Spanish-speaking disabled populations.
Palabras claves— comunicación aumentada y alternativa, interfaces flexibles, monitor de actividad de lenguaje.

189 O Ensino a Distância como Instrumento de Auxílio a Pessoas com Limitações Motoras Severas

Marisa Aparecida Olivieri, Silvia Cristina M. Rodrigues

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Abstract The objective of this study is help to insert the people with several disabilities to job market. Nowadays the E-learning has been increasing in Brazil and around the world. The E-learning has been becoming possible to a lot of people and institutions the acess to the knowledge and its difusion. Throught the internet and of the E-learning, Moodle, a Motrix software was developed an applied digital content in the course of Business administration in the discipline of Marketing using the content about E-commerce becoming possible the people with several disabilities, the access to the universities, digital inclusion and inclusion to the job market.
Palabras claves – Novas tecnologias, Ensino a Distância, Pessoas especiais .

227 Método computadorizado para treinar a avaliação da espasticidade em cursos de fisioterapia

M. M. X. V. Carvalho[1], A. P. Silva[1], F. C. Amate[2], A. F. Costa[1] and A. F. Frère[1]

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Abstract— It is difficult for the physiotherapy students as well as for the physiotherapists with little experience, to evaluate correctly the patients with spasticity through the modified Ashworth scale. Modified Ashworth scale graduates the spasticity initiating in zero (normal tonus) until four (serious spasticity), it is subjective and most of the times is difficult for the student notice clearly the threshold among several graduations. It is easy to mistake the degrees 1 and 1+, and the degrees 1+ and 2, which resemble too much. Four students of the 4° year of physiotherapy evaluated 32 patients and obtained 84.37% of disagreement. Therefore in this research was developed a device to simulate the degrees of brachial biceps spasticity, constituted of a computerized system and a mechanical arm with elastic bands with different resistances. The students were trained with the mechanical arm for a week, for 2 minutes in each band. After the training the same patients were evaluated by the students and among them were obtained 96,88% of concordance, indicating the efficiency of the method.
Keywords— spasticity, medical instrumentation, computerized evaluation, elbow.

ROOM 4: YOUNG INVESTIGATOR AWARD, Chairman: Alfredo Hernandez; Jacques Demongeot; Fernando Infantosi, Ratko Magjarevic

102 Using a finite element model to predict thoracic injuries

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Abstract— As improvements are made to crash test dummies, new injury criteria must be developed. This study presents a 2-dimensional finite element model of the human thorax that can be used as a tool to predict thoracic injuries. The force-displacement response of the model was validated against cadaver impact data. Then the model was used to simulate frontal cadaver crash tests and correlate the model outputs with injuries. Logistic regression was used to create an injury criterion that uses outputs from the finite element model to predict rib fracture.
Keywords— Thorax, Injury, Fracture, FEA, Dyna

151 Diseño y construcción de un fantoma de próstata para el tratamiento en radioterapia conformacional

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Abstract- The main objective of this work is to design a prostate phantom to calibrate the planning system for treatment using conformation radiotherapy. The phantom is made of acrylic and nylon. These materials have densities similar to soft tissues and bone, and are readily available in Peru with low cost. The phantom is imaged using a calibrated CT scanner. The CT images are used for the calculation of the absorbed dose using a three-dimensional planning system (WINPLT-3D). This calculation is compared to the experimentally measured data in the phantom by means of the clinical linear accelerator Varian 2100 C/D. Preliminary results show that the planned dose and the measured dose differ in less than ±3.0%, which suggests that the three-dimensional planning system has been correctly calibrated.

Keywords: phantom, conformation radiotherapy, clinical linear accelerator, CT scanner.

210 Obtaining Energy Expenditure and Physical Activity from Acceleration Signals for Context-aware Evaluation of Cardiovascular Parameters

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Abstract— This work presents the design and development of an online daily-life activity measurement system. This system has been conceptualized to be used along with other vital parameter sensor-systems, e.g. blood-pressure and electrocardiogram (ECG), to provide the necessary context information for the evaluation of the health status of cardiovascular risk patients who are not hospitalized, but must be permanently monitored during their daily routines. The activity and energy expenditure are captured and estimated from accelerometers, which are placed on different points of the body. The activity, the ECG and the blood pressure are sent to a base station (smart phone or a PDA) and from there to a data base, to which the physicians have access. Thus it is possible to continuously analyze the vital data of a cardiovascular patient taking into consideration the activity or physical strain.

Keywords— Activity monitoring, energy expenditure, context-awareness, cardiovascular data.

238 A Fast Normalization Method of cDNA Microarray Data based on LAD

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Abstract— This paper introduces a new method for normalizing cDNA microarray expression data. The proposed approach assumes that the fluctuations between replicated microarray data follow a Laplacian model and, therefore, the normalizing parameters, shifting and scaling parameters, are optimally obtained using a robust algorithm based on Least Absolute Deviation (LAD) regression. The normalization is achieved by iteratively recentering and rescaling the data sets such that the mean absolute error (MAE) between the reference set and the normalized set is minimized. The proposed approach unifies the iterative LAD based parameter estimation and the normalization procedure into a single iterative algorithm that normalizes the microarray data set, right after a rough estimation of the normalizing parameters.

Keywords— Microarray normalization, gene expression data, least absolute deviation, robust linear regression.

301 Sistema de adquisición, transmisión y análisis de señales de ECG

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Abstract— Present job describes a development for an ECG acquisition, transmission and ECG analysis system. The acquisition equipment has several functions as digitalize the signal, save the signal on a Compact Flash card, or send

them to PC or other USB connection. This equipment is based on PIC 16F873 microcontroller and performs all the functions helped by periferical devices as amplifiers, isolated amplifiers, isolated power switch, active filters, etc. Transmission is performed by a G20 Motorola chip that works on GSM network. The signal is sent by that network to a precise Internet IP node, in order to see on this PC the signal in real time. ECG analysis is based on Wavelet transform algorithms. Complementing that equipment it was developed an Internet page *http://www.frsn.utn.edu.ar/holter/* where the equipment can load the signal with another data of the patient in order to see by the doctor anywhere.
Keywords— ECG analysis, PIC 16F873, Motorola G20 module, Wavelet Transform.

366 Creación de un Departamento de Ingeniería Clínica para una Institución de Salud de Tercer Nivel en la Ciudad de Barranquilla (Colombia)

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Universidad Autónoma del Caribe/Centro de Bioingeniería Cebi-UAC, Investigador, Barranquilla, Colombia

Abstract— The present paper describes the methodology applied in the conformation of a Clinical Engineering Department in a third level health institution located in Barranquilla, Colombia. The main objective of this project is to provide a functional and operative structure to this institution that allows the management of its biomedical technology in an efficient way, including the purpose of obtaining a high quality in the offered services by means of the rational and proper use of this kind of technology. In the same way, the establishment of the Clinical Engineering Department will optimize the availability and the right operation of the biomedical technological resources, gaining high levels of security and reliability in all the developed processes.
Palabras claves— Tecnología Biomédica, Gestión Hospitalaria, Mantenimiento.

ROOM 5: TECHNICAL SESSION CLI 1, Chairman: Susana Llanuza; Rene González

24 Increasing The Corrective Maintenance Efficiency Using Multiple Linear Regression And Clustering Techniques.

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Abstract—In this research the multiple linear regression and clustering techniques were utilized for improving the efficiency of corrective maintenance tasks in a clinical engineering department (CED). The indicator under study was turnaround time (TAT). The multiple linear regression to build a predictive model for TAT values was carried out. The variables reasoned to have contributions to that model were response time of clinical engineering department (RTce), response time of stock service (RTstock), priority level, and service time. The regression process showed heavy dependence on RTstock, RTce, and priority, in that order. Clustering techniques uncovered the main causes of high TAT values.
Index Terms: Data mining, Benchmarking, Technology Management

32 Evaluación del Mantenimiento Correctivo A Equipo Médico en Hospital de Especialidades Pediátricas en Costa Rica

A. Rosales-López y M. R. Ortiz-Posadas

Universidad Autónoma Metropolitana-Iztapalapa/Departamento de Ingeniería Eléctrica, D. F. México

Abstract – The main purpose of this work is to analyze the corrective maintenance of medical technology done by the Area of Medical Equipment Maintenance of a pediatric specialties hospital in Costa Rica during 2005-2006 period, in order to identify the clinical services and medical equipment of most frequent failures; so that a maintenance strategy will be proposed to demonstrate that a correct technological management guarantees the optimal use of all institution's technological resources, contributing on the other hand to make patients stay at hospital safety.
Palabras clave – Mantenimiento preventivo, capacitación, gestión tecnológica, ingeniería biomédica, ingeniería clínica.

82 Projeção de Custos para Aquisição de Equipamentos de Ultra-Som em Clínicas Médicas

M. G. Duarte, V. L. da S. N. Button

Departamento de Engenharia Biomédica (DEB/FEEC) e Centro de Engenharia Biomédica (CEB) da Universidade Estadual de Campinas (UNICAMP), Campinas, Brasil

Abstract— The objective of this work is to present a projection of costs for ultrasound scanning equipment acquisitions by medical imaging clinics and to understand how these acquisitions affect the final value of ease exam. In order to meet customer demands for the newest technology, medical imaging clinics substitute their equipments in shorter periods of time, trying to follow the launching of more sophisticated products. The cost of the anticipation of ultrasound scanning replacement was projected to verify how it affects the clinic budget. According to medical imaging clinics market profile, two factors of great importance in ultrasound scanning acquisition have been identified: the cost of tax loans paid and the monthly demand of imaging services. Medical imaging clinics seldom have the preoccupation to verify the impact of these factors in the equipment replacement, which may cause damage to their financial health. For this study data from 04 clinics, that have together 12 equipment acquisition processes in a given period, have been collected and analyzed. The clinics are located in the city of Campinas (SP, Brazil), which has a population greater than 1 million people. Each chosen clinic monthly makes, by ultrasound equipment, from 400 to 700 exams. The results showed that each exam costs from $1.00 up to $7.22, just due to ultrasound scanning equipment acquisition. When the anticipation of medical equipment replacement was combined to the cost of tax loans paid and the monthly demand of imaging services, the projected cost of an imaging exam reached values between $1.00 and $20.00.

Keywords — Cost, Ultrasound, Equipment Acquisition.

203 New Challenges in Controlling EMI in Hospitals

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Abstract— Over the last twenty years, hospitals have been attempting to incorporate wireless technology into their day-to-day operations. Clinical engineers who are responsible to facilitate the integration of wireless technology into hospitals are faced with many challenges. Wireless technology has been evolving from networks with a small number of relatively high power sources to networks with a large number of relatively low power sources. This has made characterizing the hospital electromagnetic environment a complicated process and the associated potential for electromagnetic interference (EMI) difficult to determine. There is no globally-accepted comprehensive protocol to evaluate the function/malfunction of medical devices exposed to radio-frequency (RF) fields. In addition, there is often uncertainty in determining the degree of clinical impact that a malfunction has. The evaluation of malfunctions and their severity is not only a technical matter related to expected behavior of the medical devices, but must be evaluated considering: the clinical status of the patient, the medical staff opinion, institutional mission and the intended application of the device. There is a need for the development of RF management policies to deal with the changing reality of wireless in hospitals and to develop more effective clinical impact of EMI testing. Risk mitigation policy is a part of the evidence-based management programs.

Keywords— EMI, Medical Devices, Field Measurement, Malfunction, Risk.

252 Custo dos Equipamentos Eletromédicos nos Procedimentos de Assistência à Saúde

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Abstract— The growth in medical equipment, mainly occurred after World War II, led the health-care practice through deep transformations and consolidated the modern health-care model. The new technologies brought along increasing (and complex) costs to the health care system. Employing the concepts of Time-Driven Activity-Based Costing and Life Cycle Cost, this paper provides a method for estimating the equipment-related costs that occur in health-care procedures. In order to evaluate the proposed method, it was run a simulation of a diagnostic procedure in a health-care institution.

Keywords— clinical engineering, medical equipment costs, technology assessment, Activity-Based Costing.

393 Aplicación Regulatoria de Criterios de Calidad a la Instrumentación de Medicina Nuclear

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Abstract— The great development of technologies in the field
of Nuclear Medicine has increased the possibilities for early detection of pathologic processes non-associated to anatomical alterations, as well as, the use of radiopharmaceuticals for cancer treatment. To ensure adequate diagnosis and treatment processes, it is crucial to establish Quality Assurance Programs for the instrumentation. The National Control Center for Medical Devices (Centro de Control Estatal de Equipos Médicos, CCEEM) regulatory body of the Ministry of Health in Cuba, has received a License for the implementation of a National Quality Audit Service for Nuclear Medicine Departments. This has been achieved upon completion of the technical and legal requirements established. At the same time, CCEEM has participated on the elaboration of a National Protocol for Quality Control of the Nuclear Medicine Instrumentation; has implemented two national regulations, and has licensed and audit group composed by experts from different institutions. For the implementation of all these documents and regulations, a National Course on Quality Control of Nuclear Medicine Instrumentation have been organized every two years, with the participation of professionals from all nuclear departments among the country. The experiences taken since the beginning of the national audit program have shown not only an improvement on the execution of quality control tests, but also a better performance of professionals in nuclear medicine departments. Also, there is a increasing concern about quality concepts and their influence in a better service delivered to patients. On the other hand, the necessity for incorporating clinical aspects to the audit procedures has been identified to propitiate a harmonised development of the Quality Assurance Programs.
Keywords— quality control, audits, regulations, Nuclear Medicine instrumentation.

POSTER SECTION 1, BIOPHY, BIOMAT, HEALTH

16 Computer Simulations for Calculation of Workload Weighed Transmission Curves of Brazilian Shielding Materials

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Abstract— Shielding design of diagnostic imaging facilities has been a subject of several research works during the last years. A strong motivation of the present study is related to the fact that the most typically shielding material used in Brazil are barite concretes. The present work introduces a new technique for computer simulation of the attenuation properties of shielding materials taking into account the elemental chemical composition of the material and simulated X-ray spectra. The results of simulated attenuation properties of local barite concretes were combined to a set of workload spectra obtained in Brazilian hospitals
Keywords — Shielding, diagnostic imaging, computer simulations, radiation protection, barite concrete.

27 Análise da Mecânica Respiratória em Tempo Real: Efeito das Alterações no Padrão Ventilatório em Normais

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Abstract—Several respiratory diseases, as well as surgical procedures, introduce pathological alterations in the thoracoabdominal motion. The aim of the present study is to investigate alterations in respiratory mechanics of healthy people, under different breathing patterns by using a real-time implementation of the Forced Oscillation Technique. Twenty individuals were submitted to a protocol in which they performed different breathing patterns for a period of 18 seconds. The results suggest that alterations in the normal breathing pattern can increase the mechanical load of the respiratory system, especially in men and during the exhalation phase.

Palabras chaves— Biofísica, Instrumentação Biomédica, Mecânica Respiratória, Mobilidade Toracoabdominal, Oscilações Forçadas.

46 Utilización de un Modelo Estadístico para Optimizar Actividad Radionuclídica en Estudios de SPECT Cerebral con Tc-99m-HMPAO

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Abstract— A method based on clustering analysis and image quality discriminant functions is tested over HMPAO-99mTc-SPECT images. Signal-to-Noise ratios and Signal-to-Background ratios in each transaxial slice were measured and used as image quality indexes. They were employed to develop image quality classification using a model of three clusters. The mathematical classification was compared with the subjective image quality evaluation. Linear image quality discrimination was developed taking, as independent variables, the characteristics of the patients, equipment and radiopharmaceutical, and, as dependent variable, the cluster centroids. The results were analysed among 30 brain SPECT, acquired under different activities (400 to 1000 MBq), looking for the minimum that guaranty good image quality. The value of 800 MBq was the optimum obtained after the application of the above methodology. The labelling yield was the main parameter which determined image quality in clusters.
Palabras claves— Optimización, SPECT cerebral, Tc99m-HMPAO, Análisis discriminante, Técnica de clustering.

327 Un método híbrido (dinámica molecular / MonteCarlo) para modelar plasticidades sinápticas en células excitables.

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Abstract— Present work comprises a computational model to reproduce the dynamics of synaptic vesicles. An algorithm is developed and implemented to allow the study of synaptic plasticity resulting from the controlled fusion of synaptic vesicles in the presynaptic terminal. The presynaptic terminal is spatially modeled as a box located within the coordinate axis with the presynaptic membrane corresponding to the z=0 plane. Forces controlling changes of speed and position for each vesicle result from three sources: (1) Electric Fields originating from intracellular, extracellular and intravesicular medium [1] and from charges in the vesicular and presynaptic membranes. (2) Forces derived from the polarized water clathrate surrounding the synaptic vesicles . (3) Frictional forces derived from moving synaptic vesicles which are proportional to their speed [2]. Physical constants employed in the simulations were approximated to those reported for squid giant axon by other researchers. The size of the Synaptic Vesicles and the Terminal Box were also chosen from those reported by other researchers. Synaptic vesicles were incorporated into the terminal box by means of a predetermined sequence up to the point were the pool reached equilibrium. Once in equilibrium vesicular fusion probability was modulated to simulate periodic stimulation and response of the Synaptic Pool. Results obtain from the simulation are consistent with experimental results reported by other researchers, there fore validating the model.
Palabras claves— Dinámica Molecular, Vesículas Sinápticas, Monte Carlo híbrido, Plasticidad Sináptica.

328 Caracterización de membranas hemodialíticas por microscopía de fuerza atómica

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Abstract— Recent development in the bio-medical engineering and use of the new type of nano-materials, requires different and rather more sophisticated analytical tools. The Atomic Force Microscopy (AFM) is one of the most sophisticated tools very often used for the surface morphology characterization. The pore size characterization and distribution on the surface of the dialysis (renal) membrane is of a special importance for qualitative and quantity evaluation of the hemodialyzer quality. In the present study, AFM has been used to characterize the surface pores of a

hollow-fiber dialysis membrane (polysulfone). The inner and outer side of the fiber dialysis membrane, were subject of investigation (imaging). In order to understand the process of the hemodialyzer deactivations, membranes previously used in hospitals after a single use, 10th and 23rd times of use, were analyzed by AFM. The obtained AFM images revealed significant differences in the quality and characteristics of the surface conditions of the hemodialysis membranes, on the nanometric level. This study also clearly shows that AFM could be a powerful tool for evaluation of the hemodialysis membrane conditions.

Palabras claves— Hemodiálisis, membrana, AFM.

144 Obtención de células madre inmortalizadas derivadas de lipoaspirado para su diferenciación hacia diferentes linajes

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Abstract— Adult stem cells are considered the present and the future in gene therapy. One of the sources for adult stem cells is adipose tissue where CMDL (lipoaspiration derived stem cells) are obtained, CMDL are well known for their autorenovation capacity, long term viability and potential to differentiate to diverse cellular types in vitro, like adipogenic, condrogenic, miogenic, osteogenic eventhough neurons.

Palabras claves— tejido adiposo, terapia celular, células madre, lipoaspirado

359 Caracterización Microestructural de un recubrimiento de YSZ para aplicaciones biomédicas

S. Armengol

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Abstract—In the present work a study of the microstructural characterization of YSZ coatings and their mechanical properties for biomedical applications has been carried out. The mechanical properties of the coating were evaluated by spherical indentation and the microstructure by optical and atomic force microscopy. The microstructural characteristics of the coating consist of a columnar structure that provides deformation tolerance. Spherical indentation allowed the determination of the Young Modulus of the ceramic coating, and the detection of the critical resolved shear stress. The results obtained show that YSZ coatings are able to withstand high stresses and have excellent properties to be used as a biomaterial.

Palabras claves— recubrimiento cerámico, propiedades mecánicas, biomateriales, circona, indentación esférica simple.

374 Estudio de Mezclas de Polietileno de Alta Densidad (PEAD) con colágeno/acetato de sodio e Hidroxiapatita (HA)

R. González Paz[1], A. Grillo[1], J.L. Feijoo[1], K. Noris-Suárez[3], R. Perera[2] y J. López[1]

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Abstract— Blends and/or composites of HDPE, type I collagen gel extracted from rat tails and dried in presence of sodium acetate, poly(ethylene –co- acrylic acid) (a compatibilizg agent) and hydroxiapatite were studied. Differential Scanning Calorimetry (DSC) analyses demonstrated that the collagen gel was able to tolerate the processing conditions of HDPE since it kept its characteristic denaturalization temperature. Transmision Electronic Microscopy (TEM) showed that the fibrillar structure of collagen was kept and it finds itself dispersed on the HDPE matrix. Collagen supplies an important reinforcement to HDPE by increasing 2,7 times the HDPE Young's modulus values. The compatibilizing agent did not show any important contribution to the Young's modulus of the HDPE/collagen/copolymer blend in comparison with the blend where no compatibilizing was used. On the other hand, the HDPE/HA blends showed a Young's modulus about two times that of pure HDPE, due to the HA crystals which confer stiffness to the whole system.

Palabras claves— Colágeno/ acetato de sodio, gel, PEAD, hidroxiapatita.

382 Desarrollo de prótesis de núcleo pulposo – Modelo de elementos finitos de una unidad funcional de la columna vertebral y caracterización de materiales

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Abstract— The development of a prosthetic device for the replacement of the nucleus pulposus of the intervertebral disc is being widely studied in the recent years, with a great variety of designs and materials used. In this work is shown an approach to the elaboration of prosthesis for the nucleus pulposus, following the principal requirements about biomechanics and biocompatibility. For this, a 3-D model of a functional spinal unit (FSU) of the lumbar spine was made, with the aim of study de biomechanics of the intervertebral disc. A 3-D reconstruction of the L4-L5 segment was built using Axial Computarized Tomographies. Stress analyses of the model was perform using the Finite Element Method. The selection of the material to use in the prosthesis elaboration is of great importance for the biocompatibility of the device. Therefore, a research about chitosan hidrogels crosslinked whit genipin is being started. Both of these materials are proved to be biocompatible, giving a hint about their possible use. Mechanical testing in compression shown the fragility of the chitosan hidrogels, but their morphology could make them able for other biomedical applications. The reaction kinetics between chitosan and genipin was studied with dinamic rheometry, showing the change of the hidrogels from a liquid solution to a viscoelastic solid.
Palabras claves— Prótesis, Elementos finitos, núcleo pulposo, Hidrogeles, Quitosano.

21 ECG con transmisión inalámbrica vía celular

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Abstract— This work explain the design of an instrument of acquisition and registry of the signal ECG which is transmitted by wireless means to the PC for its visualization. The system of electrocardiographic signals using two networks: the cellular network GPRS and Bluetooth. The device uses to transmit wireless means with the standard of Bluetooth interconnection towards the computer, being sent the electrocardiographic activity (ECG) of the patient. The design is structured in two fundamental stages the one of transmission and other of reception. A prototype of digital electrocardiograph with serial communication to computer is shown, whose signal appears locally by a control program that allows to store it and to publish it in a Web site. The site can be accessed by cardiology specialists to emit a remote diagnosis and thus to avoid the transfer of the patient to the welfare center.
Palabras Claves— ECG digital, LabView, red telefonía celular, GPRS, GSM.

63 Estrategia de Capacitación para el Uso del Sistema PACS-RIS en el Instituto Nacional de Enfermedades Respiratorias de México

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Abstract— A training strategy to use the picture archiving and communication system (PACS) and the radiology information (RIS) of the National Institute of Respiratory Diseases of Mexico is presented in this work. The objective was to develop an instrument of training for each of the subsystems that comprises the system, according to the profiles of the users with the aim to promote its maximum use and thus assisting the Institute's medical services productivity. Three training courses for each of the three subsystems that form the PACS – RIS were developed and specific manuals for each type of user were generated. In general, the results revealed a considerably increase in the usage of the system.
Palabras claves— PACS, RIS, capacitación.

123 Diseño de un sistema de Telecardiología en Cuba

G. Rodríguez, A. Rodríguez, R. Almeida, R. González, G. Montes de Oca y N. Pina

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Abstract— This work offers the design of a system of Telemedicine in support of the services of Cardiology in Cuba. The system is intended to make best use of the available material and human resources in this field of the medicine, as well as the kindness of the telecommunication, in order to offer a quick and specialized service with no limitations of the place where the patient or cardiologist is. The feasibility of the system is presented, taking into account the existence of digital electrocardiographs with communication possibilities and a telematic network that allows the connection among different medical institutions from the primary level of health.
Palabras claves— Telemedicina, electrocardiografía.

168 A conceptual model for the electronic pharmaceutial prescription in Belgium

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Abstract— This paper describes the results of a study, commissioned by the Belgian Ministry of Health, in order to set up a theoretical framework as a basis for the future introduction of an electronic medical prescription system in Belgium. Our analysis of the flow, currently followed by the paper prescription, complemented with a stakeholders analysis and taking into account the availability of operational tools resulted in a theoretical model that obtained acceptance by the parties involved. The model we propose here is compared to other realisations, elsewhere. Moreover we describe a realistic modality allowing seamless transition between the paper-based towards the electronic prescription.
Keywords— Electronic medical prescription, pharmaceutical prescription, e-health

235 Sistema de monitoreo electrocardiográfico a distancia

R. Guardarrama, R.I. González, D.J. Jimenez, A.R. Rodríguez and F. León

Instituto Central de Investigaciones Digitales, Ciudad de la Habana, Cuba

Abstract— This paper is about a two-lead portable monitor able to detect dangerous ECG events in real-time processing, by detecting the QRS complexes and measuring the heart rate. Also, it sends both signal channels to a remote server computer in a cardiac care center through the patient cell phone using the Bluetooth standard protocol [1]. This transmission can be triggered by an automatic detection of a dangerous ECG event or manually by the patient. The device also has a graphic LCD that shows the signal and during the communication it visualizes text messages that can be sent by the specialist at the server. The device has a built-in buzzer for notify the patient where is an incoming message or something else according with the device configuration.
Palabras Claves— bluetooth, electrocardiograma, monitor portátil, ECG

250 Analizador de un Sistema de Monitoreo Holter de 3 canales: EXCORDE 3C

G. Montes de Oca, G. Rodríguez, A. Rodríguez, R. Almeida, R. González, N. Pina

Instituto Central de Investigación Digital, Ciudad de la Habana, Cuba

Abstract— The new Holter analyzer named Excorde 3C is a powerful tool for long-term ECG studies. This software is able to read digital ECGs acquired with the Excorde 2C and 3C recorders. The analyzer includes a friendly user interface, a database to store the processed cases, ECG and measurements can be displayed in several formats, a complete set of printed reports, a complete ST segment study (including ST versus heart rate analysis), an arrhythmia analysis module and a Heart Rate Variability study. This software is a Windows application designed according to the oriented programming rules in a visual programming environment. Several components were developed for ECG processing and viewing.
Palabras claves— sistema de monitoreo Holter, electrocardiografía ambulatoria, software para Holter.

262 Metodología para la Validación de un Sistemas de Telemonitoreo Electrocardiográfico

A.Alfonzo [1,2], M.Huerta [2], S. Wong [2], G. Pasariello [2], A. La Cruz [2], M. Díaz [2] and J. Cruz [2]

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Abstract—Recent studies in Bioengineering area show a great interest in telemedicine projects, it is motivated mainly for the fast development of information and communications technologies reached during the last decade. Since then numerous projects of telemedicine in different areas have been published, among them the electrocardiographic monitoring, as well as methodological reports for the evaluation of these projects. In this work a methodology to validate an electrocardiographic telemonitoring system is presented. A procedure to verificate the operation of Data Acquisition Module (DAM) of the electrocardiographic telemonitoring system is given, taking as reference defined standards, and procedures for the measurement of the parameters of the Quality of Service (QoS) required by the system in a Local Area Network (LAN)

Keywords -Telemonitoring, Electrocardiographic, QoS, Validation.

296 Metodologia Centrada no Usuário para Especificação e Padronização de Informações do Prontuário Eletrônico do Paciente

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Health Technology Postgraduate Program -Pontifical Catholic University of Paraná, Curitiba, Brazil

Abstract – Nowadays many Health Information Systems (HIS) are not used, because they carry through part of the functions and characteristics that the end users need. One of the main faults is the specification and the design of such systems without the participation of end users. The lack of information definition to specific Eletronic Health Record (EHR) is another point that make system utilization difficult. The main purpose of this paper is to describe a user-centered methodology for HIS information specification and standardization, with emphasis on EHR. The aim of this methodology is to consider the needs of the end users of the system, through the participation of them during the information standardization. Specialists identify and define which informations are important and essential to EHR, by questionnaires answers based on Likert scale. Therefore, a user-centered methodology and information standardization could help work designer, making it easer.

Keywords - user-centered methodology, Specification, Standardization and Electronic Health Record

317 Diseño de una red de Telemedicina para zonas urbanas de difícil acceso: caso Baruta - el Hatillo

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Grupo de Bioingeniería y Biofísica Aplicada (GBBA).Universidad Simón Bolívar, Caracas .Venezuela

Abstract— Telemedicine relates to the use of the Telecommunications to improve the quality of health services in remote or isolated areas. Telemedicine application varies depending on the net area development. The problems that arise for telemedicine in developing countries are analyzed in this work. Main wired and wireless technologies that allow access to nets are described. Problems at health level in Baruta and El Hatillo municipalities in Miranda State in Venezuela are presented here, and finally a pilot net proposal is posed regarding the application and deployment in these municipalities, which will interconnect sixteen rural and urban outpatient units along with a reference hospital, the Centro Medico Docente La Trinidad. Such net will allow teleconsultations, telecardiology and out patient units control information delivering.

Palabras Claves— Telemedicina, teleconsultas, redes inalámbricas

377 Aplicación de Mecanismos de Seguridad en una Red de Telemedicina Basados en Certificados Digitales

T. Vivas[1], M. Huerta[1], A. Zambrano[1], R. Clotet[2] y C. Satizábal[3].

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Abstract— The medical information of the patients is private and extremely sensitive because the information is confidential, That way It have been stored and transmitted carefully because the information is exposed a series of

threats that approach these technologies and it is necessary to protect it in a sure way. This study contemplates the investigation about the existing and best practical information technologies security to design a security mechanisms pilot of telemedicine network that allow to guarantee the confidentiality, integrity and availability of the medical information of the patients of the hospitable centers involved.
Palabras claves— Telemedicine, Information Security, Asymmetric Cryptography, digital signature, digital certificate.

411 Nuevo Software De Informe y Estadística Para Los Centros Médicos.

D.Marimón, J.C. Rodríguez

Salud, Bioingeniería, Sociedad de Bioingeniería de Cuba, Pinar del Rió, Cuba

Abstract— The Medical Diagnostic Center of High Technology "March 10" is located in Vargas State Venezuela, began its works March 24 2006. Some of our main deficiencies were the acquisition and processing in time of the statistic. The nonexistence of a format and normal models for the delivery of patient's results damaged the excellence of the services. They were not registered demographic data neither any information on the positive or negative result of the studies for assisted pathologies. To solve these deficiencies it was developed and implemented software with a very simple graphic interface. Now technicians and specialists can elaborate and kept the reports in the database where later on they can be carried out searches for different approaches based on the international classifier of illnesses. This improve the acquisition and process of the daily statistic or for previous dates. Being achieved uniformity in the delivery of the reports for departments, also wins in time and quality in the services. The software includes a dictaphone system and patient security and privacy is preserved. One has registered more than 212735 studies with 59236 patients in the center. This has facilitated different investigations carried out by our specialists as they are works of masters, of thesis, of investigative development and scientist among others. This solution has been extended to 8 Centers of Doctors of High Technology with excellent results.

17:00 to 18:15 TECHNICAL SESSIONS

ROOM 1: TECHNICAL SESSION INF, Chairman: Francisco Azuaje; Jose Luis Ramirez

25 Sistema de Reconocimiento de Patrones en Bioinformática

J. Altamiranda[1], J. Aguilar[2] and L. Hernández[3]

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Abstract— Data Mining is defined like a set of methods for the extraction of knowledge from large databases. In this work we propose the construction of a System of Data Mining for Systems Biology, whose objective is to identify the patterns of the chemical substances present in the brain of a rodent during the development of a given activity (to sleep, to eat, etc.) The system identifies the classes that represent the chemical substances, and the classes that represent the activities made by the rodents. The performance of the system of Data Mining was tested using an example in which the neurotransmitters Glutamate and Aspartate are studied and the samples obtained are classified.
Palabras claves—Systems Biology, Bioinformatics, Data Mining, Artificial Intelligence, Artificial Neural Network.

307 Software Gráfico Para Diagnóstico Médico Por Lógica Difusa

I. Salgado[1], A. Rodríguez[1], I. Chairez[1] and A. Zúñiga[2]

[1]Unidad Profesional Interdisciplinaria de Biotecnología México, [2]Centro de Investigación y Estudios Avanzados del IPN, México

Abstract— El surgimiento de sistemas expertos ha modificado sustancialmente la forma de dar seguimiento a las enfermedades presentes en un paciente, hasta hace algunos años esta parte de la atención hospitalaria recaía en la experiencia de los médicos tratantes. El principal problema que puede presentar un software de diagnóstico especializado consiste en asociar la experiencia y conocimiento de un médico con un algoritmo computacional que establezca parámetros y en base a las variables médicas dar una conclusión sobre el estado metabólico del paciente. El presente trabajo muestra el diseño de un software gráfico basado en lógica difusa que permite brindar un diagnóstico

de las enfermedades que conforman el síndrome "x" o síndrome metabólico, las variables provienen de una base de datos del departamento de Nutriología Clínica del Instituto de Nutrición de México y coloca al paciente en una escala de riesgo derivada de las variables contenidas en la Base de Datos. Mediante lógica difusa ponderada asignamos diversos pesos a cada una de las variables dependiendo de la gravedad y el nivel de afectación que tengan sobre la salud del enfermo.

Palabras claves— Lógica Difusa, Síndrome metabólico Base de Datos, Prediagnóstico, Sistemas Expertos.

310 Banco Virtual de Imagens Bidimensionais de Estruturas Anatômicas para Aplicação na Radiologia

C.E. Santos[1] e A.F. Frère[1,2]

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Abstract — The simplified virtual phantoms do not offer good representations for organs and complex anatomic structures. More elaborated, voxel-based phantoms require a significant quantity of tomography images as reference in order to be generated. In both cases, it is not possible to change the composition and position parameters of the generated models, even using external tools. This paper presents a method for populating an image database with virtual anatomic structures from 3-D phantoms generated using a multi-platform software called Blender. The phantoms generation process was based on images from an anatomy atlas and pictures from a skeleton with certified measures. The resulting models present high-definition graphics, comprising three distinct layers that represent, respectively, the human body external anatomy, the osseous system and the internal organs. New phantoms can be generated by modifying the model's appearance and positioning in the tool. The phantoms can also be sectioned from different perspectives, generating images that could be stored in a 2-D image database, making its usage faster, more efficient and functional. The possibility of changing parameters related to the phantoms anatomy and positioning, even using a modeling tool, makes the new kind of phantom a good alternative to voxel-based computer-generated phantoms, without the main problems found on the adoption of the later ones.

Keywords— computer-based phantoms, computer simulation, quality control, image processing, medical imaging.

378 Gestión de Imágenes Médicas Usando Grid Computing, Modelo para el Apoyo de la Investigación en el Área de Salud en Venezuela

Jesús Campos[1], Emilio Hernandez[2]

Abstract— It is desired to insist on a proposal of solution that allows to solve the management and control of clinical data in hospital environment with possibility of handling sources of associate medical images to each patient and who these images can be transferred to centers of storings of data, considering distributed computing, and that such are able to satisfy the requirements with the investigation and the academy, as well as for its safekeeping and backup.

Palabras claves— Digital Image Processing, Medical Imaging, Storage, Grid Computing .

96 Algoritmo Para La Inversión Del Modelo De Cole-Cole A Partir De La Parte Real Del Espectro De Impedancia Eléctrica

D. A. Miranda[1], J. G. Barrero[2]

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Abstract— It is presented the partials results of an early uterine cancer detection based on electrical impedance spectrum. It was developed a new algorithm to the inversion of the Cole-Cole model using only the real part of the electrical impedance spectrum. The new algorithm is based in a hybrid inversion model, a direct inversion and a genetic algorithm. The basic procedure is described by the following sequence. First, the imaginary part of the electrical impedance spectrum is precalculated using a direct inversion of Debye model. Second, the Xiang direct inversion is used to calculate a first approximation of the Cole-Cole parameters. Finally, it is use of a genetic algorithm to optimize the Cole-Cole parameters doing minimum the square error between the data and the model.

Keyword: EIS, Electric impedance spectroscopy, early uterine cancer detection, Cole-Cole model, Debye model, Xiang algorithm.

ROOM 2: SPECIAL SESSION IMA, Chairman: Miguel Torres-Cisneros, Victor Ayala-Ramírez

398 Image Processing For In Vitro Cell Tracking

E. Perez-Careta[1], J.G. Aviña-Cervantes[1], O. Debeir[2], J. Sánchez-Mondragón[3], D. May-Arrioja[3] and M. Torres-Cisneros[1]

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Abstract— In this paper, we propose an image processing method able to detect cells trough in *vitro* phase-contrast video microscopy. Bodies of the cells and image background are very similar; it does not allow having a good performance of tracking process. The proposed method normalizes original image to obtain better object-background contrast, image is equalized to highlight the object to be tracked, and image is threshold in order to obtain a better object-background contrast. Gray Level Morphological Gradient is applied to obtain more defined contours in the areas surrounded by Halos. Dilatation and Erosion were combined to achieve this goal. A subtraction process was applied after dilation of image to obtain borders.
Keywords— Image Processing, Cell Tracking, Image Normalization, Image Equalization, Morphological Gradient.

399 Extracción de Características en Mamografía Digitalizada Utilizando Filtrado Quincunx

M. González, J. Quintanilla, M. Sánchez, G. Cortina A. Vega.

Universidad de Guanajuato/Facultad de Ingeniería, Mecánica, Eléctrica y Electrónica, Salamanca, México

Abstract– In this paper, an Adaptive Wavelet Transform is applied on a Quincunx grid (Red-Black Wavelet Transform) with the image denoising purpose. The Quincunx filtering is applied on digitalized mammography images in order to detect microcalcifications. From the images, features like the gradient magnitude and features of local contrast and normalized local contrast with differents windows sizes, are extracted. These features model the microcalcifications and health tissue. The model applies a sequential selection method based on a General Regression Neural Network (GRNN) to obtain the best features. Images segmentation is carried out by means of unsupervised k-means algorithm; obtain images with information about microcalcifications and mamma tissue. The results are compare applied the classic Wavelet Orthogonal filtering.
Palabras clave– **Quincunx Wavelet, Wavelet Transform, Local Cotrast, Normalized Local Contrast, K-means.**

400 Automatic search of information about cancer in the Web

Rafael Guzmán-Cabrera[1,2], M.A. Hernández-Figueroa[1],José Ruiz-Pinales[1]

[1]FIMEE, Universidad de Guanajuato, Mexico, 2DSIC, Universidad Politécnica de Valencia, Spain

Abstract— Due to the dramatic increase on available information in the WEB, users are in the need of new tools to find, filtrate and analyze the huge amount of data returned by search engines. In this paper we present a new tool for WEB searching which starts from a small set of examples labeled by the user. From them a process of selection and weighting of words to form new queries ensures the recovery of more relevant documents. The results obtained on a search for cancer related documents illustrate the effectiveness of the method.
Keywords— Web, Search, Query.

401 On the Application of Robotic Vision Methods to Biomedical Image Analysis

V. Ayala-Ramirez, R.E. Sanchez-Yanez and F.J. Montecillo-Puente

Universidad de Guanajuato / FIMEE, Laboratory for Vision, Robotics and Artificial Intelligence Research, Salamanca, Mexico

Abstract— In this paper, we present some robotic vision method that could be useful for biomedical image tasks. We establish some parallels between image analysis tasks in the robotics vision and biomedical image processing contexts. We address some dynamic vision methods and we present how its application could be extended to problems in biomedical image analysis.
Keywords— robotics, vision methods, image analysis, biomedical images.

98 Guiding The Surgical Gesture Using A Lingual Electrotactile Display

F. Robineau[1], Y. Payan[1] and J.P. Orliaguet[2]

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Abstract— Tactile sensation can provide spatiotemporal information on the human skin. We want to use this modality as a computer aided surgery device. First, we review the different kinds of mechanoreceptors involved in the tactile mechanism to show the role of each receptor type. Next, we describe both the vibrotactile and electrotactile displays used to convey information transmitting tactile vibration on the skin. Then the high discrimination ability of the tongue is identified. Finally, the purpose of our research is developed. We propose to give a surgeon a feedback about the position of surgical tool tip inside the body of a patient providing him electrotactile stimulation on the tongue using a Bach-y-Rita tactile display.
Keywords—Mechanoreceptors, tongue, vibrotactile and electrotactile stimulation, computer aided surgery.

ROOM 3: TECHNICAL SESSION INS 1, Chairman: Julio Cruz; Guillermo Villegas

14 Fuente conmutada para una familia de electrocardiógrafos

A.L. Fernández M.A. Grillo y E. Medina

Instituto Central de Investigación Digital (ICID)/División de Equipos Médicos, Ciudad Habana, Cuba

Abstract— In current times, finding medical equipment which does not use a switched-mode power supply (SMPS) or any other solution of this kind is very hard. This paper presents the electronic design of a SMPS with nickel-metal hydride (Ni-MH) battery backup, which is devised to be used in a group of portable ECG machines developed in Cuba. After obtaining the general diagrams of this power supply, the three main blocks are briefly explained. Then, the different parametric and electric security tests carried out in each of these blocks are talked about. The results of these tests prove that the development of the required SMPS for the medical equipment produced in Cuba is thoroughly feasible.
Palabras claves— Fuente conmutada, SMPS, AC-DC, DC-DC, respaldo de baterías.

19 Sistema de monitoreo de cardiaco para pilotos de combate en pleno vuelo.

B. P. Edson[1], C. Y. Duvan[2], R. L. Leonardo[3]

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Abstract—This work presents the design of a cardiac monitoring system for pilots of the Colombian Air Force. The main goal is to continue using the voice channel of the aircrafts for sending both the voice signal and the ECG signal, without interfering one in another. The system is composed by two subsystems: the transmitter and the receiver. The transmitter one consist of the ECG acquisition circuit, the voltage controlled oscillator, a low pass filter and a signal adder. The receiver one consist of a low pass filter (in order to obtain the original voice signal) and the link to a personal computer through the sound card, which, by means of a mathematical software, the ECG signal is demodulated, filtered and visualized on screen.
Palabras Claves—Monitoreo, signo vital, pilotos en vuelo, telemetría, canal de voz.

23 Monitoreo de ECG con cable de 3 ó 5 hilos

Arturo Cuan Cheong, Mario García Valdes

ICID, C. Habana, Cuba

Abstract— This paper deals with the characteristics of an electronic module intended for ECG applications, that allows to carry out the simultaneous recording of several leads using three or five lead patient cable using in our Bedside Monitor. The high quality components, like programmable PIC microcontrollers and instrumentation amplifiers, used throughout the design are a guarantee for complying with both technical and security requirements that international standards demand for this type of equipment.
Palabras claves— ecg, derivaciones, PIC

380 Procesamiento Digital sobre Monitor Cardíaco

Carlos Centeno, Eduardo González, Fernando Cagnolo y Carlos Olmos

Grupo de Ingeniería Clínica Universidad Tecnológica Nacional, Córdoba, Argentina

Abstract— In this work we considered to take the obtained data from basic a cardiac monitor and by means of the use from digital signal processing (DSP) to come to improve the characteristics and benefits of the same one. This monitor was developed as didactic-experimental equipment in the Laboratory of Bioelectrónica of the Department of Electronic Engineering of the Technological University National Regional Faculty Cordoba is a device of under cost able to acquire the twelve derivations with three simultaneously. Its structure consists of a block analogical, that the function fulfills to acquire and to prepare the signal of the ECG, and a digital stage, that turns the analogical values to words digital which are processed with DSP techniques. In this work they evaluated the use of diverse digital filters, in aspects such as, run time, conditions for its implementation, amount and type of variables. On the other hand it was come to compare the result of the implementation of these techniques with the data obtained without her. The final equipment is a monitor, portable electrocardiograph and of low cost, able to be implemented with different configurations from digital filters or without them, all it with the purpose of allowing to its application in the degree education, postdegree and applied investigation.
Palabras claves— Electrocardiograma, DSP, monitoreo.

388 Sistema Multiagentes para el Monitoreo Inteligente

J. Cruz[1], A.I. Hernández[2,3], A. Beuchée[4], S. Wong[1], G. Passariello[1], F. Mora[1], G. Carrault[2,3]

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Abstract— This work is performed in the context of the intelligent monitoring of physiological signals using multiagent systems. Multiagent systems allow the handling of distributed information, communication and coordination between independent organizations and the implementation human-machine interfaces. The proposed system allows the early detection of episodes of apnea-bradycardia and the automatic activation of a kinesthetic therapy to stop these episodes. To achieve this goal, a multiagent architecture is defined in which specific agents are associated with the different stages of the monitoring process: acquisition, processing, diagnosis and therapy. The system is composed of one or several acquisition devices and by a monitoring application. The monitoring application was implemented using a multiagent platform, thus facilitating the integration of specific knowledge and substantially reducing the time of software development. This work represents an important contribution to the automatic patient monitoring process.
Palabras claves— multiagent systems, medical information systems, signal processing, health care, neonatal care

ROOM 4: SPECIAL SESSION INS, Chairman: Miguel Cadena, Oscar Infante

395 Nuevos métodos de análisis de la Variabilidad de la Frecuencia Cardiaca

D. Jugo[1], R. Medina[1,] R. Rojas[1], T. Núñez[2,] E. Arellano [2],A. Borrego[2]

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Abstract— This work describes new methods of analysis of heart rate variability whose efficiency has been demonstrated. It begins defining term HRV, continuous with a brief summary of the traditional methods of analysis of HRV. Finally describe results obtained when applying the methods of Transformed of Lomb, Detrended Fluctuation Analysis, and Symbolic Dynamics to a group of chronic chagasic patients.
Palabras claves— Heart rate variability, Autonomic nervous system, Nonlinear dynamics, chronic chagasic patients

396 Asociación de la variabilidad de la frecuencia cardiaca y de la variabilidad de áreas pupilares en sujetos sanos, con respiración controlada.

Martínez-Memije R[1,3], Estañol Vidal B[2] , Infante Vazquez O. Suaste E[3].

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Abstract— There are a variety of protocols to probe the autonomic nervous system (ANS). A non invasive tool to asses this activity is by studying the heart rate variability (HRV), under controlled maneuvers. Controlled respiration induces modulation in tachograms (time intervals between cardiac beats) the so-called respiratory rythms. In the pupil some authors have also reported these respiratory changes, but they are less evident than in the heart rate and have been poorly studied.

In this work we registered the spontaneous HRV and pupillary area variability (PAV) simultaneously. This system simultaneously register the EKG in D2 and the pupil activity (at three frames per second) under conditions of controlled luminance, in eight normal subjects with an age range 23-35 years, with a maneuver of controlled respiration at a rate of six respirations per minute for two minutes to study the relationship between the HRV and PAV. In this maneuver, the tachogram and pupillogram signals were analized in the frequency domain at the same frequency criteria than HRV, by mean periodogram, also we calculated its coherence function. The spectral analysis showed an evident band centered in 0.1 Hz in both spectrum, this band is correspondent to respiratory rhythm. This is most evident in the coherence function and it has a signifcat value of 0.7 (significance $\geq$ 0.5). That shows the close relation between both signals in this maneuver; it probably reflects a common origin of respiratory modulation at this different ANS effectors. During inspiration the pupil dilates whereas during expiration the pupil constricts showing the same type of alternation sympathetic/parasympathetic observed at the heart level.

Keywords— Heart rate variability, Pupillar noise, pupillometry, autonomous nervous system.

397 Metabolic Variability: ¿Noise or New Physiological Information?

M. Cadena[1], J.F. Rodríguez[2], L.H. Medel[2], O. Infante[3] and B Escalante[4]

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Abstract— The aim of this paper is to propose the measurement a new type of physiological variability. The premise is that there is embedded information in the form of short-term metabolic variability (MV) when the human gas exchange is measured using the mixing chamber and the breath by breath indirect calorimetry technique (ICT). This two measurement methods are compared to observe metabolic dynamics when subjects are subdue to physiological stimulus. Variances and low frequency power spectrums (0-0.5 Hz) are use to measure the MV activity. The hypothesis is proved measuring the MV in a population of 17 young volunteers subdue the clino-ortho maneuver. The test protocol was adapted using 30 minutes of data acquisition to include both mixing chamber and breath by breath ICT. Subjects were measured after 8 hours of fasting. The results showed a MV increment from 32.5 to 40 ml/min ($p<0.01$) for de VO2 standard deviation with none significance change for de the VCO2 using the mixing chamber ICT. Analogously the ICT breath by breath MV showed a total power spectrum change from 34.9 to 60 $(ml/bth)^2$ for the VO2 and from 24 to 37 $(ml/bth)^2$ for the VCO2 ($p<0.05$), mainly in the frequency region from 0.01 to 0.03 Hz. Therefore, it was concluded that breath by breath MV was approximately 3 times more relevant than the mixing chamber MV with the possibility to evidence metabolic control mechanism.

Keywords— metabolic variability, indirect calorimetry, gas exchange, metabolism, VO2 and VCO2.

72 Detección de las frecuencias cardiaca y respiratoria mediante una báscula electrónica

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Abstract— A technique for heart and respiratory rate detection using a common electronic weighing scale is proposed. For heart rate detection, the system senses force variations related to the blood accelerations in the aorta. Because respiration modulates that force signal, we can extract the respiratory rate from it. We have applied our method on

three different weighing scales whose static and dynamic characteristics were first estimated by a mechanical pulse test. Their sensitivities were from 4 μV/N to 15 μV/N, and their frequency response was broad enough for heart and respiratory rate estimation. For sensing the low force variations (about 240 mN), we designed an amplifier with an overall gain about 75×10^3. The signal-to-noise ratio (SNR) of the main peaks of the pulse signal detected was up to 60 dB, which is large enough for heart rate estimation by simple signal processing methods. Respiratory rate was estimated using frequency domain analysis. The technique was tested on 16 volunteers, wearing footwear and without any additional electrodes/sensors attached to their bodies. The error was ± 0.58 beats/minute for heart rate and ± 1.40 breaths/minute for respiratory rate.

Keywords— Force variations, heart rate, respiratory rate, weighing scale.

108 Design of an Equipment for Acquisition and Processing of the Electrocardiogram and Breathing Signals for the Analysis of Heart Rate Variability

Ángeles Fabián Alvarez[1], Edmundo Barrera Cardiel[1], Humberto Ruiz Vega[2], Gerardo Barrera Cardiel[3]

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Abstract— This paper presents the design of a prototype of a portable equipment for acquiring and processing the electrocardiogram and breathing signals for the analysis of heart rate variability. The equipment has been mainly designed to analyze the relationship between breathing to different frequencies and beat-to-beat heart rate variability. The equipment consists of a module of hardware and software for the acquisition of the electrocardiogram and breathing signals and a second module of software for processing both signals. This software was developed by using graphical programming based on the LabVIEW platform. The architecture, design criteria and test results of the designed equipment are presented.

Keywords—measurement, heart rate variability, breathing.

ROOM 5: ROUND TABLE, MR INS 1, Organizer Luis Lara Estrella

Instrumentación, Equipamiento De Sector Salud.

Martha Zequera, Luis Vilcahuaman, Renato Garcia, Juaquin Lejeune, Miguel Cadena, Alexander Somariba, Ruben Medina, Luis Lara Estrella

POSTER SESSION: BEST STUDENT AWARD, Chairman: Claudia Barenco, Antonio Bosnjak, Adriana Vilchis, German Castellanos

192 Comparative Studies of Different Vascular Stents in terms of Mechanical Performances: Finite Element Analysis

Seung-Kwan Cho[1], Won-Pil Park[1], Eun-Jung Cho[2], Dohyung Lim[1], Han-Sung Kim[1] and Jai-Young Ko[3]

[1]Dept. of Biomedical Eng., Yonsei Univ., Institute of Medical Eng., Yonsei Univ., Wonju, Republic of Korea, [2]Altair Engineering Korea Co., Ltd., Sungnam, Republic of Korea, [3]M. I. Tech Co., Ltd., Seoul, Republic of Korea

Abstract— Seven representative commercialized stents were evaluated by FE analysis in terms of the criteria based on the itemized list of Food and Drug Administration (FDA) and European Standards (prEN). Tenax and MAC standard were generally excellent in various evaluation items. Palmaz-Schatz was the most excellent in fatigue durability, but its flexibility was a little inferior than that of other stents. This study may suggest a guideline for improvement in stent design and function.

Keywords— Finite element analysis, Non-clinical test, Performance evaluation, Vascular stent

143 Idade Óssea: Uma Nova Metodologia de Estimação

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USP / Escola de Engenharia de São Carlos - Departamento de Engenharia Elétrica, São Carlos, São Paulo, Brasil.

Abstract— Clinical assessment of skeletal age is a frequent, but yet difficult and time-consuming task. Automatic methods, which estimate the skeletal age from hand radiography, are currently being studied. This work presents a methodology based on bone segments measure (area) using active contours. Initial results showed the possible relation of bone age with features (area) found to each ossification center used to the bone age estimation in classical methods.
Keywords— Bone Age, Medical Image, Hand Radiography, Active Contours.

211 Uma abordagem de Fusão de Sinais Vitais baseada em Redes Bayesianas

V.R. Martins[1], J. Boudy[2], R.V. Andreão[1] e T.F. Bastos-Filho[1]

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Abstract— It is proposed in this paper the use of probabilistic nets (with the use of Bayesian network technique) for vital and movement signal fusion. The signals are acquired by a mobile telemonitoring system for patients at home (called RFPAT), developed for automatic identification of urgent situations. The advantages of probabilistic network are shown, as well as the methodology used to perform the sensor signal classification. Finally, the applicability of the system as an important tool to assist elderly patients or patients with cardiac diseases attendance hospitalized at home is demonstrated through experiments.
Keywords— Data Fusion, Bayesian Networks, Telemonitoring, Decision Support Systems, Artificial Intelligence

341 Detección de genes cry1 y cry2 en cepas venezolanas de Bacillus thuringiensis y sus posibles aplicaciones en el campo de la Biotecnología Agrícola

A. E. Gillis and M.A. Santana

Universidad Simón Bolívar, Departamento de Biología Celular, Lab. de Biotecnología Agrícola, Caracas, Venezuela

Abstract— Bacillus thuringiensis (Bt) is a valuable biopesticide that is being used for the control of agricultural plagues of economic importance. Their insecticide properties are attributed to the presence of δ-endotoxins, Cry toxins, which are synthesized during the phase of sporulation of the bacterium. These toxins, when ingested by the larvae of the target insect, generate a set of physiological reactions that cause their death. The objective of the present work was the isolation and characterization of Bt strains from soils of the Guayana Region (Venezuela). Soils of different locations of Guayana were collected, dried and processed until the isolation of colonies with Bacillus spp. morphology. These colonies were grown in agar-water until sporulation and observed under the microscope for the verification of the presence of crystals, having identified 94 strains with Bacillus morphology. These strains were characterized for the presence of genes cry by the use of the PCR technique and the use of general primers for cry1 and cry2. Of the total of analyzed strains, 75% presents the genetic profile cry1/cry2, which is toxic against Lepidoptera and Diptera and may have important applications in the agricultural and health fields.
Palabras claves— Bacillus thuringiensis, genes cry, PCR

354 Caracterización mediante FTIR y DSC de la interacción colágeno – hidroxiapatita

R. J. González-Paz[1], J. L. Feijoo[1], K. Noris-Suárez[2], A. M. Ferreira[2] y G. González[3].

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Abstract— In the present work, we studied the effect of the mineral content (hydroxyapatite), on the thermal stability of the bone collagen matrix. The demineralization process was followed measuring the percentage of remaining mass and characterized by Fourier transform Infra red spectroscopy (FTIR) and Differential Scanning Calorimetry (DSC), using a Calcium chelant agent (EDTA). A 52 % loss of the initial weight was observed after 72 hours of treatment, associated with a decrease of the mineral content, indicated by changes in the intensity of the peaks correspondent to PO4-3 vibrations. The bone collagen`s denaturalization and degradation temperatures was followed by DSC, showing

an endotherm in 166º C for the untreated bone and in 113ºC for the 72 hours treated bone, correspondent both to the bone collagen denaturalization temperature. The thermogram for the 12 hours demineralized exhibited a small endotherm in 250ºC, corresponding to slight degradation, for the 72 hours treated bone the endotherm decreased to 230º C, correspondent to the bone collagen degradation. The above results lead us to conclude that the bone collagen triple helix losses its thermal stability when the interactions with the surrounding hydroxyapatite are eliminated.
Palabras claves— Hueso, Colágeno óseo, Hidroxiapatita, DSC, FTIR.

86 Algoritmo de Máxima Verossimilhança para a Estimação da Velocidade de Condução Média de Sinais Eletromiográficos de Superfície

S. Salomoni[1], F.A. Soares[1], F.A.O. Nascimento[1], W.H. Veneziano[2] e A.F. da Rocha[1]

[1] Universidade de Brasília/Departamento de Engenharia Elétrica, Brasília-DF, Brasil, [2] Universidade Tecnológica Federal do Paraná/Departamento de Eletrônica, Pato Branco-PR, Brasil

Abstract — Surface electromyographic signals may be acquired using multi-channel electrodes, allowing the estimation of important characteristics, like the motor unit or single fiber conduction velocity (CV). This work presents an algorithm to minimize the mean square error of the estimation of the delay between signals from different channels spaced between one another by the inter-electrode distance (IED). Considering the CV constant during voluntary isometric contractions of low intensity, and knowing the IED, the estimation of the delay between adjacent channels allows the direct calculation of the mean CV. In this work, in order to increase accuracy, the problem is moved to the frequency domain. A numeric method is presented to accelerate the mean square error minimization time. As a result, it was observed that the use of more channels within the calculations leads to smaller variances of the CV estimative, if all the channels considered are located between the innervation zone and the tendon region.
Palavras chave — Velocidade de condução, eletromiografia, máxima verossimilhança, minimização, arranjo linear de eletrodos.

POSTER SESSION: BEST YOUNG INVESTIGATOR AWARD, Chairman: Claudia Barenco, Antonio Bosnjak, Adriana Vilchis, German Castellanos, Ratko Magjarevic

147 A novel approach for Pattern Recognition in Capillary Electrophoresis Data

G.A. Ceballos[1], J.L. Paredes[1] and L.F. Hernandez[2]

[1] University of Los Andes / Electrical Engineering Department , Mérida, Venezuela , [2] University of Los Andes / Laboratory of Behavioral Physiology , Mérida, Venezuela

Abstract— In this paper, a novel approach for Capillary Electrophoresis data analysis based on pattern recognition techniques in the wavelet domain is presented. Low-resolution, denoised electropherograms are obtained by applying several pre-processing algorithms including discrete wavelet transform, denoising and detection of region of interest. The resultant signal is mapped into character sequences using the first derivative information and multi-level peak height quantization. Next, local alignment algorithms are applied on the coded sequence for peak pattern recognition.
Keywords— Capillary electrophoresis, discrete wavelet transform, dynamic programming, pattern recognition.

338 Acreditación de Laboratorios de Ensayos de Equipamiento Electromédico

D. Rubio[1, 2], S. Ponce[1, 2], A. Álvarez Abril[3], E. Fascioli[3]

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Abstract— During the past years, the complexity of biomedical technology and the hospital's facilities have been increased in a great way, becoming in a possible health risk. Biomedical equipment security must be considered an important issue to protect patients and users. Testing laboratories have to assure devices working in optimal performance following local an international normative.
Laboratories should develop his measure activities under a quality management system. This article tries to show the experience of the Biomedical Devices Testing Laboratory in the way to get the accreditation.
Palabras claves—ensayos, equipamiento electromédico, calidad.

90 Algoritmo de Compresión de EEG mediante Predicciones usando el Polinomio de Interpolación de Newton con Diferencias Divididas

E. Velarde Reyes

Centro de Neurociencias de Cuba, Ciudad de La Habana, Cuba

Abstract— This paper presents an on-line algorithm for compressing EEG signals with low computational cost, ideal for microcontroller applications. A Newton Divided Differences Interpolation Polynomial is used. An amount of 98 experiments were made for testing the method. Parameters as Compression Rate, Correlation Coefficient and Mean Square Distortion were calculated in order to assess the compression quality. The lowest Compression Rate measured was 37.60 % while the lowest Correlation Coefficient was 99.52 % and the highest Mean Square Distortion was 6.872 %.

Palabras claves— EEG Compression, Interpolation Polynomial.

182 Web based Teletherapy System for Telemonitoring and Remote Control of Therapeutic Devices

U. Grossmann, L. Jatobá, J. Ottenbacher, W. Stork and K. D. Mueller-Glaser

Institute for Information Processing Technology, University of Karlsruhe, Germany

Abstract— Health Monitoring is a growing field of research and development that gets more and more attention. Monitoring of patients at home by means of telemedical devices is a great chance to reduce costs for the healthcare system and increases the quality of life. Expanding the idea of health monitoring, a system is presented which not only monitors patient's vital data, but also enables the physician to adapt the therapy from afar by remote controlling the therapeutic device at the patient's site. Taking therapy of pain with infusion pumps as an example, the shortcomings of current treatment are discussed and optimizations using a teletherapeutic system are shown. The presented system consists of a webserver with webservice interface, which allows bidirectional, secure and fault tolerant communication between the physician and the devices of the patient.

Keywords— Teletherapy of pain, telemonitoring, security, trusted computing, fault tolerant web communication, radio frequency identification.

183 Aplicación de la Transformada Wavelet para el desarrollo de un método computacionalmente simple de detección del final de la onda T.

P.V. Rivera Farina[1], J. Pérez Turiel[2], A. Herreros López[2]

[1] Fundación CARTIF/División de Ingeniería Biomédica, Valladolid, España. ,[2] Universidad de Valladolid/Departamento de Ingeniería de Sistemas y Automática, Valladolid, España.

Abstract— Diabetes Mellitus is a chronic metabolic disease characterized by hyperglycemia and associated with microvascular (ie, retinal, renal), macrovascular (ie, coronary, peripheral vascular), and neuropathic (ie, autonomic, peripheral) complications. The World Health Organization estimates that 171 million people worldwide suffer from diabetes. This number is expected to double by the year 2030. Much of this increase will occur in developing countries and will be due to population growth, aging, unhealthful diets, obesity, and sedentary lifestyles.

Ischemic cardiopathy is one of the early manifestations of this disease. It is said to cause QT interval prolongation, thus providing a simple way to detect it or at least suspect of its presence.

The method we propose here, even if it's not the most accurate to define the boundaries of the T-wave, manages to detect it with a dispersion comparable to other "state of the art" methods. It's main advantage is that it is computationally lighter and easy to adapt to real time processing in order to implement it on medical devices. That way a doctor wouldn't need to go trough hours of data revision but just trust what the device has detected.

Preliminary results are promising, with mean values approaching those provided by other methods and with slightly smaller dispersions. This opens the door to a method that's computationally light and reliable enough to unattended wave detection and to the development of a reliable method to detect ischemic cardiopathy in its early stages.

Keywords— QT interval, T-wave, Wave detection, Wavelet transform, Diabetes.

206 Diseño y Control de un Exoesqueleto para Rehabilitación Motora en Miembro Superior

R. Gutiérrez[1], F. Vanegas, J. Duque[2], O. Avilés[2] and P. Niño[2]

[1]Universidad Militar Nueva Granada / Ingeniería Mecatrónica, Investigador, Bogotá, Colombia, [2]Universidad Militar Nueva Granada / Ingeniería Mecatrónica, Docente - Investigador, Bogotá, Colombia

Abstract— The biomechanical system's design and its control, used for arm rehabilitation therapy, are considered in this work. A designed three degrees of freedom (DoF) exosystem is manipulated by a fuzzy controller and relational database user interface. It allows generating different trajectories for each DoF; in that way the patient can receive special programmed therapy. The exosystem design, its control and power system, as well as the user interface are presented. Simulations results are provided to show the system and proposed control scheme performances.
Keywords— Lógica difusa, rehabilitación, mecatrónica, miembro superior.

THURSDAY SEPTEMBER 27TH

8:00 to 10:00 AUDITORIUM, PLENARY LECTURES, Chairman: Sara Wong

Advances in Biomedical Signal Interpretation and Modeling , Dr. Pablo Laguna, Spain,

Physiological Modeling: Model-based signal processing, Dr. Alfredo Hernández, France

10:30 to 12:00 TECHNICAL SESSIONS

ROOM 1: TECHNICAL SESSION SIG 2, Chairman: Alfredo Hernandez; Miguel Altuve

7 The Influence of Signal Representation on Fetal Heart Rate Variability Analysis

T. Kupka[1], K. Horoba[1,] J. Jezewski[1], A. Gacek[1], P. Labaj[1] and J. Zietek[2]

[1] Institute of Medical Technology and Equipment, Department of Biomedical Informatics, Zabrze, Poland , [2] Medical University of Silesia, Department of Gynecology and Obstetrics, Katowice, Poland

Abstract— Analysis of variability of fetal heart rate (FHR) is very important in prediction of the fetal wellbeing. The beat-to-beat variability is described quantitatively by the indices originated from invasive fetal electrocardiography which provides the FHR signal in a form of time event series. Nowadays, monitoring instrumentation is based on Doppler ultrasound technology. We used two bedside fetal monitors with different processing methods for heart beats detection and FHR signal determination: the autocorrelation and crosscorrelation techniques. Both monitors provide the output signal in a form of evenly spaced samples. The goal of this work was to evaluate the influence of signal representation on the indices describing FHR variability. For both monitors the indices calculated for the sampled signal decreased in relation to the indices determined from event series.
Keywords— Doppler ultrasound, fetal heart rate variability, heartbeat events.

165 Comparación de un índice vagal a la misma frecuencia cardiaca entre los estados de ejercicio dinámico y de recuperación temprana

R. Arias-Ortega[1], M.J Gaitán-González[2]

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Abstract— Root mean square of successive differences (rMSSD) is an accurate index of the heart rate variability and it has been associated to autonomic vagal modulation. The aim of this study was to compare the behavior of this index in relation to the heart rate during the states of dynamic exercise and recovery. The heart rate and the rMSSD were obtained in ten subjects during three minutes of dynamic ramp exercise done in a climbing step, form rest to 80% of theoretical maximum heart rate, followed by four minutes of recovery. The rMSSD values were calculated using a ten second window around 55% to 75%, in 5% steps, of maximum heart rate for exercise and recovery. An analysis of variance for repeated measures was used to compare the rMSSD value between exercise and recovery and its values for the different heart rates, finding differences for both factors. The differences between the conditions were present

for the heart rate values lower to 65% of the maximum heart rate. For relative heart rate above this value, the rMSSD did not change during exercise, probably due to vagal withdrawal. For recovery, the rMSSD increased noticeably below 65% of maximum heart rate, producing hysteresis.

Palabras claves— Variabilidad-frecuencia-cardiaca, rMSSD, Ejercicio, Recuperación temprana al ejercicio.

201 Respuesta Vagal Durante el Reflejo de Inmersión Evaluada Mediante un Índice Vagal Variante en el Tiempo

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Abstract—In this paper the immersion reflex is explored at different water temperatures, considering that the maneuver is non-stationary. Given that this reflex produces a parasympathetic response and that the root mean of successive differences (rMSSD) of the beat-by-beat heart period is considered as a vagal index, a time variant rMSSD was proposed. To estimate this index an autoregressive model was fixed by adaptive filtering and non-differences were found when compared with conventional rMSSD for stationary maneuvers. The heart period records of eight subjects in prone position were obtained during a three stages protocol: one minute of control, 20s of maneuver and one minute of recovery. The maneuver consisted on apnea, without and with face immersion in water at temperatures of 19º C, 11º C and 2º C. Comparing the average of four beats at the end of each stage for time variant rMSSD and heart period, differences were observed for the thermal stimulus level ($P<0.01$) and among the stages ($P<0.01$). Apnea did not present differences among the stages ($P>0.05$), probably due to the position effort. After one minute of recovery, the rMSSD return close to control values while heart period did not. The time variant rMSSD estimation proposed allows reviewing the behavior of the non-stationary immersion reflex; using it we could observe the direct relation between the stimulus and vagal response magnitude.

Palabras claves— Reflejo de inmersión, rMSSD, variabilidad de la frecuencia cardiaca, respuesta vagal

202 Relación entre el pulso fotopletismográfico digital y la presión arterial incruenta latido a latido ante el reto ortostático

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Abstract— We present a method to examine the changes in the photoplethysmographic pulse (PhP) and its association with blood pressure (BP) beat to beat, applying it to healthy subjects in clinostatic and ortostatic position. PhP change is more significant in response to postural change than the corresponding increase of the arterial pressure. The spectral power of the PhP showed comparable frequency bands those of the arterial pressure, but the changes in each one are more evident that those of BP when the individual goes of clinostatic to ortostatic position. The coherence function showed that the linear relation in frequency between both parameters is fine among half to eight Hertz but the spectral gain between both signals is greater in ortostaitc position. These results make think that this type of study can have clinical importance when allowing that by photoplethysmography (simple nonbloody method and of low cost) we pruned to evaluate the arterial rigidity and other associated parameters, with the person laid down or standing up. With this, we think that the PhP may be to a fine indicator of cardiovascular adjusts caused for the change of clinostatic to ortostatic position, which can complement the well-know in the arterial pressure.

Palabras claves— Pulso arterial, Volumen Fotopletismográfico, Control cardiocirculatorio.

204 A Statistical Approach for Studying the Power Spectrum of the Center of Pressure Displacement for Subjects in Orthostatic Posture

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Abstract— Postural control assessment by visual feedback in health population is still controversial. This works aims at investigating the influence of the visual system on the power spectra estimates ($\hat{S}(f)$) of the center of pressure displacement (COP) using two distinct protocols: eyes open (EO) and closed (EC). Subjects ($N = 144$) were submitted to stabilometric test, with 30 s in each eyes condition. $\hat{S}(f)$ was estimated for the anterior-posterior stabilometric signal

using the Bartlett periodogram method for both eyes condition. The Spectral F-Test (*SFT*) was then applied to test the null hypothesis (H_0) of same power contribution at each spectral frequency and in the frequency band Δf = 0.1-0.3 Hz. While for 69.4% of subjects H_0 within this band has been accepted, for 40 subjects this hypothesis was rejected ($SFT(\Delta f) < 0.06$). In the latter cases, the Romberg quotient of the sway area of the band-passed (0.1-0.3 Hz) signals resulted in higher values (median of 386.66) than that obtained without filtering. Thus, it is suggested the use of the spectral F-Test and band-pass filtering for assessing differences between the sway in different protocols.
Keywords— Center of Pressure Displacement, Postural Control, Spectral Analysis, Spectral F-Test, Visual System

292 Circadian pattern and night-day variations in human arterial stiffness: assessment using ambulatory recording of arterial pressure and pulse transit time

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Abstract—Several factors have been implicated in the circadian pattern of cardiovascular vulnerability. However, the exact mechanisms involved in the peak incidence of cardiovascular events occurring during the early morning hours and in the afternoon are not completely identified. Arterial stiffness (AS) is a risk factor for cardiovascular morbidity and mortality. The purpose of our study was to investigate the circadian variation of AS in healthy individuals and to test the hypothesis that there was a circadian pattern in the AS coincident with the circadian variation in the cardiovascular susceptibility. Additionally, a night-daytime comparison of AS was performed. Method: 24-hrs of ambulatory blood pressure, heart rate and aortic-brachial pulse transit time (PTT_{AB}) recordings were obtained in sixteen healthy individuals. AS surrogates, derived from the PTT_{AB} and systolic and diastolic pressure were calculated. The myocardial oxygen consumption (MVO2) was quantified. The AS and MVO2 shows a circadian pattern with the highest and lowest levels, respectively, in the night. The greater reductions in the AS were temporally coincident with the morning increase in the arterial pressure, heart rate, and MVO2. The lesser AS found during the day-time, could be considered a physiological adaptation to minimize the oxygen consumption during the period of maximal physical activity.
Key-words— Ambulatory blood pressure monitoring, arterial stiffness, circadian pattern, pulse transit time.

ROOM 2: TECHNICAL SESSION IMA 2, Chairman: Ruben Medina; Jacques Demongeot

42 Plan of Processing With Filtering of Noise Related To Contrast Enhancement Techniques Applied to Images of Dense Breasts

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Abstract— Dense breast images represent a continuous challenge to the stages of imaging processing involved in CAD schemes ("Computer Aided Diagnosis") mainly due to their low contrast and its implications to the human and computational visualization. The noise present in radiological images, specifically mammograms, represents and impediment in the diagnostic process. The main purpose of this work is to use a selective non-linear model of contrast enhancement with a density continuous-automatic classification regarding digital mammographic images associated with a model of noise removal and the preservation of edges. Two different databases were used - composed by regions of interest (ROIs) obtained from dense breasts images and ROIs of phantoms. Initial tests performed have pointed out a remarkable improvement in the dense breast images contrast apart from a significant reduction in the number of false positives.
Key words— Dense breast, microcalcification, non-linear model of contrast enhancement, CAD ("Computer Aided Diagnosis").

153 Reducción de Ruido en Imágenes de Fase Para Aplicaciones en Resonancia Magnética

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Abstract— Complex images with low signal to noise ratio (SNR) appear in various applications. The recovery of the associated phase images needs to consider noise influence, including loss of contrast and phase residues that can deteriorate the phase unwrapping process. Noise reduction in complex images has been addressed by various methods; however most of them deal only with the magnitude image. Only few works have been devoted to phase image denoising, despite the existence of important applications like Current Density Imaging (CDI) and Magnetic Resonance Imaging (MRI) that require their use. In this work, a group of denoising algorithms in the wavelet domain were developed and applied to the complex image in Magnetic Resonance Imaging (MRI), in order to recover the phase information. These filtering algorithms were applied to tomographic and phantom images. Significant decrement in the number of remaining phase residues were achieved by using the proposed filters.
Palabras claves— Denoising, noise, phase images, MRI, wavelet.

215 Compressão Sem Perdas De Imagens Mamográficas Utilizando Código Gray E Algoritmo Ppm

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Abstract— This work describes a mammographic image compression method that uses segmentation and the prediction by partial matching (PPM) data compression algorithm, together with the gray code and a bit plane image decomposition. The compressor will be included in a Computer-Aided Diagnosis System which is still being developed. Results show that the method achieves competitive compression rates in comparison with other advanced compressors, and brings some additional benefits which will be discussed in this work.
Keywords— Mammography, Compression, Prediction by Partial Matching (PPM), Bit Planes, Gray Code.

313 Dinâmica Simbólica Aplicada à Análise do Efeito da Apneuse em Imagens de Ressonância Magnética Funcional Cerebral

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Abstract— Symbolic dynamics was used to investigate the effect of breath-holding on brain functional Magnetic Resonance Imaging (fMRI). Data from an open Internet database were used. Two conditions were compared: breath-holding (on-off task period of 30 seconds) and resting. A symbolic dynamics parameter P(n), equal to the proportion of brain voxels with positive derivatives at each scan in a run, was calculated from the blood oxygenation level dependent (BOLD) signal. The robustness of P(n) was assessed by comparing the results of the original data and data split into odd and even slices. Slice-time correction was also investigated. The average normalized spectrum of P(n) of all breath-holding runs had greater power peaks at the breath-holding frequency (f_{bh}=1/30 Hz), contributing with about 35% of the total signal power, whereas none of the resting runs showed similar behavior. In all cases, P(n) indicated global, periodic effects caused by the respiratory modulation in all breath-holding runs, as opposed to the resting runs.
Keywords— fMRI, BOLD signal, breath holding, vasoreactivity, symbolic dynamics.

232 Método para morfometria de cabeça para projetar periféricos destinados à pessoas com limitações de movimentos

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Abstract—The digital world presents restricted and inaccessible to people with severe motor limitations that do not have a functional interface to put the mouse into motion or to use the keyboard. Peripherals activated by head motion are useful to these people, because of the lesion severity or motor deficit, almost always the head's actions keep preserved. However the fact of these peripherics have to attend the individual characteristics incapacitates the mass

production increasing, therefore the production cost increase. In this work was developed a method that allows to evaluate accurately the morphometric analysis of head, trying to determine common characteristics to everybody to provide a peripheric that attends most of the people. Thus was used Frankfurt's found odontological plan with an instrument composite by protection glasses, level bubbles coupled on its stems, two oliva placed in auditive meatos , a flexible ruler to mould the head between the nasal support and the seventh cervical, a scanner to capture the data and a software to register and to prosecute these data in the computer. Data were collected of thirty voluntary, the software accomplished the overlapping of the heads drawings and calculated the differences among individuals' morphometrics curves.

Palabras claves— cranial morphology, craniometric, cephalometric, craniometric point

172 An Automatic Method for Delineating the Pectoral Muscle in Mammograms

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Abstract— A method, based on Morphologic Operators, is proposed for pectoral muscles segmentation in mammograms. For the pre-processed image with nine gray levels, morphological operators were applied to homogenize this image. Afterwards, the image is binarized and an inferior reconstruction operator applied to remove structures disconnected from the pectoral muscle. The automatic delineating of the pectoral muscle edge was based on polynomial functions fitting, up to the third degree, according to a least square average error. A total of 100 images from the MIAS database (65 normal, 20 benign and 15 malign cases) was used in this work. The parameter overlap ratio (*RS*), which considers the radiologist-defined edge, was used for comparison. For a threshold of $RS \geq 0.6$, 97% of the pectoral muscle edges were delineated.

Keywords— Pectoral muscle, breast cancer, Morphological Operators, mammography.

ROOM 3: TECHNICAL SESSION INS 2, Chairman: Renato Garcia; Ricardo Silva

87 Electrocardiógrafo de 12 canales con atractivas opciones de conectividad

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Abstract— This paper presents the most outstanding features of the design as well as the fundamental benefits of a 12 leads digital electrocardiograph, intended for the performance of a resting electrocardiogram. Their portability, wide format of printing, high resolution screen, its capacity of storage cases and the choices of connectivity satisfy the state of the art of digital multichannel ECG machines.

Palabras claves— Electrocardiógrafo de 12 canales, Electrocardiógrafo para ECG en reposo, EKG, Electrocardiógrafo con conectividad.

111 Diseño y desarrollo de un prototipo para la obtención indirecta de la Derivación Bipolar II del ECG a través de la señal fotopletismográfica

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Abstract— This work consists in designing and developing a prototype that obtains an approximation of a normal ECG Lead II signal by means of a normal Photoplethysmographic signal (PPG). These signals are of vital importance for the heart functioning and are obtained by means of an only one optoelectronic transducer. This transducer will offer patients the necessary comfort that is not found in similar and traditional methods. Later, a low cost electronic prototype was made for the PPG signal conditioning, its respective analog-to-digital conversion and the data sending via serial port to a PC computer. Also, a Windows Graphical User Interface (GUI) has been developed in MS Visual C++ 6.0 to allow the PPG signal processing required for the obtaining of the ECG Lead II signal, and the corresponding visualization of both signals on a PC monitor. It has been made possible by means of using software algorithms for the implementation of a recursive autoregressive (RARX) model that converts PPG signal to ECG Lead II signal, considering

that both signals are repetitive signals and have the same repetition frequency. This developed work (hardware and software) is of a low cost with regard to traditional Medical Monitoring equipment and appears as a great alternative to be used in the medium and low complexity medical assistance services in Peruvian remote Health Medical Centers, improving the patients' life quality. Likewise, we are contributing to Biomedical Instrumentation research and development in Peru.

Palabras claves— Señal fotopletismográfica (PPG), Derivación II Bipolar ECG, modelo autoregresivo recursivo (RARX), interfaz gráfica de usuario (GUI), PC.

154 Diseño de un registrador para pruebas de Holter

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Abstract— The aim of this paper is to present the design of a Holter recorder device, capable of acquiring and studying up to 72 hours of a patient's ECG signal. The device allows to detect possible eventual arrhythmias very difficult to perceive through a rest electrocardiogram. The recorder for ambulatory studies is able to store 2 or 3 ECG leads onto a Flash Card to be analyzed afterwards. This article also describes the criteria employed for the selection of the electronic components used and the interconnection between them within the device. Some characteristics related to this are mentioned and the performance obtained is discussed.

Palabras claves— ECG, Holter, Registrador de Holter, Electrocardiograma de larga duración.

241 Melhoria De Qualidade E Produtividade Através De Um Sistema Informatizado Em Um Laboratório De Ensaios

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Abstract—Medical electrical equipment must be tested in order to verify if they are constructed and designed according to safety prescriptions. The NBR (Norma Brasileira) IEC (International Electrotechnical Commission) 60601 series is the normative standard set used by medical electrical test laboratories that follows the NBR ISO (International Standardization Organization) IEC 17025:2005 for this purpose in Brazil. The automation, measurement and control of the process is a key chalenge to improve the quality and productivity of test laboratories. This article presents an information system developed as a tool to aid test activities in a laboratory designed to test medical electrical equipment and improve the results of measurement of productivity. Some resourses to be included in this software are proposed in order to help the managers planning quality and productivity control.

Keywords— Biomedical instrumentation, test laboratory, medical electrical equipment, quality and productivity.

243 Prototipo De Unidad de Registro EDF Para Holter Digital de Bajo Costo

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Abstract— This paper describes the development of a recording unit for biomedical signals based upon standard secure digital memory cards, supporting the European Data Format (EDF) for the implementation of a low cost digital Holter. This device takes advantage of the possibilities offered by these wide spread memory cards (which are currently mass produced at very low prices due to their use in digital cameras and other handheld devices), in order to ease the implementation of long term digital signal acquisition, as happens with ECG records for HRV analysis. The use of recently introduced microcontrollers supporting these devices, as well as native USB support, may lead towards a future reduction of the price of these devices.

Palabras claves— Instrumentación, Holter, Registro digital, Bajo costo, ECG.

284 Electrocardiografía de Alta Resolución, con Transmisión Inalámbrica y Acceso WEB

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Abstract—In this work, a 12 lead ECG design is presented. This device uses an evaluation module of microconverters TI MSC1211Y5, with a resolution of 24 bits, achieving the acquisition and measurement of biopotenciales in a direct way, with minimal amplification, using less circuitry, diminishing energy consumption and cost. The captured readings are wirelessly sent to a computer, where is done the processing, storage and WEB upload, information which could be accessed by cellular phone using GPRS protocol.
Palabras claves— Electrocardiography, converter, modulation, delta, sigma.

ROOM 4: TECHNICAL SESSION MEC 1, Chairman: Martha Zequera; Diana Rodríguez

89 Sistema telemétrico para el monitoreo de la presión plantar

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Abstract. In this work the design and operation of a telemetric system by foot pressure measurement in human beings is reported. Composed of a distant hardware block portable by the user, where the pressure signals are acquired, conditioner and transmitter. The receiver stage connected to the computer serial port hand over data to a graphical user interface programmed in Matlab® where operator visualizes information acquired during walk. The system uses ultra-thin and flexible force sensors to measure pressure signals. Devices use in conditioner and transmitter stages were selected according low-power consumption requirements to bring system portability.
Keywords- Force sensors, Graphical User Interface (GUI), Plantar pressure, Portability, Telemetric system.

142 Modelo Computacional Simple de la Marcha Bípeda Humana

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Abstract— This work develops a simple neural network aimed to model the oscillatory neural pattern involved in the control of the human biped walking. The neural network proposed exhibits a highly non linear dynamics and generates oscillatory firing rates which decode the angular velocity for the segments forming the human legs. This model neural network is biologically inspired since it takes into account the structure and functional connectivity found in animal nervous systems generating rhythmic movements in wild behavior. From this approach, it is possible to say that this work supports the idea of the existence of general principles for the movement neurocontrol in animals. There are no considerations about stability under gravity effects.
Keywords— motor neurocontrol, human walking, neuro-robotics, non linear oscillations.

185 Análise Da Distribuição De Pressão Plantar Para Diferentes Formatos De Palmilhas De Silicone Através De Elementos Finitos

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Abstract: The plantar pressure distributions for a 42 normal feet were collected during barefoot standing using a pressure platform. From these data, a pattern foot, for this study, was characterized. A 3-D finite element foot model was generated and two insole models were simulated. The current paper investigated the effects of different insole models in pressure plantar distribution, using silicon of the foot-shoe interface. In addition, this study proposed a new concept for the bony structure of heel design, generated based on the x-ray and anatomical images. The finite element analysis implies better distribution of plantar pressure with flat insole than insole concave. Both insoles reduced plantar pressure of approximately 30%. The technique presented is an ideal clinical tool to explore the effects of various insoles models.

Key words: Plantar pressure, Finite element method, Silicon insole, Stress distribution.

278 Trajetória Do Centro De Massa Na Marcha Humana Normal Em Ambiente Aquático

C. C. de Araujo, E.F. Manffra, D. I. R. Ribas, P. Nohama

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Abstract— Water based exercises have been largely adopted in rehabilitation programs. Among them, walking in water is one of the most popular. For this reason, biomechanical characterization of walking in water have been done by investigating joint angles, joint moments, ground reaction forces and electromyographic activation patterns. Despite of this, very few is known about motor control strategies employed by the central nervous system (CNS) during walking in water. It is well known that control of body center of mass (BCOM) during gait is strongly related to posture and balance. In this sense, examination of the BCOM displacement during gait provides information about dynamic stability control and CNS strategies to achieve it. Therefore, the aim of this work was to investigate the behavior of BCOM during walking in water, comparing its characteristics with those on dry land. To do this, nineteen male healthy adults were videotaped while walking at self-selected speeds on land and in water at the Xiphoid-process level. Markers were placed over anatomical landmarks, their coordinates were recovered and position of BCOM was calculated through a segmental analysis method. Beside the usual BCOM characteristics such as vertical excursion and horizontal velocity, the horizontal distance between the BCOM and the point of support was calculated. During the single stance phase, such distance provides a measure of stability. Among the results, it was possible to observe differences between the form of BCOM´s trajectory in water and dry land. This property might indicate that the interchange of potential and kinectic energies is different in water environment.
Palabras claves— Body center of mass, biomechanics, under water gait.

325 Effectiveness Of Insole In Reducing Plantar Pressure And Impruving Gait On Diabetic Patient (2007)

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Abstract— This study presents the effect of three orthotics treatment techniques in reducing metatarsal head, heel and toes pressure during walking. A pressure measurement study was carried out in a diabetic patients group wearing four insoles, including the insole, which was designed by the computer model proposed in this project.
The aim of this study was to evaluate the effect on plantar pressure distribution in different insoles prescribed and manufactured with various techniques on a random group of patients with diabetes mellitus in the early stages of the disease. Four different types of insoles were made by methods available on the market and a computer model proposed on this project was used in order to design and manufacture the insole.
It is well documented that subjects with peripheral neurpathy resulting from diabetes mellitus are at an increased risk of developing foot ulceration. Decreased sensation, in combination with high underfoot pressures, has been identified as a prime aetiology factor in thee cause of plantar naturopathic ulceration [1].
Key words—Biomechanics, insole, pressure distribution, diabetic foot.

345 Sistema para el Análisis de Movimiento en dos Dimensiones CineMED II

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Abstract— This paper describes the development of the second phase of the human movement analysis system called CineMED. It is based on videogrammetry methods and image processing in order to record the human movement. We used a digital camcorder, which was located to four meters of the person, capturing its gait in the Sagittal Plane. Also, we developed a kinematic model of lower limbs; this model takes the position data of the bony landmarks and calculates the joint angle of the hip, knee and ankle, besides the pelvic tilt during gait.

In the second phase we enhance the results of the system and modified the digitalization module in order to acquire the kinematics data in an automatic manner. The software uses the kinematics data of an optical arrange and kinetics data of a force platform and applies a dynamic inverse method in order to compute the net reaction joint force. Finally, we carry out experiments to measurement the performance of the system.
Palabras claves— Análisis de movimiento, Dinámica Inversa, Fuerza de reacción Articular, Plataforma dinamométrica, Detección de marcadores.

ROOM 5: TECHNICAL SESSION SIG 3, Chairman: Carlos González; Oscar Yanez

113 Descomposición Empírica y Filtrado Adaptable con Ajuste Temporal para la Reducción de Ruidos Cardiacos en Sonidos Respiratorios

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Abstract- Lung sounds (LS) are important for diagnosis of the pulmonary system but interference signals such as heart sounds (HS) complicate their computer analysis. Sub-band decompositions have provided promising schemes for filtering HS; however, the mother wavelet and the number of level of decomposition have to be selected. On the contrary, the Empirical Mode Descomposition (EMD) offers an adaptive, local, complete, and orthogonal decomposition for dealing with nonstationary and nonlinear signals. In this work a combination of EMD, linear adaptive filtering (AF) and time warping (TW) procedure is proposed for filtering HS. The proposed scheme was applied to simulated and real signals. The scheme reduced significantly the power of HS in both simulated and real signals. Therefore, we concluded that the combination of EMD and AF is a promising scheme to deal with heart sound interference in lung sounds analysis.
Palabras claves- sonido respiratorio, ruido cardiaco, descomposición de modos empíricos, filtro adaptativo.

114 Extracción de características en señales MER para el reconocimiento de zonas cerebrales

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Abstract—We present a methodology for dynamic feature extraction by means of adaptive filter banks in case of automatic identification of brain zone using micro electrode recording. Proposed biorthogonal filter banks changes according energy. Besides, adaptive lifting schemes, which allow filter order change, are used for filter bank implementation. Lifting schemes are introduced because lower computational complexity and less processing time. As features, both maximum value and variance of different wavelet decomposition levels are selected for brain zone classification. As a result, classification performance level of 98.5% value, estimated by means of bayesian classifier with Mahalanobis distance, is reached which is better than in 5% in comparison to those obtained figures for filter banks but having fixed parameters.
Palabras claves— adaptive filter banks, Teager algorithm, brain zone.

117 Detección de actividad muscular en registros EMG superficiales en aplicaciones de compresión de datos

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Abstract— Este artículo presenta la programación de un algoritmo para la compresión de señales electromiográficas (EMG) aplicando la detección de contracción muscular y reposo. Por medio de un análisis multiresolución se estima la porción de la señal que corresponde a relajación (baja frecuencia correspondiente a ruido de fondo) y contracción (alta frecuencia relativa), se elimina la información no significativa en términos de energía (señal de ruido); y posteriormente se codifican los datos resultantes, en este caso se aplica la codificación run length.

Además, se estima la tasa de compresión para un nivel de distorsión específico. Posteriormente, se examina que los tiempos de contracción y reposo no se modifiquen con la compresión de los datos. Como principal resultado, se encontró el compromiso existente entre la relación de compresión y la detección de las regiones de contracción y relajación muscular. Altas tasas de compresión implican una incorrecta identificación del rango de tiempo de la contracción muscular.

Keywords— señal electromiográfica, contracción muscular, relajación muscular, transformada wavelet discreta, relación de compresión, run length.

350 Diseño de un Módulo Electroencefalográfico para Interfaz Cerebro Computadora Orientada a Personas con Discapacidades Motoras

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Abstract—In this work a acquisition module of EEG (Electroencephalographic) signals was developed, oriented to the later construction of a brain computer interface, that allows to offer aid and/or therapy of rehabilitation to people with motor and/or communication disabilities. The study of these brain computer interfaces is not new, has around 2 decades of investigation. For the implementation of these systems is basically needed 3 stages : An EEG signals acquisition, a signal processing stage so that it is finally possible to extract specific signal features, according to certain stimuli and finally, features are translated into commands that operate a device like the movement of wheelchairs, prosthesis of amputated members, movement of images in screen or even selection of letters to form words in them. The acquisition systems developed in this work is centered in the development of the stage of acquisition of EEG signals for the mentioned aims. Palabras clave— Electroencefalografía (EEG), interfaces cerebro computadora (ICC), Brain computer interface (BCI), módulo MP100 de BIOPAC, amplificadores de instrumentación.

312 Análise de Filtros Espaciais em Sinais EMG de Superfície nas Condições do Máximo Volume de Contração

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Abstract— Nowadays the surface EMG measurement and its signal analysis have combined two important techniques in order to improve the signal resolution and better investigate single motor units: measurements configurations with smaller pick-up areas and application of the spatial filtering to electromyography. Smaller pick-up areas can be achieved through multielectrode arrays and multichannel recording, making possible the detection of correlated excitations at different sites of the muscle. Spatial filters combine the information of several electrodes to form one output signal channel. This work aims at evaluating the EMG signals measured from some subjects with a linear array of 16 electrodes and compare their resolution through the application of Bipolar, Longitudinal Double Diferentiating and Longitudinal Quadruple Diferentiating spatial filters.

Palavras-chaves— filtros espaciais, arranjos lineares de eletrodos, unidades motoras, resolução espacial, seletividade.

346 Diseño e Implementación de un Sistema de Clasificación de Tareas Mentales a través de Redes Neuronales Artificiales.

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Abstract— A neuronal classifier for the recognition of mental tasks is a very important part in a Brain Computer Interface System (BCI) due to the fact that this part of the system have to be capable of interpreting the mental tasks that the subject is executing in a certain moment. For this reason arises the idea of looking for the most successful classification system for the interpretation of the mental tasks. In this article we show the implementation of two types of classifiers of cerebral activities across artificial neural network (Backpropagation and Radial base). The classifiers were developed under Matlab's environment, using the electroencefalogram (EEG) of three different subjects. Also we show the rate of success classification for every net used in the different experiments.

Palabras Claves— Electroencefalograma, Clasificador neuronal.

POSTER SESSION 2: CLI ENG., MODELING, REHABILITATION, APPROPIATED TECH

69 Indicador de Produção aplicado ao Gerenciamento de Tecnologia em Saúde

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Abstract— In this work we describe the development and application of an indicator of productive activities (ICEB) to the management of health care technology by the Centro de Engenharia Biomédica (CEB) at the University of Campinas (UNICAMP), Brazil, aiming at performing quantitative evaluation of the services supplied by the Clinical Engineering (CE) staff to the health care area of the university. We have established performance scores (A to D), as well as other indicators based on ICEB. The indicator was applied to compare services offered to the so-called Surgery Center (ICEB = 0.68, score B) and to the Physical Therapy Unit (ICEB = 0.52, score C). The indicator was also applied to study the service delivered by the CE group while doing corrective maintenance for ventilators (ICEB = 0.71) and sphygmomanometers (ICEB =0.47). The results were treated as flags for the CE group. If properly used, ICEB may be applied to pinpoint where real problems exist and help to improve the interaction between the health care department and the CE group.

Keywords — Clinical Engineering, health technology, management, indicator, corrective maintenance.

84 Uma Abordagem Soft para a Integração da Engenharia Clínica na Assistência em Saúde

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Abstract — The healthcare system evolution and the amount of the healthcare equipments out of service in the developing countries, justify the need of seeking other ways for that the integration of the Clinical Engineering in the healthcare environment is improved. A novel manner of work to the Clinical Engineering is analyzing the HT with a process point of view. The health technological process and HT concepts are stated. A management model for improvements in the health technological processes, denominated Healthcare Technology Management (HTM), is proposed. To get contextualized information from a health technological process and assisting in the HTM implementation, the soft approach used in the Operational Research area for systematization of complex problems were investigated. The MCDA (Multicriteria Decision Aid) is an Operational Research methodology from soft approach that it may be used to get contextualized information from health technological processes. The results show that the suggestions from the multicriteria model obtained with the MCDA could assist the Clinical Engineering to implement the HTM. In this way, the Clinical Engineering area must develop an effective involvement in the decision making procedures, passing on to be a support actor for being one of the decision makers in the healthcare environment.

Keywords — Clinical Engineering, Healthcare Technology, Multicriteria Analysis, Health Technological Process, Decision Making.

200 Sistema para avaliação de funcionalidade de ventiladores pulmonares integrado a banco de dados

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Abstract— This work presents a prototype based on a microcomputer to assess the performance of lung ventilators according to the NBR 13763 and NBR IEC 60601-2-12. A microcontrolled electronic unit was developed to acquire samples from two differential pressure transducers (related to flow velocity and airway pressure) and from a temperature/humidity sensor. The sampled data is sent to a PC via Bluetooth. Software running on the PC presents the pressure, flow velocity and volume waveforms on the PC screen in real time. It also calculates ventilatory parameters and guides the operator during the ventilator assessment. Data on the lung ventilator (model, manufacturer and others), the sampled waveforms and the calculated parameters are stored into a database. The calibration procedure of the sensors and the tests carried out in a lung ventilator with the developed system are presented.

Keywords— lung ventilator assessment, NBR IEC 60601-2-12, NBR 13763, Bluetooth, clinical engineering

315 Análise de Risco em Unidades Eletrocirúrgicas de Alta Freqüência

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Abstract: This papers describes the risk analysis of high-frequency Electrosurgical Units. It was in five stages, enclosing from equipment principle of functioning uplo the risks points of control and its periodicity, searched in scientific publications, end alert of ECRI and specific national and international estandart with respect to high-frequency electrosurgical units. As results it was suggest risks the management,, detaching the risks factors,, the hazard, the damages, the control points and the periodicity for accomplishment of the control points,, with the objective not only protect to the patients and operators, but of also detaching the importance of the participation of all the staff involved in the process.
Key-words: Management, Risk Analysis, High-frequency Electrosurgical Units.

410 Control de Calidad en Equipos de RM

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Abstract - A new form is explained of storing the information that characterizes a resonator magnetic Panorama 0.23T manufactured by the PHILIPS. It is also presented a computer suite of tools for the control of the quality of the team, leaving of this information. This suite of applications developed in Matlab 2006 allows to approach the information in a totally automated and versatile way. User's graphic interface is shown that mediates between the user and the stored information, it manipulates the data and it generates reports of the state of the resonator.
Palabras clave: resonancia magnética, control de la calidad, predicción de fallos, Panorama 0.23T, PHILIPS.

31 Avaliação do Desempenho da Técnica de Oscilações Forçadas na Identificação Precoce das Alterações Respiratórias em Crianças Asmáticas

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Abstract: This work investigates the potential of the Forced Oscillation Technique (FOT) in the analysis of the respiratory mechanics in asthmatic children. The results obtained in 30 asthmatic children classified as normal to the spirometric exam and 27 asthmatics with mild obstruction were compared with 14 controls. The parameters obtained by FOT described an increase in respiratory system resistance ($p<0.0003$), as well as reductions in homogeneity ($p<0.001$) and dynamic compliance ($p<0.002$). These results were coherent with the physiological process under study. ROC analyses confirmed the clinical usefulness of FOT parameters and confirmed the high potencial of this technique in the proposed application.
Palavras-chave: Engenharia clinica, Avaliação de tecnologias, Instrumentação biomédica, Oscilações forçadas, sistema respiratório, asma, crianças.

39 Validação do uso da técnica de oscilações forçadas no diagnóstico da doença pulmonar obstrutiva crônica

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Abstract –The objective of this study was to evaluate the potential of Forced Oscillation Technique (FOT) in the diagnosis of Chronic Obstructive Pulmonary Disease (COPD). A total of 84 individuals were analysed, 28 healthy, 28 mild and moderate COPD and 28 severe COPD. The clinical usefulness of the parameters was evaluated by the analysis of receiver operating characteristic curves, investigating sensibility (Se), specificity (Sp) and the area under

the curve (AUC). In the mild and moderate group, 4 of the 7 studied parameters obtained appropriate accuracy for clinical use (AUC>0.8), while in the diagnosis of patients in the severe group, 1 parameter obtained appropriate accuracy and 6 presented high accuracy (AUC>0.9). In conclusion, the parameters obtained by FOT presented adequate Se and Sp, indicating that this technique can be helpful in the evaluation of the respiratory mechanical alterations in patients with COPD.

Palavras-chaves – Engenharia Clínica, Avaliação de Tecnologias, Instrumentação Biomédica, Biofísica.

160 Análisis de la Respuesta Inmune específica contra el VIH-1 como un Proceso Óptimo.

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Abstract— Los modelos matemáticos determinísticos que describen la interacción del virus VIH-1 y el sistema inmune del huésped han demostrado ser una valiosa herramienta de análisis de la dinámica de la infección. Estos modelos dependen de una serie de parámetros que son estimados a partir de datos experimentales y/o ajustados para obtener resultados compatibles con la experiencia clínica. Dichos parámetros representan, por ejemplo, tasas de infección de células sanas, tasas de producción de linfocitos citotóxicos específicos contra la infección, tasas de muerte de células y de copias virales, etc.

Los fenómenos biológicos representados por estos parámetros son complejos y existe evidencia de que algunos de ellos no mantienen un valor constante durante el curso de la infección.

El objetivo de este trabajo es plantear la variabilidad del parámetro que regula la expansión clonal de linfocitos citotóxicos específicos contra la infección como un proceso óptimo. Utilizando un modelo determinístico no lineal de tres variables y el principio del Máximo de Pontryagin, los resultados obtenidos indican que la expansión clonal de linfocitos citotóxicos durante el curso típico de la infección puede interpretarse como un proceso que maximiza un funcional de costo-beneficio con soporte biológico.

Keywords— VIH, modelos determinísticos, principio del máximo de Pontryagin.

213 Calcium release and uptake from the cardiac sarcoplasmic reticulum: Experimental and mathematical models

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Abstract— Excitation-contraction coupling (ECC) and cardiac muscle force development rely on the regulation of both release (through channels or ryanodine receptors, RyR) and uptake (by an ATPase) of Ca^{2+} by the sarcoplasmic reticulum (SR). In this work, we propose an experimental model in which Ca^{2+} transport is simplified by using a thermodynamic approach to inhibit part of the cellular Ca^{2+} transporters but keeping functional the SR release and uptake as almost sole transporters. Instead of membrane excitation, electrically quiescent cells were stimulated with brief caffeine pulses (10 mM, 0.1 s duration). The method was tested experimentally and the results were compared to mathematical simulations performed by using a modified version of the mathematical model of Ca^{2+} cycling in cardiomyocytes previously proposed [1]. Results indicated that the experimental model is suitable to study properties of the SR-cytosol Ca^{2+} transport in intact cells without significant interference of other competing transporters (e.g. Na^{+}/ Ca^{2+} exchanger).

Keywords— Excitation-contraction coupling, mathematical modeling, caffeine, Ca^{2+} transients, cardiac myocytes

240 Metodología para la reconstrucción 3D de Estructuras Craneofaciales y su Aplicación en el Método de Elementos Finitos

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Abstract— Este artículo describe la implementación de una metodología para la reconstrucción de estructuras anatómicas craneofaciales conformadas por tejidos duros y blandos a partir de imágenes biomédicas de modo que puedan ser utilizadas en aplicaciones que involucren el método de los elementos finitos en el área de la bioingeniería. Se logró reconstruir estructuras como mandíbula, hueso temporal y algunas piezas dentales de manera satisfactoria, conservando las características anatómicas reales de cada estructura y obteniendo un sólido conformado por superficies que permiten hacer simulaciones biomecánicas por medio del método de los elementos finitos, con posibles aplicaciones en cirugía maxilofacial y ortodoncia.

Palabras claves— Análisis de elementos finitos, craneofacial, imágenes biomédicas, modelación geométrica, reconstrucción tridimensional.

44 Otimização do Uso do Flutter VRP1 em Reabilitação Respiratória: Caracterização Mecânica e Desenvolvimento de Programas de Apoio ao Usuário

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Abstract: The Flutter VRP1 is a respiratory rehabilitation device designed to aid sputum clearance. Although the adequate use of this device depends on the airflow produced by the patient and the angle used, the relationship between these variables are not know and not usually taken into account in practice. The aims of this work were: (1) characterize the mechanical behavior of the cited device, and: (2) based on this characterization, create a program in order to optimize the use of this device. The mean deviation between the polynomial equations developed to describe the studied variables and experimental results were adequate for clinical use. The resultant program is small and easy of use. We concluded that this program might help professionals of respiratory rehabilitation on using Flutter VRP1.

Palavras Chaves – Engenharia de reabilitação, Pressão positiva oscilante, Flutter VRP1.

124 Análise de Parâmetros Cardíacos em Ratos com Epilepsia Submetidos a um Programa de Exercício Físico Aeróbio

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Abstract— Studies has showed beneficial effects of physical exercise in epilepsy. Thus, sudden death in epileptic patients is higher than in no epileptic. It is well known the positive effects of exercise to the prevention and rehabilitation of cardiac diseases. Based on this, we analyzed the heart rate *in vivo* and *in vitro* and the ventricular pressure *in vitro* of rats with epilepsy submitted to an aerobic physical exercise program. Adult male Wistar rats were divided into 4 groups of 6 animals: epilepsy group, trained epilepsy group, control group, trained control group. The pilocarpine model was used to obtain epilepsy groups. Trained groups were submitted to aerobic exercise program consisting of 30 days during 50 min at 60% of VO_2 max. Our results showed difference in heart rate *in vivo* only in animals with epilepsy when compared with control animals. A significant difference in heart rate *in vitro* was observed in trained animals with epilepsy when compared with animals with epilepsy. No significant difference in the ventricular pressure in vitro was observed among all groups. These results suggest an altered intrinsic autorhythmicity of trained animals with epilepsy, however, without altered heart contractility function.

Keywords— epilepsy, sudden death, pilocarpine, heart and physical exercise.

125 Modulação da Expressão de Receptores Opióides no Hipocampo de Ratos Submetidos à Atividade Física Voluntária e Forçada

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Abstract— Several studies have demonstrated an involvement of the opioid system (opioids and opioid receptors) on the positive effects of physical activity in function and health brain. However, this mechanism still remains unclear. Moreover, only few studies have analyzed the opioid receptors expression following physical exercise as well as the type of physical activity that could exert major influence in its expression. Therefore, the purpose of our study was to verify whether aerobic physical activity (voluntary – wheel running and forced – treadmill) alter the opioid receptor expression in the rat hippocampus. The animals were divided into three groups: group 1 (n=5) rats submitted to treadmill running for 7 consecutive days, group 2 (n=5) rats submitted to voluntary wheel running for 7 consecutive days and group 3 served as control (n=5). The animals were perfused and the brains were processed for histological analysis through immunohistochemistry. It was observed an increase in mu opioid receptor expression in CA1, CA3, hilus and dentate gyrus of forced and voluntary group. Optic density analysis for kappa opioid receptor showed an increase in CA3 in voluntary group. Our data demonstrate that the forced and voluntary physical activity induce alterations on the expression of mu and kappa receptors in the hippocampus of rats suggesting a possible envolvement of these receptors with the beneficial effect of the physical activity.

Keywords— opioid receptor, physical activity and brain.

413 Curación de Úlceras empleando Estimulación Eléctrica en Instituciones Primarias de Salud

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Abstract— The electrical stimulator STIMUL W has been applied in primary level health institutions as an alternative for improving the health status of patients in the prevention and healing of different types of ulcers. Patients included in these tests didn't have any previous successes with the application of other types of treatments. In this paper, new results are presented and discussed, demonstrating the benefits of applying this treatment in primary healthcare institutions.

Key words: National Health System, electrical stimulator, Willms' tumor, prevalence

309 Proposta de uma plataforma didática para o ensino de Engenharia Biomédica em Cursos de Graduação de Engenharia Elétrica: I Os Sinais Bioelétricos

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Abstract— This work presents a proposal of system for the development of a platform designed to support practical learning of biomedical engineering subjects in undergraduate electrical engineering courses. This system (the Biomedical Signal Processing System – Didactical Module, or SPSB-MD) includes hardware and software tools for the study of the special characteristics of bioelectrical signals for Electrical Engineering undergraduate students and biomedical professionals.

Keywords— Education, bioelectrical signals, didactic system.

335 Enseñanza Remota de Conceptos Anatómicos y Funcionales del Sistema Músculo Esquelético

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Abstract— In this paper we present the results of using a virtual content developed inside a telepresence application. The application combines video-conference with networked virtual environment allowing an instructor and a group of students to manipulate a virtual object in a collaborative manner. The virtual environment describes bones and muscular structures in order to support teaching of musculoskeletical concepts in a remote physiology class. The

virtual environment simulates the movement of flexion and extension of the elbow and the muscular contraction. Current preliminary results show that the content developed within telepresence application can compensate for the lack of physical presence of the instructor in the classroom.
Palabras claves— Ambiente Virtuales Colaborativos, Enseñanza Remota, Sistema músculo esquelético, Ambientes virtuales Distribuidos, Telepresencia.

13:45 to 14:45, AUDITORIUM, PLENARY LECTURE, Chairman: Carmen Muller-Karger

Biophysical Regulation of Mammalian Cell Function: Understanding Disease, Developing Therapies, and Engineering Functional Tissues, Dr. Natacha DePaola, USA,

15:00 to 16:30 TECHNICAL SESSIONS

ROOM 1: SPECIAL SESSION SIG 2, Chairman: German Castellanos; Sara Wong

18 Compresión de señales de ECG mediante transformada wavelet con algoritmo MSPITH-1D

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Abstract— This paper present a model to compression of ECG signals based in wavelet transform, the coefficients of expansion of the original signal are coding with the Set partitioning in Hierarchical Trees algorithm (SPIHT). The SPIHT algorithm is the last generation of coders used with wavelet transform, this algorithm is employing more sophisticated coding of images and signals. In this work we implemented a modification in the MSPIHT algorithm, to this algorithm we introduce a new modification to signal analysis in 1-D. Compression ratios of up to 24:1 for ECG signals lead to acceptable results for visual inspection and analysis by medical doctors.
Palabras Claves— Compresión ECG, MSPIHT 1-D, prd, SPITH, Wavelets.

148 Parámetros que mejor identifican la presencia de la miocardiopatía chagásica a partir del electrocardiograma superficial

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Abstract— This paper reports the evaluation of a high fidelity ECG hardware/software (CardioSoft, Houston, TX), in a group of chronic chagasic patients. It has been observed that several electrocardiographic abnormalities that are present in Chagas'patients, also occur in the Brugada syndrome, which involves genetically defective cardiac sodium channels, This fact suggests that acquired damage to cardiac sodium channels may also occur in Chagas' disease. We compared several conventional and advanced resting 12-lead and derived Frank-lead ECG parameters in 34 Chagas' seropositive patients (studied at the Universidad de Los Andes) to those in 34 age-and gender-matched healthy controls (studied at NASA's Johnson Space Center). Chagas' patients who had resting (Bundled Branch Block) BBBs, (Left Ventricle Hypertrophy) LVH criteria by conventional ECG, pathologic arrhythmias and/or echocardiographic ejection fractions (EFs) < 40% (n=10) were excluded, however, for the rest of patients significant differences persisted in multiple conventional and advanced ECG parameters between the Chagas' and control subjects (n=24/group), especially in their respective J-Tpeak interval durations, QT interval variability indices, T-wave axes and low frequency (Heart Rate Variability) HRV powers (p=0.001, p=0.001, p=0.006 and p=0.025 respectively). Concerning the potential changes in transmural dispersion of repolarization and cardiac sodium channel function, the Chagas' seropositive patients also had: 1) significantly increased corrected Tpeak-Tend interval durations versus controls (97 ± 9 vs. 91 ± 10 ms, p=0.05); 2) significantly decreased corrected J-Tpeak interval durations versus controls (212 ± 19 versus 226 ± 18 ms; p=0.009) and 3) more than twice the incidence of resting ST segment elevation in any of leads V1-V3 and of both leftward and rightward QRS axis deviation than controls. Chagas' patients with preserved (Left Ventricle) LV systolic function have untoward changes in cardiac repolarization, including decreased corrected J-

Tpeak intervals and increased corrected Tpeak-Tend intervals ('TDR') and (QT variability) QTV, potentially suggesting an acquired loss of cardiac sodium channel function.
Palabras claves— High frequency electrocardiography, Chagas disease, Heart rate variability.

274 Predicción De Riesgo De Muerte Súbita Cardiaca En Pacientes Chagásicos Mediante Dinámica Simbólica

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Abstract - Chagas´ disease is a tropical illness characterized by the presence of damage in the myocardium during each stage of the disease, ventricular arrhythmias and sudden death are the main causes of mortality due to disease. In this document we study the characterization of cardiac data from chagasic patients through the application of symbolic dynamics, in order to detect patterns that help us predict the risk of sudden death. The process is made evaluating RR intervals (tachograms) taken from high resolution electrocardiograms (ECGHR) pertaining to 2 kinds of chagasic patients: positives (6 subjects) and negatives (19 subjects) with respect to the cardiopathy test. Data series corresponding to each patient are taken by symbolic dynamics algorithms, which allow represent each value of the tachogram through a symbol. Finally, the symbol chain calculated for each signal is evaluated through entropy analysis, studying the frequency of words of length 3. Also, we look at the original signal searching for reduced amplitude zones (RAZ), and checking if its mean and standard deviation have useful information for this research. The results show the great potential of symbolic dynamics in the characterization of ECGHR signals of chagasics patients, constituting itself as a promising alternative to predict their risk of sudden death.
Palabras Claves - Enfermedad de Chagas, Variabilidad del Ritmo Cardiaco, Dinámica no Lineal, Dinámica Símbólica.

383 Use of Support Vector Machines in Predicting Success of Intracardiac Cardioversion by Electric Shocks in Patients with Atrial Fibrillation

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Abstract— The objective of this study, was to build support vector machines (SVM) for predicting success of electric shocks in the internal cardioversion (IC) of patients with atrial fibrillation (AF). Some investigations have found correlations between parameters and necessary energy for defibrillating AF, but no tool exist for predicting whether an electric shock will be successful or not in low energy IC. Thirty eight patients with AF, for elective DC cardioversion at the Royal Victoria Hospital in Belfast, were included in our study. Two catheters were positioned in the right atrial appendage (RAA) and the coronary sinus (CS), to deliver a biphasic shock waveform, synchronized with the R wave of the electrocardiogram (ECG) signal. A voltage step-up protocol (50-300 V) was used for patient cardioversion. The ECG was analyzed for an average time interval of 52,8±10.1 s (corresponding to segments before each shock). Residual atrial fibrillatory signal (RAFS) was estimated by means of bandpass filtering and ventricular activity (QRST) cancellation. QRST complexes were cancelled using a recursive least squared (RLS) adaptive filter. The atrial fibrillatory frequency (AFF) and the instantaneous frequency (IF) series were extracted from the RAFS. AFF was calculated from whole segments and from the 10 seconds of the RAFS previous shocks. The mean, standard deviation and approximate entropy of the IF time series were computed. RR intervals of the ECG segments were also analyzed. A total of 26 patients were successfully cardioverted, employing 167 shocks (141 non successful). SVMs were built for classifying success on shocks for energy up to 2, 3 and 6 Joules, employing different combinations of the computed parameters. A maximal exactitude of 93.42% (sensitivity=92.31% and specificity=93.65%) was obtained classifying shocks below 2 Joules, 95.51% (sensitivity=92.86% and specificity=96%) for shocks up to 3 Joules, and 92.91% (sensitivity=78.95% and specificity=95.37%) for shocks ≤6 Joules.
Keywords— Support vector machine, cardioversion, atrial fibrillatory frequency, instantaneous frequency

391 Agrupamiento no supervisado de latidos ECG usando características WT, Dynamic Time Warping y k-means modificado

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Abstract— Heartbeat clustering is convenient in Holter record analysis and interpretation for data mining. Nevertheless, this clustering has to address several problems due to factors such as long signal length (high computational burden), noise and artifacts (patient movements, baseline wander, electrode-skin contact variability, powerline interference), and waveform variability because of patient's physiology and pathology. Therefore, it is very important to choose a suitable clustering configuration sufficiently robust against these problems. Such configuration includes the core of the clustering method itself, centroid initialization, dissimilarity measure, feature extraction and selection, and computational cost optimization techniques. To this aim, we present in this work an improved version of the *k*-means clustering algorithm. First, a preclustering stage is employed to reduce the initial heartbeat set using Dynamic Time Warping (*DTW*) and a suitable conservative threshold. In the clustering stage, a local search heuristic (k-medians) is analyzed. Feature extraction from heartbeats is carried out by using WT coefficients (from biortogonal 2.2 wavelet) and trace segmentation. The modified k-means considers both the dynamical and nonlinear behavior of ECG signal and provide best performance that *k*-means standard algorithm. As a result, the modified *k*-means algorithm is less sensitive to the presence of outliers and hence clustering error declines (up 8% in average) compared to the k-means standard algorithm. Non supervised analysis results are presented for a set of 44872 heartbeats with 16 different types of arrhythmia from *MIT*´s arrhythmia database.
Palabras claves— clustering, ECG analysis, WT, arrhythmia.

392 Caracterización dinámica de registros ECG para identificación de arritmias

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Abstract—We present a methodology for feature extraction by means of adaptive filter banks in case of automatic identification of arrhythmias using ECG recording. Proposed filter banks, which are supposed to track in more accurate way any change of parameters of time-varying sequence, is developed for biorthogonal wavelet bases using Teager algorithm. Besides, adaptive lifting schemes, which allow filter order change, are used for filter bank implementation. Lifting schemes are introduced because lower computational complexity and less processing time. As features, both maximum value and variance of different wavelet decomposition levels are selected for brain zone classification. Results are provided using MIT database, in case of 2, 4, and 6 wavelet vanishing moments, for classification of 10 different arrhythmias. As a result, classification performance level of 98.5% value, estimated by means of bayesian classifier with Mahalanobis distance, is reached which is better than in 5% in comparison to those obtained figures for filter banks but having fixed parameters.
Palabras claves— adaptive filter banks, Teager algorithm, arrhythmias.

ROOM 2: TECHNICAL SESSION IMA 3, Chairman: Julian Mattes; LuisUrbano

180 A Level-set Segmentation Approach for 4-D Cardiac Images

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Abstract— Cardiac diseases are one of the main causes of death in the World. This has motivated an important research effort aiming at the development of accurate tools for improving diagnosis and treatment. Recently, the Multi-Slice Computerized Tomography (MSCT) has emerged as a new source of 4D cardiac images that enables recording of cardiac shapes and their dynamical behavior during the cardiac cycle. This imaging technology requires the development of accurate techniques for analyzing and quantifying these images. This work presents the development of a software tool that enables a semi-automatic segmentation of cardiac cavities in MSCT images. The

system core is a Level-Set algorithm. According to this algorithm, the contour is embedded as a zero level set of a higher dimensional level set function whose evolution described by a differential equation is performed considering features extracted from the images. The segmentation tool allows the user to define an initial rough segmentation by manual tracing of several contours in the 3D MSCT database. This approximate segmentation is improved using the level-set algorithm. The validation is performed by comparing the segmentation obtained using the level-set based algorithm with respect to the segmentation performed by medical experts. First results based on left ventricle extraction are promising.
Palabras claves— Level sets, Left Ventricle segmentation.

311 Segmentación Utilizando Contornos Activos (Snakes) de Imágenes de Resonancia Magnética del Cerebro.

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Abstract— The segmentation of brain structures from Magnetic resonance imaging, is a very important tool in the diagnostic and follow up of several pathologies of the central nervous system. The obtaining of the contours of brain structures presents following problems: the great volume of data and noises in the images introduced by the acquisition equipment. During the past few years, the deformable models of active contours (Snakes) have been used for the segmentation of images and in special in images of Magnetic Resonance (R.M.), this document presents the automated segmentation of brain structures implementing Snakes like a fast and efficient solution for the obtaining of the contours of the objects with the purpose of helping in the medical planning.
Palabras claves— Segmentación, Snakes, contornos, Cerebro.

347 Uso de Contornos Dinámicos Discretos para la Segmentación de Próstata en Imágenes de Ultrasonido en Dos Dimensiones

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Abstract—Prostate cancer is the second cancer type, after skin cancer, which most commonly affects men around the world. It also has the second highest mortality rate after lung cancer in Perú. Segmentation of the prostate boundary from ultrasound images is one of the most important tasks for diagnosis and treatment. Different algorithms of automatic segmentation have been created without much success. As a result, nowadays this task is performed manually, becoming an arduous, time-consuming and heavily user dependent job due to limited quality of ultrasound images. This works presents a short review of methods that have been proposed for semi-automatic segmentation, and implements a segmentation algorithm based on Discrete Dynamic Contours, which have been previously shown to have good results in this task. For this implementation, initialization requires selection of 4 points which will not change their positions in order to delimit the prostate location. Pre-processing is used to improve contrast quality and reduce noise, using Sticks and Anisotropic Diffusion algorithms. Results show accuracy and sensitivity over 90% in the segmentation of prostate in two ultrasound volumes.
Key Words– Segmentation, ultrasound, deformable contours, prostate.

356 Simultaneous Tracking of Contours in Dynamic Medical Images

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Abstract— A framework for temporal estimation of contour deformation in image sequences has been developed. The proposed solution for point-wise tracking finds, for a point, one optimum trajectory across multiple frames, in contrast with frame-to-frame tracking (2-frame). The multiframe approach aims (i) to find the complete point trajectory as the global optimal track over the space with multiple contours, and not as optimal sub-tracks concatenated over this set of contours; and (ii) take into account information from an extended time interval. The multiframe solution is framed as a shortest-path problem and uses the Dijkstra's algorithm. The method applies the dynamic programming technique to

find the global trajectory. The algorithm requires no special initialization or markers. It is a non-invasive method and image modality independent. The usefulness of the multiframe tracking is illustrated using synthetic images. The method demonstrated to be consistent with methods published in the literature.
Keywords— Left ventricular motion estimation, point-wise tracking, medical imaging, multiframe, shortest-path algorithm

390 Model-based image analysis of the cardiac function

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Abstract— Many approaches have been proposed to analyze images and extract parameters of cardiac function and shape, however, some limitations still persist, like the accuracy of automatic segmentation processes, tracking of points in image sequences, identification of relevant physiological parameters, elevated computational cost. We discuss some of the attempts to solve such problems from the light of image analysis, and a brief review of current model-based approaches for the analysis of functional cardiac imaging data. An outline of different limitations to overcome and a problem statement of our own complementary approach to model-based image analysis are presented.
Keywords— Image analysis, cardiac function, cardiac electromechanics.

300 Modelado de Tumores Cerebrales en la Planificación de Neurocirugías

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Abstract— This article has two main goals: (1) to present the capacity of our computer assisted planning software to show the spatial relationship between a brain tumor and its neighboring arteries through 3D views, as an important advantage for the neurosurgeon during surgical approach planning, and (2) to generate geometrical models of brain tumors using a novel technique based on Support Vector Machines (SVM), to provide a better tridimensional perception and understanding of them.
Palabras claves— Cirugía Asistida por Computador, Modelado Tridimensional, Máquinas de Vectores de Soporte.

ROOM 3: ROUND TABLE, MR-CLI 2 Organizer: Alirio Algarra

Normas Ing. Clinica, Sistemas de Gases Medicinales

Lic Roman Mercado, Ing Jose Sepulveda, Ing Edgardo Vazquez, Lic Marina Contramaestre, AGA, TSU Keila Patiño, Alirio Algarra

Abstract— - The medical gas distribution system is vital in any hospital. It is installed to provide for a reliable source of medical gases at any hospital point of use at any time. The design, installation and operation of these systems follow international, regional or national standards. In Venezuela there is no National Standard for this discipline. Foreign standards are applied as "Good Practices". This round table: "Standards related to Medical Gas Systems in Healthcare Facilities in Venezuela" is intended to discuss the subject from different points of view covering most of the authors involved aimed to analyze the subject, reach important conclusion and make proposal s to government agencies to get specific solutions.

ROOM 4: TECHNICAL SESSION MEC 2, Chairman: Juan Carlos Avila; Carmen Muller-Karger

105 A robot for ultrasound examinations

Vilchis-González, A., Avila-Vilchis, J.C., García-Torres, A. and Bernal J.

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Abstract— This paper presents a new design of a slave robot carrying an US (ultrasound) probe for remote ultrasound examination, that will allow an ultrasound probe to be orientated and translated with respect to its axial direction. This robot will be integrated to a master-slave system called TERMI (Tele-Ecografía Robotizada de los Miembros

Inferiores, in Spanish). The system will be controlled by a medical specialist to perform a remote diagnostic from ultrasound data. The patient will be in the slave site away from the physician. This system offers the advantage to supply medical assistance in places where there are not medical experts for the examination of patients. The research focuses in a new robot mechanical design to perform diagnostic of the venous thrombosis disease in lower members. The architecture consists of a rigid mechanism with four degrees of freedom, adapted to the dimensions of a linear ultrasound probe.

Keywords— **Medical Robotics, Mechanical Design, Telemedicine.**

107 New hepatic biopsy robot prototype

Avila-Vilchis, J.C., Vilchis-González, A.H., Estrada-Flores, R.G. and Escobedo, A.

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Abstract— This work presents a new robot architecture to be used in hepatic biopsies. This paper focuses on the orientation subsystem of the robot, its mechanical design, modeling and simulations. First experimental results are reported in this paper. The goal of this work will be to compare the quality of hepatic tissue samples, taken by conventional procedures, with those taken by the robot prototype, however, this study is not reported here.

Keywords— Medical robotics, Robotic biopsy, Dynamical model.

191 Optimización del hueso trabecular y efecto de las microgrietas en el remodelado

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Abstract— Bone remodeling is an optimization process of the bone structure to support natural mechanical charges induced by activities like walk. In this investigation, osteocytes are represented by automata that sense the mechanical stimuli in their vicinity. In natural process, the remodeling is affected for microcracks, which are incorporated to this model using mechanical fractures law. That includes the relationship between microcrack growth rate and stress intensity. These laws predict the crack lengths and their orientation. The results demonstrate that microcrack growth rate initially decreases with the increment of stress intensity. However, when a minimum peak is reached, the microcrack growth rate increases. The results of this computational model are in agreement with studies performed by other authors.

Palabras claves— Modelamiento, microgrietas, adaptación funcional y autómatas celulares.

344 Development of a DSC-based Rotary Chair for Oto-neurological Diagnosis

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Abstract— This paper describes the project, test and construction of an automatic rotary chair to be used as human vestibular system stimulator for clinical diagnosis in otorhinolaryngology (ORL). The hardware and software details of this digital signal controller based system are presented, including the software controller and the obtained results. The prototype was considered appropriate for the proposed application and five identical chairs are being used experimentally in Brazilian ORL services.

Keywords— Rotary chair, DSC, electronistagmography.

126 Desarrollo De Una Protesis Electromecanica De Mano Y Antebrazo Controlada Por Mioelectricidad Para Una Persona Discapacitada Con El Antebrazo Derecho Faltante

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Abstract—This project consists in designing and assembling a myoelectric prosthesis of forearm and hand with means of use in people that suffers from upper member mutilation. The system consists of two basic movements, the rotation of the wrist and the opening and closure of the hand. The activation of the electro mechanic movements of the prosthesis are achieved by the muscular contraction of the biceps and chest muscles. Detecting muscular contraction requires myoelectric sensors called electrodes which are strategically placed on the surface of the muscles. These sensors are capable of reading the low voltages produced during the excitation of the muscles fibers. The structure of

the prosthesis was designed to resemble the most to the anatomy of an average human arm. Special considerations were made during the construction of the structure due to the light-weight requirements and integrity resistance when lifting considerable loads. An esthetic covering was used to offer the patient a confident environment of acceptance while using the prosthesis.
Términos Importantes— EMG: Electro miografía. Técnica de estudio de la actividad muscular. PWM: Pulse Width Modulation. Modulación por Ancho de Pulso.

169 Andador com Sistema de Controle de Aceleração de Marcha para Pacientes com Comprometimento nos Membros Inferiores Devido a um A.V.E.

R. A. Carmona[1,2], C. Bessi[2], G. C. Azevedo[3] , D. F. O. Azevedo[1] e M. A. Fumagalli[1]

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Abstract: The use of walkers without an appropriate acceleration system to assist the gait of patients with lower limb disabilities is widely used in rehabilitation protocols. However, some patients could demonstrate difficulty or inability in the gait control during the training with this device because some motions could cause peaks of acceleration. These movements represent instants between the initial support and the load answer when the patient tends to drag the opposite member to the support member resulting in disequilibrium and instability. The aim of this work is the development of a walker with integrated supports and acceleration control which will provide better stability during the gait in patients with neurological pathologies. An acquisition and treatment system of the signals using wireless communication integrated with supervisory software was developed and implemented to acquisition of acceleration parameters. The break system was implemented with constant and variable torques. Dynamic tests were done with the whole system: walker, accelerometers, acquisition board, circuit of power, brakes, transmission and supervisory systems. On the slope and through the characteristic curve presented by the supervisory system can be observed that the system of brakes with variable torque provided a softer deceleration than the brakes with fixed torque. Therefore, the new device provided a better adaptation of patients with the neurological pathology during the gait control.
Keywords – acceleration control, electromagnetic braking, wheel walkers.

ROOM 5: TECHNICAL SESSION MAT, Chairman: Natasha Depaola ; Karem Noris

26 Desenvolvimento de scaffolds bioativos do compósito polimetilmetacrilato e hidroxiapatita: análise in vitro

T. H. S e Sousa, C. A. Fortulan, B. M. Purquerio, A. R. Santos Jr.

Resumo - Este trabalho objetivou as investigações in vitro e em microscopia eletrônica de varredura (MEV) de um scaffold manufaturado com PMMA (Polimetilmetacrilato) e HAp (Hidroxiapatita). A carboximetilcelulose (CMC) foi utilizada na forma de gel como agente porogênico, a fim de torná-lo bio mimeticamente viável como substituto ósseo. Foram utilizadas para os ensaios in vitro células VERO, uma linhagem celular tipo fibroblastos. Foram realizados ensaios de citotoxicidade indireta e direta. Os resultados indicaram que as diferentes amostras de PMMA poroso com HAp e PMMA poroso não apresentaram toxicidade direta ou indireta. Através das imagens realizadas em MEV também se pode observar o crescimento de células na superfície do material e em direção aos poros da matriz. A análise macroestrutural dos poros das matrizes porosas também obtidas pela microscopia eletrônica de varredura (MEV) demonstrou em uma caracterização inicial do material que este apresentou características bio miméticas sendo eleito como substitutos ósseos. A média obtida do tamanho dos poros foi de aproximadamente 250μm.
Palavras-chave: Scaffolds, PMMA, HAp, CMC.

138 Influencia del campo magnético e implantes de polímero semiconductor sobre la regeneración axonal en un modelo de lesión traumática de médula espinal

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Abstract— Traumatic spinal cord injury is a public health problem that resulting in a series of motor, sensitive and autonomic disabilities. At the present, there are no effective therapeutic strategies for re-establishing neurological function in this pathology, due to the complexity for regulating the mechanisms of secondary damage and to the poor spontaneous regeneration of the mature central nervous system. In a previous study our group demonstrated that the implant of semiconductor polymers after an injury by complete section of the spinal cord (CSSC), promotes the protection of nervous tissue and functional recovery in rats. The goal of the present work was to increase these beneficial effects using low frequency magnetic fields (LFMF). Rats with CSSC were implanted or not with PPY, PPY/I or PPY/PEG and they received or not stimulation by magnetic fields. Rats were evaluated using the BBB motor scale every week during two months. At the end of the follow-up, morphologic and morphometric studies were done. Stimulation with LFMF plus PPY implants increases the functional recovery and tissue preservation and it decreases the inflammatory cells migration to the injury site. However, the combination with PPY/I was not successful. So, physical and chemical characteristics of the implant should be taken in consideration in order to obtain better results.
Palabras claves— Campos magnéticos, lesión de médula espinal, regeneración axonal, polímeros semiconductores.

162 Estudio de implante de polímero semiconductor en lesión de médula espinal en rata mediante análisis de imágenes.

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Abstract— Different plasma-synthesized polymers have recently been implanted in rats with spinal cord injury to investigate their feasibility to restore mechanical movements. The spinal cord injury can be studied using both computerized tomographic imaging and high field magnetic resonance imaging since they offer non-invasively ways to study the evolution of the lesion in animal models. These imaging modalities offer advantages over the traditional histological procedures. Animal models do not have to be sacrificed to study the tissue at different time points, it is not time-consuming because there is no need to use very elaborated staining techniques. In this paper, in vivo computerized tomographic images of a polymer-implanted rat with spinal cord injury, and preliminary magnetic resonance images of a polymer-implanted isolated spinal cord are reported. A plasma-synthesized polymer was used to promote the healing of the injured region. Images using both techniques show a great deal of anatomic information as well as the clear localization of the implanted polymer in the spinal cord. MR images are able to show superior quality anatomic details over the tomographic computerized images, but bone images acquired CT have a greater bone-tissue contrast. Digital processing techniques are able improve the visualization of the anatomic information.
Palabras claves— Lesión de Médula Espinal, Polimerización por plasma, Tomografía Axial, Resonancia Magnética.

321 Evaluación electrofisiológica del efecto de tres implantes poliméricos en la función nerviosa en un modelo de lesión por sección completa de la médula espinal en ratas

R. Mondragón[1], A. Díaz[2], T. García[1], H. Salgado[3], R. Olayo[1], J. Morales[1], G. Cruz[4], G. Olayo[4], L. Alvarez[1], A. Morales[1], A. Escalona[1], J. Manjarrez[2], M. Mendez[2] and C. Ríos[2]

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Abstract— Most of the biomaterials used nowadays for the reconstruction of the spinal cord tissue after an injury, tested in animals, have obtained modest results. This work presents a study about the effect of three novels, biocompatible and semiconductive materials, obtained by plasma polymerization: poly-pyrrole (PPy), iodine-doped pyrrole (PPy/I) and pyrrole-polyethylene glycol (PPy/PEG). These polymers, separately, were implanted in the spinal cord tissue of rats after a trans-section. We used adult female Long Evans rats, submitted at electrodes implantation into sensory cortex, one week after all animals were subjected to complete spinal cord transection and neurophysiology recovery was evaluated with open field-BBB scale and somatosensory evoked potentials. The results

showed motor recovery only in animals with PPy implant *vs* control group (without implant). In conclusion, implant of PPy is fine tolerated from spinal cord tissue and improvement conduction and function after spinal cord transaction.
Palabras claves— Lesión de la médula espinal, biomateriales, polipirrol, potenciales evocados somatosensoriales. Escala BBB

364 El grado de glicosilación del colágeno óseo regula la adhesión y la capacidad de biomineralizar de las células óseas

A. Bello, A. H. Márquez y K. Noris-Suárez

Universidad Simón Bolívar/Departamento de Biología Celular, Caracas, Venezuela

Abstract— In the bone tissue, collagen is the most abundant protein, conforming 90% of the organic matrix of this mineralized structure. Different works indicate that in postmenopausal osteoporosis, the early degradation of the bone tissue seems to be due to the presence of bone collagen in a condition of overglycosylation, especially in the trabecular bone. To understand the role of the glycosylation of the collagen molecule and how it can regulate functions of the bone cells, such as cellular adhesion and biomineralization, is the main objective of the present work. 8 rats were ovariectomized and another 8 were sham-operated (control group). After 45 days the rats were sacrificed, femurs were extracted and the bones were decalcified in order to obtain the collagen matrix mineral free. Primary cultures of bone cells were obtained from calvaria of neonatal rats. The adhesion and differentiation (alkaline phosphatase activity and biomineralization) of these cells were evaluated on the collagen bone matrix obtained of the ovariectomized and control rats. The results of this work show a greater adhesion of the osteoblastic cells on the bone collagen for the control group in comparison with the adhesion found for the ovariectomized group, in the first two hours. Additionally, cell FA activities and mineralization on material differ between control and ovariectomized animals bone collagen samples. In conclusion, in the present work we present evidence that suggest that bone cells can recognize differences in the degree of glycosylation of the collagen matrix in ovariectomized animals in comparison with the control group, and the cellular response is different as a consequence of these variations of the extracellular material.
Palabras claves— Glicosilación del colágeno, matriz ósea, osteoporosis postmenopausal, osteoblastos.

PO2 Oakley: tecnología envuelta en arte

Gianfranco Luongo Scelza

Departamento Tecnico de Oakley, Caracas - Venezuela

17:00 to 18:15 TECHNICAL SESSIONS

ROOM 1: ROUND TABLE, MR ELE , Organizer: Ana Ma. Ferré

Electromedicina. Normas

Alvaro Sandoval , Roman Mercado,Ing. Giovanni Labella,Dr. Joaquin Lejeune, Carlos Barba , Ana Maria Ferré A.M

ROOM 2: ROUND TABLE, MR APP, Organizer: Susana Llanusa

Educación en Ingeniería Biomédica, Plataformas Educativas

Alfonso Martìnez Ortiz, José Folgueras, Susana Llanusa,

Abstract— Importance of networking tools for continued education. Educational platforms available at present in the region: Virtual Public Health Campus and Virtual Health Library. Incorporation of Biomedical Engineering in these projects. Web 2.0 tools for networking. Sharing and building knowledge in a participative fashion.

ROOM 3: TECHNICAL SESSION INS 3, Chairman: Ramon Salazar; Alexander Somarribas

66 An approach to reliable motion artifact detection for mobile long-term ECG monitoring systems using dry electrodes

J. Ottenbacher[1], M. Kirst[2], L. Jatobá[1], U. Grossmann[1] and W. Stork[1]

[1] Institute for Information Processing Technology, University of Karlsruhe, Germany ,[2] FZI Research Centre for Information Technologies, Karlsruhe, Germany

Abstract— The authors present a research project aiming to develop a context-aware cardiac permanent monitoring system. A significant challenge addressed by this project is to acquire reliable ECG signals with dry electrodes in order to do an automatic analysis und alerting. A method to detect motion artifacts by the simultaneous measurement of electrode/skin-impedance is proposed. Investigations of the correlation of motion artifacts and impedance signal are presented. Results of applying an impedance signal based artifact detection algorithm on QRS detection is shown.
Keywords— long term ECG monitoring, artifact detection, dry electrodes, electrode/skin impedance

93 Diseño de un medidor de conductividad electrolítica, para operar en el rango de conductividad eléctrica del tejido humano.

S. A. Jaimes[1], J. P. Valencia[2], D. A. Miranda[3]

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Abstract— A Van der Pauw electrolytic conductivimeter was development to calibrate an electrical resistivity probe. This conductivimeter is used in studies of early cancer screening because such studies require a measurement probe, i.e., tetra-polar probe, which needs to be calibrated. The standard calibration procedure uses electrolytic solutions of known electrical conductivities. The development Van der Pauw electrolytic conductivimeter should be used as primary standard in the probe calibration. A maximum measurements uncertainty of 1.64% was achieved.
Palabras claves— Conductividad eléctrica, conductivimetro, Van der Pauw, celdas de conductancia, factor de forma.

129 Avaliação Tecnológica de Desfibriladores Bifásicos

F. S. Sônego, P. S. Avelar and R. Garcia

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Abstract— The sudden technological advance has increased the number of alternatives for health assistance technologies. Some of those technologies clearly bring mortality rates reduction, for instance, defibrillators for ventricular fibrillation treatment. Nonetheless, some of those technologies are used in an indiscriminate way and without any detailed evaluation of their safety or efficiency. Thus, this research evaluated, through a health technologies assessment method, the effectivity of biphasic defibrillators against monophasic defibrillators, on ventricular defibrillation treatment, showing in a quantitative way that, generally, biphasic defibrillators are approximately 49% better able than monophasic defibrillators in reducing the persistent ventricular fibrillation risk after the first shock.
Keywords — Health technology assessment, Defibrillator, Systematic Review, Clinical Engineering.

288 Software for Embedded Controllers Design: Application to a Caloric Stimulator for Electronystagmography

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Abstract— This paper describes the development and tests of a software which was projected to support the work of designing and testing dedicated embedded controllers. The software was developed to accomplish two main features: helping to model the physical system to be controlled; and helping to easily implement and test a proposed controller to be applied to the physical system. The first practical application of this software was the design of a temperature controller for the next version of a bi-thermal caloric stimulator named E96, which has as main requirement fast and accurate temperature response with no overshoot. That equipment helps otorhinolaryngologists in electronystagmography exam. Details on the caloric stimulator hardware and software, the proposed controllers and the results obtained, are presented. The software was considered functional for the proposed application.

Keywords— Controller design, digital control, control system modeling, caloric stimulator, electronystagmography.

297 Sistema para Captura da Spreading Depression através do Eletrocorticograma

H. J. A. Moraes, R. C. A. Guedes, R. E. de Araujo, M.A.B. Rodrigues

Universidade Federal de Pernambuco, Brasil

Abstract— This work establish an specific electrocorticogram system (ECoG) to measure and process bioelectrical signal from small animals. ECoG provides better temporal and spatial resolution than electroencephalogram and is less vulnerable to movement or muscle artifact. The system is applied on the analysis of Spreading Depression. The Spreading Depression is a phenomenon in which a fast change in the amplitude of the spontaneous electric activity of the cerebral cortex takes place when this is artificially stimulated. The ECoG signal were captured by silver electrodes and amplified. The electronic setup was computer controlled and the amplification gain of the signal was automatically established by software. The analysis of Spreading Depression ECoG signal can help in the diagnosis of, as the epilepsy and the migraine.

Key Words — Spreading Depression, electro-corticogram , Bioelectrical Signals, Data Acquisition

ROOM 4: ROUND TABLE, MR HEA Organizer: Fernando Morales

Telemedicina y Tele Salud en Latinoamérica

Carlos Marcelo Scavuzzo, Luiz Ary Messina, Dr. Eduardo Romero Castro, Dr Edgar Rodas Andrade, Dra. Adriana Velásquez Berumen, Dr. Carlos Figueira, Dra. Hyxia Villegas,Dr. Fernando Morales

POSTER SESSION: MEC

51 Estudio De Parámetros Espaciales Y Temporales De La Marcha Normal De Mujeres Adultas Mayores.

L. Núñez[1], G. Rodríguez[1,2,3], E. Ramírez[4], A. Alessi[1,2,3], I. Quiñones[1], AI. Pérez[1].

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Abstract— The elderly gait pattern is cautious, at-tempting security and the maximal stage of stability. They reduce the step length and increase the width of the based- support to facilitate the maintenance of the balance during the gait. The literature reports the beha-vior of the elderly gait parameters but they do not fit the anthropometric characteristics of Mexican women. Then the purpose of the present study was to generate a da-tabase for Mexican elderly gait pattern and at the same time to evaluate the effects of age in gait patterns. These values may serve as baselines for comparing the gait of osteoporotic women in a future study or other disabled women. At the National Institute of Rehabilita-tion, Mexico City, 250 normal women were selected in three age groups, 60-69, 70-79 and 80-89 years old, without history of fracture in lower extremities, osteopo-rosis or any important muscle-skeletal problem (altera-tion). The gait parameters were measured with a porta-ble walkway system GAITRite, which allows spatial and temporal gait analysis without attachment of any sen-sors on the patient. The parameters of height, weight, leg length, step time, gait cycle, ambulation time, veloci-ty, single support, double support, stance time, swing time, step and stride length, step/extremity ratio, toe in / toe out, h-h base of support and total distance were analyzed. The Functional Ambulation Profile (FAP) cal-culated from walkway data and provided by commercial software was used to defined the ability of the elderly to walk with maximal independence and to asses gait based on specific spatial and temporal gait parameters. As results the mean age was 69.1(6.5) years, the mean stature 151(6.1) cm, and the mean weight 63.5(9.9) kg.

Palabras claves— Análisis de marcha, parámetros espa-cio-temporales, mujeres adultas mayores.

68 Nuevo sistema para la ayuda en el enclavamiento distal de varillas intramedulares usadas en fracturas de huesos largos

R. Martínez M., A. Minor M.

CINVESTAV / Bioelectrónica, D. F., México

Abstract— Each year are performed more than 492, 000 surgeries on the world for repair fractures in long bones. The most used method to fix this problem is the closed intramedullary nailing, According as surgeons the most difficult task is the interlocking of the nail. The present work proposes a new system for detection of the intramedullary nail's holes used in rehabilitation of fractures in long bones (tibia and femur). The proposed method is based on the use of permanent magnets and magnetic sensors to locate the exact point where the bone must be drilled for the interlocking of the nail. The proposed system is aiming to diminish the great radiation doses to surgeons and patients. The suggested device is portable and supplied by batteries to provide a total autonomy, easy to use and great reliability.
Keywords— Intramedullary nails, magnetic sensor, orthopedics.

118 Application of the principal component analysis in quantitative evaluation of effects of subthalamic stimulation in Parkinson disease

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Abstract— This study aims at testing the application of principal component analysis (PCA) in the vertical ground reaction force (vGRF) to evaluate the effects of the deep brain stimulation (DBS) of the subthalamic nucleus (STN) in Parkinson disease (PD) patients with and without medication. A sample of 13 PD patients who have undergone STN DBS were evaluated under four test conditions: medication off and stimulation off (mof_sof), medication off and stimulation on (mof_son), medication on and stimulation off (mon_sof) and medication on and stimulation on (mon_son). A control group with 25 subjects was also evaluated. PCA method was applied on vGRF and the first two principal component coefficients (PCC) were obtained in both groups. The region of control group (CG) values was separated in the PCC plane with the elliptical area of displacement. Mahalanobis dis-tance (MD) was calculated to measure how far the first two PCC was from the CG. The results showed that the PCC of the mof_son, mon_son and mon_sof moved toward CG elliptical area in comparison to the mof_sof. The MD was statistically different among the four test conditions in PD subjects, with the lowest value in stimulations and medication condition (mon_son). These results indicated the potentiality of the PCA in determining ab-normalities in the gait and evaluating quantitatively evaluate the effects of the treatments. Furthermore, the STN DBS shows improvement on vGRF pattern in PD patients, mostly along with medication.
Keywords— Principal component analysis, Ground reaction force, Parkinson' disease, deep brain stimulation

130 Caracterización Biomecánica De La Marcha Atlética Con Análisis 3D

D.E. Gutierrez[1], M.A. Riveros[2] y J.M. Escobar[3]

[1] Universidad Manuela Beltrán/Directora de BIOMED, Bogotá, Colombia, [2] Universidad Manuela Beltrán/Fisioterapia, Docente, Bogotá, Colombia, [3] Universidad Manuela Beltrán/Ingeniería Biomedica, Docente, Bogotá, Colombia

Abstract— In this article is described the process that is carry out to characterize the technique of a runner athlete by using a high speed capture movement system, infrared cameras and a passive retro-reflective markers, which are placed at strategic spots on the athlete's body. This allows to register the position in the space of all markers into a capture space trough a time line. The information that is obtained is mainly about the positioning of each marker at the three axes in the space. We based on this information in order to reconstruct and have an additional information that come from mathematics computational analysis of the available data, such as inclination of the segmental bodies in regard to another, speed, acceleration and orientation generated by the markers. What was mentioned along with a group of high performance athletes allow us to analyze the movements of an athlete on the field
Palabras claves— Biomecánica Deportiva, Cinemática, Sistemas opto electrónicos, Análisis Integrados.

176 Análisis Biomecánico de Ejecución de levantamiento de pesas olímpicas

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Abstract— Man in his race for improvement has driven science to meddle in many life aspects, being sports a huge research field. Science has provided tools to increase sports skills deepening the study of the body's work and physical movement. This project goal is to analyze one classic weight lifting movement technique and its effect on the human body different muscular groups.

Palabras claves- biomechanics, weight lifting, technique, muscular groups

194 Ajuste Postural No Processo De Equilíbrio Instável Em Indivíduos Com Privação Momentânea Da Visão

T. D. A. Fonseca[1], D. G. Goroso[1], F. H. Magalhães[1], e J.A.F.Lopes[2]

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Abstract: The postural control is essential to voluntary motor acts, and daily life activities. The CNS (Central Nervous System) has many strategies to maintain the body equilibrium against the gravity. The objective of this study was to evaluate the effect on anticipatory postural adjustment (APA) and compensatory postural adjustment (CPA) in the Instantaneous Point of Equilibrium (IPE). Kinematics and kinetic resources have been used to locate IPE at upright posture. The subjects were 1O young adult without any orthopedicor neurologic injury or disease mean age = 25, 6 ± 2, 26 years; mean weight = 68, 22 ± 2, 71 kg; mean height = 1, 69 ± 0, 25 m. The EMGs of six right side muscles were measured with surface, disposable, differential monopolar electrodes. The motor task was fast trunk extension, from 90 degrees flexion to the upright posture. We calculate the variables APA and CPA from EMGs of some trunk and lower limbs muscles. The preliminary results show that vision is important for modulating muscle activity amplitude during APA and APC, as it seems that non-visual sensory information could not fully compensate for the lack of continuous visual feedback.

Keywords - Postural adjustment, vision, non vision, EMG.

198 Experimental Study of Bypass of Critical Locations in Relation to Vessel Wall Shear Stress

M. Schmirler[1], H. Netrebska[1], J. Matecha[1], J. Adamec[1], J. Jezek[1], T. Grus[2]

[1] Czech Technical University in Prague / Fluid mechanics and Power Engineering / Prague / Czech Republic , [2] Clinic of Cardiovascular surgeries, General University Hospital and First Medical Faculty Charles University in Prague Czech Republic

Abstract— The contribution deals with the investigation of the flow parameters in the bypass junction in a human body and it is aimed at the localization of areas with critical Wall Shear Stress (WSS) values and thus at the anastomosis shape optimalization with reference to the WSS. The experimental measurement of WSS was carried out by the help of hot film anemometry and obtained results were compared with results from numerical simulations and with results from Particle Image Velocimetry (PIV). Both experimental and numerical results point to the same area which is characterized by a low value of WSS and unfavourable WSS behaviour. This area is situated approximately x/D = 1,3 behind the Toe on the side opposite the Floor and x/D = 0 on the floor side. This x/D value is affected by graft angle and by the ratio of host artery and graft diameters - the smaller angle the longer x/D ratio for minimal value of WSS.

Keywords— anastomosis, experiment, CTA, wall shear stress.

264 Parámetros de diseño de una Prótesis de Rodilla en Colombia

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Abstract— In this article some general or minimum criteria will be developed that are due to consider at the time of making a design of knee prosthesis. These parameters must consider all the aspects related to the user, like height,

weight, age and also with materials, processes of manufacture, commercialization of the product and other aspects that not only assure a functional but also an esthetical and pleasant design to the user. Considering that these parameters are classified in obligatory and wished, the use of the seconds although does not affect the design will be able to get to affect in certain degree the acceptance of the user. Having these parameters established, previous designs found in Colombia are evaluated to determine if it is what the user needs.

Palabras clave— Parámetros de diseño, Amputación transfemoral, Prótesis de rodilla.

273 Análisis de las Presiones Ejercidas Dentro del Socket Durante el Ciclo de la Marcha en Pacientes con Amputación Transfemoral.

I. Quiñones[1], A.I. Pérez[1], A. Alessi[1], G Rodríguez[1], L. Núñez[1], R. Pacheco[2]

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Abstract— The project relies on an algorithm that combine two technologies, one involved Tekscan pressure sensors, and the other Biometrics electrogoniometers. Eight male transfemoral amputees subjects were assessed on the treadmill during five minutes in three series in their own comfortable walking speed. The pressure was measured dividing the stump in four areas two anterior, and two posterior. The two anterior areas were identified as the peak pressure, however depending on the gait cycle the pressure distribution changes at several sites at the stump-socket interface.

The pressure-goniometry system algorithm could improve the dynamic stump pressures within the socket evaluation and become useful for dynamic transfemoral prosthesis assessment.

Palabras claves— Transfemoral amputee, prosthetic socket, gait analysis, pressure sensors, electrogoniometry.

280 Avaliação Eletromiográfica Comparativa dos Músculos Vasto Lateral e Vasto Medial em Cicloergômentro

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Abstract— The objective of this work is to observe the muscle fatigue and the correlation between vastus medialis and vastus lateralis muscles. Thus, surface electromyography is used combined with three different protocols of data acquisition. For fatigue analysis and correlation evaluation were applied two numerical algorithms: median power frequency (MPF) and root mean square (RMS). These two techniques are commonly used for the analysis of isometric electromyography signals. The results showed correlation ($p<0.01$) between the two muscles in study and the third protocol (constant load, constant velocity and high intensity) indicated muscular fatigue in the two techniques used.

Palabras claves—muscle fatigue, surface electromyography and ergometer cycle.

286 Prótesis externa de rodilla: estado del arte en Colombia

J.C. Gómez[1], S. Macías[1], J.F. Tamayo[1] and J.F. Ramírez[2]

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Abstract— Nowadays, Colombia has been affected by an increment of the amputations of lower limbs due to the violence problem, added to the victims of accidents, diabetes and cardiovascular diseases. It is considered that the number of people with paralysis or lower limb loss is almost 63,000 [1] and the prosthesis demand of those affected people are about 2,000 per year [2]. This article intends to make a first compilation of the information available in the country, according to national designs of knee prosthesis and advanced studies, that will serve as a support for a later process of design and construction of new prototypes that will be focused on national necessities.

Palabras clave — Prótesis externa de rodilla, policéntrico, monocéntrico, Amputación transfemoral, Minas antipersonales (MAP).

294 Propuesta de Diseño, Análisis y Construcción de Adaptadores para Prótesis Transtibial

R. R. Torrealba y C. M. Müller-Karger

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Abstract— In Venezuela there is an important demand of all kind of external prostheses components, basically due to the fact that the available ones are imported and hence, too expensive for the people who needs them. Having consciousness of it, the idea of this project is to produce adaptors of acceptable quality for a low cost, which actually get to the patient who needs this kind of adaptors. As the first step the Biomechanical Research Group of the Simón Bolívar University in Venezuela has taken the task of developing adaptors for transtibial prostheses. The present work shows the methodology and aims of the proposed project, and in particular the results obtained regarding the design of the adaptors. The final design consists of four parts, i.e. the base adaptor, the upper adaptor, the connector tube and the foot adaptor. The base adaptor joins the socket with the other components of the prosthesis, the upper adaptor which is joined to the base adaptor and at the same time fixes the connector tube, the connector tube which is the element with adjustable height of the prosthesis, and the foot adaptor which finally joins the connector tube to the prosthetic foot.
Keywords— Adaptors, Transtibial, Prosthesis, Design.

298 Desarrollo de un Algoritmo para generar una Señal de Control para una Prótesis Mioeléctrica de Rodilla

L. Tolosa[1], R. R. Torrealba[2] y R. Silva[1]

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Abstract— Many advances have been done in the area of prosthetic devices for transfemoral amputees. One of the approaches in this field has been the use of EMG signals from the muscles, in order to identify the instant of gait cycle, as well as to generate a control signal for the prosthesis actuator. This kind of signals has a huge potential for controlling a prosthesis, but at the same time has several problems associated [1]. Until now, some of these problems remained unsolved and as a matter of fact, it has not been possible to use EMG signals for the control of a commercial prosthesis.

Nowadays, research is being done at the Simón Bolívar University in Venezuela which aims at developing an A/K prosthesis. At this point, the idea is to try different approaches to the control problem, regarding specifically what kind of signals to use. One of the signals studied are the EMG signals. The present work pretends to show a methodology to make an algorithm that allows generating a control signal for a knee prosthesis.

At present time, EMG signals from leg muscles of healthy persons have been captured, processed and analyzed. A threshold has been identified from which it is possible to generate a control signal of two states of activity ON/OFF. In other words, knowing this threshold it is possible to say when to block and unblock the prosthetic knee. The research will be continued, trying to generate a more complete algorithm which gives as output not a two-states control signal, but a continuous one. This would allow to position the knee in different angular positions and surely, would be an important outcome for the A/K prosthesis being developed.
Keywords— Algorithm, EMG signal, control, A/K prosthesis

326 Diseño y Fabricación de una Prótesis de Pie de Respuesta Dinámica en Fibra de Carbono

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Abstract— The main goal of this study is to design a foot prosthesis for transtibial amputees that can be produced in Colombia and reaches the performance requirements for an active lifestyle. The material meant for this purpose is a carbon fiber composite due to is high strength, modulus and stiffness and moderate cost. The matrix of the composite is a low modulus epoxy resin to ensure a fiber-dominated strength case. The prosthesis is designed for the average Colombian amputee, weighting 80kg (175lb) and having foot dimensions 27cm (10.6in) long and 8cm (3.15in) wide, and for a high activity level, in which vertical forces can reach up to 350% of bodyweight. The prosthesis is designed using mathematical models and validated using Finite Element Analysis software. The design includes the foot prosthesis and an aluminum alloy pyramid adapter. The prosthesis is intended to be manufactured initially by

lamination and later by vacuum infusion and water cutting pretending to be produced, in a near future, at a scale that answers the need of foot prosthesis in Colombia.
Palabras claves— prótesis, transtibial, pie, compuesto, carbono.

331 Análisis, Diseño y Construcción de una Nueva Alternativa de Fijación Interna para el Quinto Metacarpiano Empleando un Polímero Biodegradable

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Abstract— Intramedullary devices for treatment of bone fractures are an effective available method. A new intramedullary locked nail for the fifth metacarpal bone, using a degradable and biadsorbable polyester Poly(p-dioxanone (PPDX) reforzed with boron nitride (BN), has been designed in order to reduce the immobilization time of the injured zone, enabling faster bone tissue healing and avoiding further surgery. Therefore, this nail allows for earlier functional ability of the bone. The name of the selected polymer is polydyoxanone PPDX ó PDS. When it is nucleated with Boron Nitride BN, it´s mechanical and biomedical properties improve, which fulfil design requirements. PPDX belongs to the aliphatic polyesters family approved by the FDA (Food and Drug Administration) and it is bio inert. Intramedullary nail design were 3D-geometricly modelled through Computer Aided Design (CAD), which allowed the analysis of the prototypes when submitted to static charges by element finite method (EFM). These loads like bending, tension, and compression simulate habitual hand movement forces, reaching solution values approximate to the real system. The EMF results show that both devices fulfil design requirements and the necessary strength provides a total fracture stability BN-reinforced PPDX but not reduce the immobilization time as pretend. However, PPDX/BN guaranty clinical observation during biodegradation and bioadsortion time. Finally, the new intramedullary locked nail mold matrix for the fifth metacarpal bone was manufactured with 1020 steel and injection transference mold was made, by polyurethane for laboratory scale. Then proceed to inject the melted biopolymer into the mold and obtained the intramedullary device.
Palabras claves— fracturas diafisiarias, metacarpiano, sistema intramedular, polidixioxanona.

340 Sistema de Plantillas Instrumentadas “PIEZOMED” destinadas a la valoración del Calzado.

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Abstract— In Colombia, there haven´t been reports about the development of an Insole Instrumented system for the footwear industry that contributes in biomechanical design of their models, improving comfort and productivity during design and production of footwear. This article describes the development of the first phase of the instrumented insole system “PIEZOMED”, which has a pair of insoles size 41, evaluated in a male footwear model casual of the Company VÉLEZ®; the insoles were instrumented with piezoresistive sensors, which had a good linear answer. This first prototype was built wired, looking for a functional design and adaptable for future valuations in footwear. The Software was developed in two parts, the acquisition module, in Labview platform, and the processing and visualization module, in C#.Net. In this phase, the system was built and its performance was tested in casual footwear and visualizing as results: 2D view dynamic, 3D view dynamicm, numeric map, P Vs. t graph, and F Vs. t graph.
In a future phase, the system will be developed wireless, with an increased resolution (number of sensors) and tested in a considerable quantity of subjects to evaluate the reliability and validity of the system in contrast with a commercial system. The main aim is to use these insoles for footwear valuation, to support the industry, looking for biomechanical, comfortable, and fashion footwear.
Key words—Instrumented Insoles; Plantar Pressure; Footwear Valuation.

384 Evaluación con distintos Materiales de Clavos Endomedulares para Fémur y Tibia mediante Elementos Finitos

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Abstract— In this work two types of intramedullary rod (IM), the first for tibia and the second for femur, are analyzed by using the finite element method, with two different materials. IM rods are used to align and stabilize fractures, and are inserted into the bone marrow canal, in the extremities bone center. One of the significant advantages of IM rods, over other fixation methods, is the rod-bone load share; thereby the patients quickly are able to use the injured extremity. However, for obtain the best device behavior, under static and dynamic forces, the finite element method are used. With this method aid, the tensional stress field and the safety factor are also achieved. Lastly, the numerical method results are validated by analytic results comparison.

*Palabras clav**es***— Clavos Endomedulares, Elementos Finitos, Tensión, Deformación, Fatiga.

389 Estudio de la fractura de tibia proximal 41-C1 empleando el método de elementos finitos

L. Zambrano, C. M. Müller-Karger

Universidad Simón Bolívar, Departamento de Mecánica, Caracas - Venezuela

Abstract— The proximal tibia fracture 41-C1 is analyzed with and without the use of fixation plates. This analysis is done considering the different stages of the fracture healing callus (soft and mature). The study is built on a finite element model of a synthetic tibia (Synbone®), which assumes linear and isotropic material behavior. It was utilized to build four new models of the fractured tibia: the first two contain the materials that make up the fracture callus, one for the soft and another for the mature stage; and the second two contain both types of callus, along with the fixation plates and the screws. Linear and isotropic behavior was again assumed for all materials. Different mechanical material properties were assigned to specific groups of elements within the original mesh, to simulate the fracture conditions.

Fixation plates were substituted by restricting and correlating the degrees of freedom at the top of the screws using constraint equations. The spatial movement of the fracture fragments was evaluated, finding greater displacements on the models without plates than those found for the models with plates. The constraint equations were proved valid as a good simulation of the rigidity contributed by the plates to the fractured bone.

Palabras claves— Synthetic tibia, proximal tibia fracture, finite elements, constraint equations.

394 Análisis de esfuerzo por el Método de Elementos Finitos en el Proceso de Diseño de Pie Artificial.

R. Figueroa, C.M. Müller-Karger.

Universidad Simón Bolívar/Departamento de Mecánica, Caracas, Venezuela

Abstract The goal of this paper is to describe the advances in the design of a simple manufacturing artificial foot. Considering that low cost solutions, to cover the demand of handicap persons, is a necessity in developing countries, the aim of this research is to contribute to solve part of the problem. The conceptual design of the artificial foot here described includes dynamic response, without articulations. The finite element method is use to perform stress and displacement analysis of the proposed artificial foot. The design process consists in the consecutive modifications of the geometry of original proposed model; initially to diminish the maximum stress value. Once the admissible equivalent stress is reached, the geometry modifications are performed to reduce weight of the model and increase flexibility. The last version of the proposed model is shown in this article.

Keywords Design, artificial foot, finite element method

FRIDAY SEPTEMBER 28TH

8:00 to 10:00 AUDITORIUM, PLENARY LECTURES, Chairman: Shankar M. Krishnan

Prediction, integration and adaptation: Life and challenges in the post-genome era, Dr. Francisco Azuaje, UK,

Can we make sense of Trypanosoma cruzi genome information?, Dr. José Luis Ramirez, Venezuela,

10:30 to 12:00 TECHNICAL SESSIONS

ROOM 1: TECHNICAL SESSION SIG 4, Chairman: Pablo Laguna; José David Díaz

8 Automated Classification of Deceleration Patterns in Fetal Heart Rate Signal Using Neural Networks

M. Jezewski[1], P. Labaj[2], J. Wrobel[2], A. Matonia[2], J. Jezewski[2] and D. Cholewa[3]

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Abstract— Correct classification of deceleration patterns in fetal heart rate signal is crucial issue for determining the fetal intrauterine distress of the fetus. Deceleration patterns lasting less than two minutes are divided into two classes: episodic decelerations and periodic ones. Periodic patterns are characterized by correlation with uterine contraction, while episodic decelerations do not show such relation. The research material includes 101 cardiotocographic records (total time 285 hours) from which, the clinical experts selected 383 patterns for further classification. Nineteen different parameters of quantitative description of deceleration were used as the input variables for the neural networks (NN) classification system. It turned out that there was a group of 11 parameters which can be removed because they have very weak influence on the classification process. Quality indices of the developed neural networks (from 93 % to 99 %) and the ROC curve indexes (from 0.9863 to 0.9944) explicitly show that the proposed NN structures are very efficient for the classification of deceleration in fetal heart rate signal.
Keywords— fetal heart rate, signal processing, feature extraction, pattern recognition.

220 Algoritmo de Detección de Fibrilación Ventricular Basado en Reconstrucción de Espacio de Fase con Retardo Variable

J.F. Sáen[1] and J. Bustamante

Grupo de Investigación en Dinámica Cardiovascular, Universidad Pontificia Bolivariana, Medellín, Colombia

Abstract—Detection of ventricular fibrillation (VF) by means of appropriate algorithms is crucial for automatic external defibrillators. One of the more recent and effective techniques reported in scientific literature is the phase space reconstruction (PSR), which is based in the non-linear and chaotic behavior of the electrocardiogram. We propose in this work a PSR based algorithm for VF detection considering variable delay times which stresses the differences between normal signals and irregular signals of VF. The evaluation of the algorithm was made with all records of the MIT-BIH and CU databases without any pre-selection. The results have shown improvement in terms of sensitivity, specificity, positive predictivity and accuracy in respect to other algorithms evaluated under similar conditions.
Palabras claves— Detección de arritmias, Fibrilación Ventricular, Reconstrucción del espacio de fase.

283 Eliminación de ruido en bioseñales utilizando la ecuación algebraica de Lyapunov

María Inés Pisarello, Carlos Álvarez Picaza y Jorge E. Monzón

Facultad de Ciencias Exactas, Universidad Nacional del Nordeste, Corrientes, Argentina

Abstract— We propose in this paper a method for the elimination of noise in biosignals, based on Lyapunov´s algebraic equation of stability for linear systems. The biosignals used were extracted from the MIT-BIH cardiac Arrhythmia Database. We corrupted these electro-cardiographic signals by adding randomly generated gaussian noise signals of different amplitudes. The method herein presented cancels noise within reasonable effectiveness and represents an alternative to other source separation algorithms.
Palabras claves— ECG, eliminación, estabilidad, Lyapunov, ruido.

319 Myocardial Ischemia Detection using Hidden Markov Principal Component Analysis

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Abstract—This paper introduces a new temporal version of Principal Component Analysis by using a Hidden Markov Model in order to obtain optimized representations of observed data through time. The novelty of the proposed method consists mainly in the way in which a static dimensionality reduction technique has been combined with a classic mixture model in time, to enhance the capabilities of dimensionality reduction and classification of myocardial ischemia data. Experimental results show improvements in classification accuracies even with highly reduced representations.
Keywords— Hidden Markov Model, Principal Component Analysis, Myocardial Ischemia.

329 Evaluación Automática Objetiva de la Capacidad Auditiva utilizando Probabilidades Posteriores en Máquinas de Soporte Vectorial

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Laboratorio de Ingeniería en Rehabilitación e Investigaciones Neuromusculares y Sensoriales – LIRINS, Facultad de Ingeniería, Universidad Nacional de Entre Ríos

Abstract— In this paper, a novel method for automatic hearing assessment using auditory brainstem responses is presented. It is based on a pattern recognition system, which consists on four stages: data preprocessing, feature generation and extraction, classification and decision. The classification between normal and pathological responses is performed using support vector machines, and decision is made by evaluating its probabilistic outputs. The results show the good performance of the system, based on the high rates of sensitivity, specificity and precision obtained with a reduced amount of data.
Palabras claves— potenciales evocados auditivos, máquinas de soporte vectorial, probabilidades posteriores.

337 Avaliação de Diferentes Wavelets para a Estimativa do Potencial Evocado Somatosensorial do nervo tibial

S.A. Santos Filho[1], E.Q. Braga[1], E.J. da Silva[1], A.F.C. Infantosi[2], C.J. Tierra-Criollo[1],

[1] Universidade Federal de Minas Gerais/ Programa de Pós Graduação em Engenharia Elétrica, Belo Horizonte, Brasil.
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Abstract - The evoked potential (EP) elicited by sensorial stimulation is overlapped on spontaneous oscillations of the electroencephalogram (EEG). The standard method to estimate the EP is the coherent average of EEG epochs, but in many cases, there are not sufficient epochs to improve satisfactorily the signal-to-noise relation (SNR). Then, a method to improve the SNR of the EP based on a wavelet denoising tool associated with a cyclic shift of the epochs, collected during 5 Hz pulse stimulus on the tibial nerve, is presented. In this context, the choice of the Wavelet can determine the improvement in SNR. To help in the choice, measures of the latency and amplitude of the EP components using different Wavelets was compared with the EP model. The *Daubechies* and *Biorthogonals* Wavelets presented better results, and demonstrate to be good choices for the analysis.

Keywords—Wavelets-Denoising-Evoked Potentials

ROOM 2: TECHNICAL SESSION FIS 1, Chairman: Ricardo Silva; Ruben Rojas

30 Avaliação das Alterações Mecânicas ao Longo do Ciclo Respiratório: Metodologia e Aplicação em Asmáticos

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Abstract: This work describes a new methodology dedicated to the real-time evaluation of the respiratory impedance in awake subjects. After the description of the hardware and software, the results obtained comparing controls and asthmatics subjects were presented and discussed. These analyses revealed higher impedances at the beginning the inhalation (10.55±5,27 $cmH_2O/L/s$) comparing with exhalation (8.23±3.78 $cmH_2O/L/s$) in asthmatics. Impedances measured during the inhalation and exhalation phases were higher in asthmatics comparing with controls ($p<0.0001$). These results are consistent with recently published theories and physiological fundamentals, confirming the potential of this method in the study of asthma.

Palavras Chaves: Biofísica, Mecânica Respiratória, Técnica de Oscilações Forçadas, Instrumentação Biomédica.

33 Simulação Computacional de Padrões das Doenças Intersticiais Pulmonares: Nodular, Reticular e Retículo-nodular

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Abstract—In this work it is presented an algorithm that simulates the interstitial patterns and their radiographic images, based on integrated thoracic and pulmonary structures. The thoracic box is modeled using control points and the dimensions of airways and arteries branches are calculated based on the flow distribution from parents to sibling branches. The inflammatory process is represented in the interstitial patterns by an increase in the thickness of the cylinder walls which simulate the bronchioles, as well as considering specific density and composition.

Keywords— Interstitial patterns, thoracic structures, pulmonary structures.

76 Parâmetros Fisiológicos de Coração de Rato em Preparação de Langendorff com Circulação Fechada e de Baixo Volume: Influência do Bloqueio Colinérgico

Effting-Jr, J. V.[1]; Necchi-Jr, J. A.[1]; Caricati-Neto, A.[2] de Godoy, C. M. G[3]

[1] Universidade de Mogi das Cruzes/NPT, Aluno de Mestrado, Mogi das Cruzes – SP, Brasil, [2] Universidade Federal de São Paulo/Farmacologia, Professor, São Paulo – SP, Brasil, [3] Universidade de Mogi das Cruzes/NPT, Professor, Mogi das Cruzes – SP, Brasil

Abstract: In a previous work we have developed a vacuum-based re-circulatory system and tested it on a Langendorff preparation with isolated rat hearts. The experiments tests showed that, for loop perfusion volume of 150 ml, important cardiac parameters depressed significantly after 30 minutes. In the present work we performed additional experiments using the same set up and methodological approach to verify if those results would be mediated by cholinergic mechanisms. We found that the cardiac parameter depressing was prevented by adding atropine, a cholinergic muscarine blocker, to the 100 ml loop perfusion. This result suggests that the observed depressing cardiac response is importantly mediated by the cholinergic transmitter, acetylcholine.

Keywords: Cholinergic modulation, Langendorff preparation; isolated heart.

163 Longitud Electrotónica en Neuronas Peptidérgicas Intactas y Axotomizadas

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Abstract— En este trabajo se registró la actividad eléctrica de una población de células neurosecretoras del órgano X de acociles *Cherax quadricarinatus*, antes y después de realizar una axotomía distal. Partiendo del modelo de cilindro equiva-lente y del cilindro más soma, y usando las curvas de carga obtenidas con la técnica de registro intracelular, se realizaron estimaciones de propiedades eléctricas lineales, tales como la resistencia de entrada y la longitud electrotónica de neuronas intactas y axotomizadas, ajustando a los modelos matemáticos los datos electrofisiológicos obtenido experimentalmente.
Palabras claves— longitud electrotónica, neuronas pepti-dérgicas, registro intracelular, modelos matemáticos.

322 Optimum Conductivity of Gels for Electric Field Homogenization in Tissue Electroporation Therapies

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Abstract— Electroporation is used in tissue for gene therapy, drug therapy and minimally invasive tissue ablation. For the electroporation to be successful, the electrical field that develops during the application of the pulses needs to be precisely controlled. It is desirable to generate a homogeneous electric field in the region of interest and a null electric field in the regions not to be treated. In case of irregularly shaped tissue structures, such as bulky tumors, electric field homogeneity is almost impossible to be achieved with current electrode arrangements. In the past (Bioelectrochemistry, 70:2, 551-60, 2007), we proposed the use of conductive gels, matched to the conductivity of the tissues, to overcome this limitation. Those gels can be used to fill the dead spaces between plate electrodes gripping the tissue so that the electric field distribution becomes homogeneous. Here we analyze, through finite element simulations, how relevant the conductivity mismatches are. We found that conductivity mismatching errors are surprisingly well tolerated by the technique and that it is more convenient to use gels with higher conductivity than the conductivity of tissues rather than gels with lower conductivity. A gel with a conductivity of 5 mS/cm could be a proper solution for most cases.
Keywords— Electroporation, electropermeabilization, electro-chemotherapy, gels.

332 Metodología para el Estudio de la Disolución de Cálculos Renales Usando Microscopía de Fuerza Atómica (AFM)

Mario Alberto Ramírez[1], Miguel Cadena[1], Sergio Ureta[2] y Nikola Batina[3]

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Abstract— Formation and dissolution of kidney stones is an important medical subject, not completely understood jet. Surgery and lithotripsy techniques, nowadays solutions are still expensive and aggressive with important limitations. The aim of this study is to develop a new methodology to evaluate efficiency of different drugs treatment upon renal stone dissolution process, at nanometric scale. The main idea is to visualize (monitoring) the dissolution processes of the renal stones surface during the different substance treatment, including some commercial medical drugs. AFM as nanotechnology technique was used to monitor dissolution at the nanometric level. Here, in this work, we show how to prepare samples for the AFM study and how to record changes in the surface topography during the stone dissolution. The preliminary results, images obtained by using commercial drug Allopurinol, show significant surface layer alternation (the renal stone destruction), which was characterized in the qualitative and quantitative way, in great details.
Palabras claves— Disolución, cálculo renal, AFM, nanotecnología.

ROOM 3: TECHNICAL SESSION HEA, Chairman: Hyxia Villegas; Jorge Letechipia

13 Lector De Historias Clínicas Electrónicas codificadas en el estándar Health Level 7 / Clinical Document Architecture para su Aplicación en Servicios de Telemedicina

E. Lugo, H. Villegas, A. Villegas y J. Pacheco

Universidad de Carabobo, Centro de Procesamiento de Imágenes, Valencia, Venezuela

Resumen— El objetivo principal de este trabajo es diseñar e implementar un software libre para leer historias clínicas electrónicas basadas en el estándar Health Level 7 / Clinical Document Architecture (HL7/CDA). La implementación del software fue realizada utilizando la metodología Programación Extrema, PHP, Javascript y XML asíncronos (AJAX) y las herramientas Apache 2 y Eclipse 3.1. El lector recibe un documento XML codificado en HL7/CDA y luego organiza su contenido en la memoria del computador. Las pruebas fueron realizadas en Linux Ubuntu 6.06 LTS y Windows XP SP2, utilizando Apache 2 y PHP 5. Los resultados obtenidos muestran que es posible la recepción de historias clínicas electrónicas que se encuentren en conformidad con el estándar HL7/CDA. Se concluye que el lector facilita la gestión de la información contenida en historias clínicas codificadas en HL7/CDA luego de su recepción, representando así una contribución al intercambio de información clínica para servicios de telemedicina.
Keywords— Telemedicina, Historias Clínicas, HL7, Clinical Document Architecture.

62 CAD.net: uma Ferramenta de Processamento de Imagens Mamográficas e Auxílio ao Diagnóstico via-Internet

M.F. Angelo[1], H. Schiabel[1], A.C. Patrocinio[2] e L.P. Freitas[1]

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Abstract — This work consists of the development of a computer scheme to provide the processing of digital mammographic images sent by an Internet user. The current system results provide indications on the suspicious mammogram regions with the detected lesions. Besides the image with convenient marks on detected clustered microcalcifications, their classification in terms of "suspect" or "non-suspect" is also provided. The density level, as well as the percentage probabilities regarding the BIRADS® classification and the mass margin shapes are presented for suspicious masses detected by the scheme. The user can upload regions of interest (ROIs). For digitized mammograms, the correct rate of was 93% for microcalcification detection, while for mass detection, it was 92%. For direct digital mammograms, the correct rate was 93% for microcalcification detection, while for mass detection, it was 89%. In addiction, it was verified that the processing time average varied between 10s (the best case: one ROI) and 1,5 minutes (the worst case: four mammograms), which this time can be considered acceptable. According to the tests performed with the purpose of checking the system efficacy, the tools manipulation was qualified as easy by 72% of the volunteers whom have tested the system and its working classified as great (40%) and good (56%). Currently, there are CAD schemes available on the market, however, they present a high acquisition cost and a final answer restricted just to the detection of suspect lesions, without providing additional data that can enhance the information the radiologists have, therefore helping them on their report. This research was carried out in order to provide this additional data by the Internet. Even though some problems occurred with the transmission of images by the Internet, the results presented by the tests performed by volunteers showed that the system has a good performance; it's available at: http://lapimo.sel.eesc.usp.br/lapimo/lapimo.htm.
*Palabras cla**ves***— mammographic images processing, telemedicine, breast cancer, diagnostic by Internet.

97 Integrando la Práctica Deliberada en Sistemas de Simulación para Educación Médica

Pablo Reyes Cabrera

Departamento de Ingeniería Biomédica, Universidad de Valparaíso, Valparaíso, Chile

Abstract— In this paper, we review some aspects of simulation-based medical education systems and show how the incorporation of deliberate practice processes can augment the learning effectiveness and overcome simultaneously two detected issues on medical education: reduction of available time of experts and a serious limitation of patient availability. We then describe the notion of deliberate practice and show how it can be implemented through an

intelligent tutoring system. Finally, we conclude that the implementation of intelligent tutoring systems is a robust method to make more effective the learning of actual capabilities of high fidelity simulation systems for medical education.
Palabras claves— Educación médica, ITS, Práctica deliberada, Simulación.

99 Sistema remoto de aquisição de sinais baseado na arquitetura WOSA/XFS

K. F. de Oliveira, D. C. Garcia ,M. L. Cotta, A. F. da Rocha e I. dos Santos

Departamento de Engenharia Elétrica, Universidade de Brasília, Brasília, Brasil

Abstract— This article presents a novel real-time, multi-layered data acquisition system based on the WOSA/XFS architecture, and implemented with the MSP430 microcontroller. For system validation, a test application was developed, in order to graphically display samples of the signals of interest, according to the sampling rate and the number of samples determined by the user.
Keywords— data acquisition, microcontroller, WOSA/XFS architecture, transceivers.

343 Implantación del sistema RIS/PACS en el Hospital Cardiológico Infantil Latinoamericano Dr. Gilberto Rodríguez Ochoa

Delgado B. Yuber A.

Hospital Cardiológico Infantil Latinoamericano Dr. Gilberto Rodríguez Ochoa , Departamento de Ingeniería, Caracas, Venezuela

Abstract— this article describes RIS/PACS system installed on the Hospital Cardiológico Infantil Latinoamericano Dr. Gilberto Rodríguez Ochoa, the different modalities and the Dicom standards, the advantages of integrating RIS and PACS, Data storage, visualization and distribution of studies. The workflow adopted by each area that produce medical images. It also describes the acceptance by the users physicians, technicians, nursery personal and the improvement on the patient attention.
Palabras claves— RIS, PACS, DICOM,

PO1 El Móvil en la Salud un campo por Desarrollar en Venezuela

Juan Fernando Toledo

Movistar, Departamento de Mercadeo

ROOM 4: TECHNICAL SESSION MOD, Chairman: Carlos D'Attellis; Carlos González

15 Modelo Biofísico Bidimensional que Simula el Efecto Ablativo Focalizado de Tejido Renal Cancerígeno a través de Radiofrecuencia y Nanopartículas Ferromagnéticas

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Abstract—A bi-dimensional biophysical model to simulate a selective ablative effect in renal cancer was designed and tested. The model involves symmetrical regions of tumor/healthy renal tissue, a single circular coil to generate an alternating magnetic field in the microwave range and the presence of magnetic nanoparticles in the tumor region. The bi-dimensional biophysical model was solved by a finite element technique on the basis of electromagnetic and heat transfer considerations. The simulation produced induced current densities and surfaces of temperature gradients in tumor/healthy renal tissues with and without nanoparticles presence. The induced current density in the tumoral region increased as a function of the nanoparticles presence and was manifested by an increase in the temperature gradient. The simulation results showed that the radio-frequency exposition of renal tumor tissue influenced by magnetic nanoparticles has the potential to being a selective thermal ablation technique for renal cancer therapy.
Keywords— Ablation, Radiofrequency, Nanoparticles, Cancer, Simulation.

120 Modelagem Computacional de Estruturas Renais

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Abstract— The efficiency of systems for radiographic images acquisition, as well as for computer aided diagnosis (CAD) is verified currently by means of phantoms or images selected by the researcher, compromising the reliability of the evaluation. In this work it is presented an algorithm that simulates the integrated kidney structures. The structures are built by the overlapping layer method, where a layer can be understood as a slice of the three-dimensional object. The urether, veins and arteries are represented by cylinders. The spatial arrangement of the arterial system is determined by the branching angle between 35 and 55 degrees, which are values defined according to the shape of the region and on the patients anatomical characteristics. The branch diameters are decreased in steps of 10% after bifurcation and there is a rotation of 90° of the branching plane, which guarantee asymmetric branching. The results obtained, evaluated by two specialists, are compatible with real anatomies, respecting the anatomical particularities. This degree of representation will allow the verification of the influence of radiological parameters, morphometric peculiarities and stage of the diseases on the quality of the images, as well as on the performance of the CAD.

Keywords—kidney, quality control, CAD, computational modeling.

156 Novel methods for multiphase assessment of pulmonary dynamics in long term patient monitoring

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Abstract - Chronic obstructive pulmonary disease (COPD) related mortality and associated impairment of the quality of life, as well as related economic burden and predictive models of the future trends demonstrate that COPD is one of the critical health care issues in the Americas and globally. There-fore, it necessitates improved quantitative diagnostic methods and techniques for long term monitoring of patient's condi-tions and active medical intervention, population comparative studies, and related comprehensive documentation of patients' expanded pulmonary function tests. Presented work encom-passes developed techniques for enhanced diagnostic evalua-tion and documentation of patient's respiratory dynamics and includes modular spherical representation of respiratory flow, volume, time characteristics with a capability of planar projec-tions, which may include among others currently used stan-dard flow/volume loops. Those spherical and/or planar charac-teristics can be complemented by associative display and quantitative analysis of auscultatory events characterized in time and/or frequency domains thus going beyond present practice of qualitative description of auscultatory observation which, when described in this traditional form, have limited value in long term monitoring. Independently developed, but with parallel utilization capabilities, non contact image based extraction and evaluation of thoracic and abdominal respira-tion related movements allow quantitative evaluation of ab-normal asynchronies. Portability of this PC based system with USB connectivity and developed software allow enhancement of patient's pulmonary function and respiratory dynamics evaluation especially in long term monitoring of patients.

Keywords - respiratory mechanics, pulmonary function test, quantitative auscultation, chronic obstructive pulmonary disease, COPD.

195 Self Organizing Maps in Respiratory Signals Classification

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Abstract— Respiratory systems can be analyzed and modeled as autonomous dynamic systems. We use a Self Organizing Map (SOM) to build a suitable respiratory dynamical model, based on the reconstruction of a complex system attractor and model it using a neural network.

The SOM reconstruction approach discussed in this paper is first tested on a well-known chaotic model (Hénon fractal attractor), and evaluated using both linear (mean and std) and non-linear indices (correlation dimension and Lyapunov exponents) indices. Subsequently the proposed approach is tested on a biomedical open database (MIT-BIH Polysomnographic), using respiratory signal patterns collected during the sleep stage. Classification results were analyzed both from a qualitative and a quantitative viewpoint by comparing the resulting non-linear indices obtained through the SOM-based reconstruction model with those obtained directly from inspiratory time series (TI) data. Results are in close agreement.

Keywords— Self Organizing Maps (SOM), Respiratory signals, Classification, Non-linear systems.

265 Simulação em LabHEART de fatores que causam arritmia ventricular

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Abstract— The action potential duration (APD) vs frequency relationship is a clear indicative of a healthy cardiac cell. Heart failure myocytes exhibit a characteristical flat response as the frequency increases. Mathematical models allow us to study the ionic components responsabile for that behavior. We customized the LabHEART model by altering the ionic currents formulations to reproduce the experimental data of control and pathological conditions from dog ventricular myocytes. Compared with control data, the inward rectifier K^+ current (I_{K1}) was decreased, the maximum conductance of the rapid component of the delayed rectifier K^+ current (I_{Kr}) was increased, the activation kinetics was slowed and the rectification property was augmented. The slow component of the delayed rectifier K^+ current (I_{Ks}) was increased in magnitude and activation shifted to less positive voltages. L-type Ca^{2+} current (I_{Ca}) was modified to produce a smaller, more rapidly inactivating current. Finally, a simplified form of intracellular calcium dynamics was adopted. In our simulations APD increased from 274.3 + ou -16.6 ms (control) to 405.2 + ou - 24.0 ms (pathological) for a range frequencies of 0.1 to 2 Hz. Calcium transient amplitude was severely decreased in the pathological case. These results show the importance of *in silico* experiments to study cardiac arrythmias and the search of new pharmacological targets.

Keywords— action potential duration, calcium current, potassium current.

375 Modelado y Simulación del Sistema Cardiovascular Materno-Fetal

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Abstract— This article presents a mathematical model that attempts to simulate simultaneous mother and fetus cardiovascular systems response, at the end of the gestational period. Physiologic remodeling of the mother's cardiovascular system (SCM) takes place during pregnancy, involving increases in Heart Rate (FC), Stroke Volume (VL), and Cardiac Output (GC) along with a decrease in Total Peripheral Resistance (RPT), without apparent changes in the Mean Arterial Pressure (PAM); while fetal cardiovascular system (SCF) is developing to satisfy fetal necessities, experiencing physiologic and anatomical modifications. The proposed model is a simple compartmental system of closed circulation composed by 14 vascular segments. The Mother's side includes a controller of arterial pressure effect (baroreceptor system) which can be simulated as proportional or as adaptive. The computer simulations were carried out by implementing the set of dynamic equations using block diagrams in Simulink®. The overall model was run under resting basal conditions of a mother with is byproduct at the end of the gestational period using both control laws. Model validation was carried out by comparing simulated responses with the literature as well as those of a set of twenty mothers measured in a clinical setting, using a t-test. Finally, another five mothers with HTAIE were measured and mimic conditions were simulated. Simulation results were in agreement with published and experimental data for mothers and fetus at the end of the gestational period. In conclusion, the proposed model is a good tool to simulated simultaneous mother and fetus cardiovascular systems response, at the end of the gestational period.

Palabras Clave— Modelo Matemático, Simulación, Control Baroreceptor, Sistema Cardiovascular.

ROOM 5: TECHNICAL SESSION APP 1, Chairman: Adriana Vilchis; Ricardo Bravo

43 Aplicación de las Tecnologías del Habla al Desarrollo del Prelenguaje y el Lenguaje.

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Abstract—This paper shows a study on the use of Speech Technologies to help people with different speech impairments.

Speech technologies provide methods which can help young people and those who suffer from speech pathologies to develop the Prelanguage and the Language, improving their communication skills. For this purpose, the acquisition of

a corpus of pathological speech is needed, in order to analyze the feasibility of the methods developed. As a result of this study two multimedia applications have been developed, to train Prelanguage and Language respectively, and a corpus of pathological speech in Spanish language has been acquired.
Palabras claves— Pre-Lenguaje, señal de voz, logopedia, Córpora.

50 Ambiente virtual para a auxiliar a concentração de crianças com hiperatividade

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Abstract — It is well known that children with hyperactivity usually can't execute some tasks due to the lack of concentration; therefore, in order to increase such children's concentration, we have developed a computerized game, with a story based on an old pirate who travels several islands and dangerous seas to find a lost treasure. To begin this adventure thechild should understand the hints showed by the characters of game. The Blender graphical tool was used to model the objects of the scenes, the characters, and so provided good interactivity, through their game engine. The objects of the scenes together with the sound effects allowed a completed immersion of the player in the environment. The developed game attends the APA (American Psychiatry Association) recommendations;therefo re, the levels are shorter compared to those of similar games. Furthermore, the children are rewarded for each executed task and not for each level; the kind and the rhythm of the tasks are frequently changed and some sensorial methods considered in the game may exert the children's memorization and concentration in a reduced visual field. The game was appraised by a games specialist, who considered as attractive as other similar games. It also has been submitted to a neurologist, who considered the game appropriated to improve the concentration of the children with hyperactivity. The game was tested with 10 children with hyperactivity, who demonstrated interest in playing the game several times. It was noted that the children who finished the game in the first attempt had experience with computerized games. The children who didn't finished after the first attempt, manifest interest trying again.
keywords — Modeling, graphics computation, computer game, virtual environment, hyperactivity.

59 Interface Braille Automatizada

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Abstract — The text reading process performed by a visual impaired individual is made by means of touch over the symbols in high-relief surface. These symbols are Braille code so that they represent the letters, numbers and several other symbols. This project is focused to develop a device in order to bring improvements of quality of life of visual impaired individual. The device is compound by two parts: hardware and software. The hardware, connected to a personal computer, is responsible by the automatization of Braille code and interface to the visual impaired individual with the computer. The software, loaded in a computer, performs several tasks. One of the tasks is to accelerate the alphabetization of visual impaired individual by means of the proposed Automated Braille Interface. Visual impaired individuals, and teachers who work in this area, evaluated the proposed system and concluded that it improves the quality of life of the visually impaired people.
Keywords — Código Braille, Deficiente Visual, Automatização Código Braille, Alfabetização Deficiente Visual.

152 Modelagem Virtual para Projetar Dispositivos de Reabilitação

T. A. Scardovelli, H. N. Martucci, A. P. Silva, B. S. Cunha, C. M. P. Fogolin and A. F. Frère

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Abstract— Nowadays in the industry, the 3D modeling is used to foresee possible errors, to calculate their structures and to reduce production costs. However the tools used in the industry many times can't be applied in therapeutic treatment because don't simulate satisfactorily the physics and the moves of the patient. In this work, it was used the *Blender* modeling tool to project two devices. One of them was destined to stimulate in the hydrotherapy the motor control of trunk in children with cerebral paralysis. The other 3D model was projected to stimulate children with Down Syndrome to creep. The modeling allowed foreseeing the children's behavior with different ages, different morphologies, many levels of engagement and to detect errors before the prototypes were constructed. The devices had been developed and tested for special children, and they were considered suitable to the physical rehabilitation.

Keywords— Computational modeling, rehabilitation, postural adjustments, motor development.

186 Sistema de informação para redução de acidentes no mergulho recreativo

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Abstract - Recreational SCUBA dive courses have a curriculum that covers security procedures which should be followed in case of emergency. Nevertheless, this is a complex matter and after the course there is no training of these procedures anymore. Besides, when an emergency situation happens, divers, panic-driven, do not succeed to follow the security procedures because the majority is counter instinctive, and even expert divers have difficulty in following them, as emergencies are unusual, and when they happen, people are not prepared. Moreover, diving accident information is spread over many publications, making difficult for divers to access it. Therefore, a knowledge management system associated with e-learning can reduce diving accidents since it will consolidate accident information and will also provide training and recycling for geographic dispersed scuba divers.

Keywords: Learning virtual environment; knowledge management; multimedia environment; e-learning; diving accidents

362 Tecnovigilancia; Sistema de Vigilancia de dispositivos Médicos

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Abstract— Technovigilancy is a new action in Mexico, it was born in USA in 1976, to grantee the efficiency and safety of medical devices. It can be a code, document that contains mandatory requirements; it uses the word shall, is generally adopted into law by authoroty that has jurisdiction, and Standard, document that contain mandatory requierements, but compliance tends to be voluntary; In Medical Equipment the clasification of the reports is divided in 3 diferents class I, II and III in which higher number indicate higher risk ; This notifications are given to the industry in order to prevent and repair the mane problem of the surce.

Palabras claves— Tecnovigilancia, dispositivos médicos, incidentes adversos.

POSTER SESSION: IMA, INS

127 Detecção Da Assimetria Mamária

S.C.M. Rodrigues[1]*, M. F. A. Veloso*[1] *e E.L.L. Rodrigues*[2]

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Abstract — This article presents the software "DENSIRADS" that organizes mammography image database in accordance with the classified breast density composition described in the BI-RADS (Breast Imaging Reporting and System Date). The methodology used in the "DENSIRADS" allows indicating the lack of symmetry in the mammography density. Nowadays researchers of the area agree that the lack of symmetry between the densities would be an important factor in diagnosis of the breast cancer. The image database used was the MIAS (Mammographic Image Analysis Society), classified by radiologist and available on-line. Sixty images had been used, being 15 pairs (30 images) classified with asymmetry and 15 pairs (30 images) classified as normal. From that 15 pairs of asymmetry images, 9 were cancer cases. The sensitivity of the DENSIRADS for the MIAS database to asymmetry images was of the 78 % and specificity of the 75%.

Palabras chave — Processamento de Imagens, Imagens mamográficas, BI-RADS, densidade e assimetria mamográfica.

159 Clasificación De Lesiones Gástricas en Imágenes Endoscópicas Mediante la Técnica de Pirámide Difusa y Redes Neuronales

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UNEXPO, Barquisimeto, Venezuela

Abstract— El procesamiento de imágenes puede ser usado en el diagnóstico médico, p.e. en el análisis de imágenes obtenidas a través de endoscopias. El carcinoma gástrico representa un desafío a la exactitud de diagnóstico de la endoscopia. Se elaboró un sistema prototipo para el reconocimiento de patrones en imágenes endoscópicas, en el que se utilizó la técnica de pirámide difusa para identificar una lesión en una imagen, y redes neuronales para dotarlo de capacidad para aprender a partir de ejemplos y de generalizar este conocimiento para realizar inferencias a partir de información incompleta. Se probó con redes neuronales de varios tipos. Las redes que produjeron mejor resultado fueron las de tipo "feed-forward" con algoritmo de retropropagación.

Palabras claves— reconocimiento de patrones, clasificación de patrones, procesamiento de imágenes, redes neuronales.

161 Iris images based personal identification

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Abstract— Technology involved in human identification based on iris images is reviewed. This paper reports ongoing research about a system for human identification based on iris images. We report some preliminary results about the segmentation of iris images aiming at providing a subject independent piece of information for extracting useful iris features for performing the identification task.

Palabras claves— Iris recognition, personal identification, biometrics.

166 Análisis Cuantitativo de la Función Ventricular a Partir de Ventriculogramas

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Abstract—This paper reports on the design of a software platform for the estimation of parameters describing the left ventricular function in ventriculographic images. The system enables the estimation of the End Diastolic Volume (EDV), the End Systolic Volume (ESV), the Stroke Volume (SV), the Ejection Fraction (EF), as well as the ventricular motion. These parameters are useful for evaluation of the cardiac function as a tool for diagnosis of several cardiac diseases. The software system is tested using several ventriculogram sequences. The validation is performed by comparing results obtained by our system with respect to results obtained by the cardiologist. Preliminary results are promising; however, a further validation is required.

Palabras claves— Software platform, Left ventricle, Cardiac function, Angiography.

178 Estimación no-invasiva de la presión de pulso arterial a partir de imágenes ecográficas en modo B

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Abstract— Pulse pressure is not constant throughout the arterial tree increasing centrifugally. Therefore, use of pulse pressure at one arterial site, such as brachial artery, as surrogate for pulse pressure at another arterial site may be erroneous. Applanation tonometry allows the non invasive determination of arterial pulse pressure in both central and peripheral arteries. However it cannot be applied to all subjects (such as obese) and at all arterial sites. In contrast, B-mode echographic derived arterial diameter waveforms can be obtained at more arterial sites and also in a majority of obese subjects. The aim of this study was to investigate the accuracy of the pulse pressure assessed by calibration of echographic arterial diameter waveforms. The left common carotid artery of 49 normotensive subjects (NT) and 45 hypertensive (HT) patients were measured non invasively by using tonometry and automatic analysis of B-mode echographic images, to obtain instantaneous pressure (P) and diameter (D) signals. Calibration of carotid D and P was

assessed from tonometer brachial artery waves and sphygmomanometer, assuming mean minus diastolic pressure constant throughout the arterial tree. Pulse pressure from calibrated diameter waves was 4±2 mmHg (NT vs. HT not significant) lower than pulse pressure from tonometer calibrated pressure waves (used as reference method), with a correlation coefficient of r=0.99 ($p<0.05$). In conclusion, pulse pressure obtained from alternatively calibrated B-mode derived arterial diameter waveforms demonstrates good accuracy within the acceptability limits of the AAMI criteria.
Palabras claves— Tonometría por aplanación, diámetro arterial, rigidez arterial, elasticidad

209 Estimação da Evolução Temporal do Miocárdio: uma Revisão

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Abstract— The temporal estimation of the left ventricular (LV) wall motion in image sequences has been the subject of intensive research for almost three decades, since it can significantly improve both diagnosis and therapy. The challenges in this area include the typical non-rigid heart motion and deformation, the different medical image acquisition modalities and the three-dimensional image data available. This work aims to review the state-of-the-art in LV tracking research, classify it into different categories, and identify new trends.
Keywords— left ventricular motion estimation, point-wise tracking, feature extraction, non-rigid motion, medical imaging.

226 Preliminary Evaluation of a SmartCam-based System for Real-Time Pupil Light Reflex Analysis

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Abstract — The early detection of diabetes-related complications can support the clinicians decisions on appropriate interventional therapy and disease management for improved outcomes. The clinical investigation of the human pupil responsiveness to light stimulation, a technique known as dynamic pupillometry, has shown potential for a simple, inexpensive and non-invasive screening tool in supporting early-stage complications detection with. To facilitate the continuity of this research and to evaluate the applicability of this technique in clinical settings, a low-cost real-time stand-alone pupillometer is desired. In this paper, we present the preliminary results of a developed prototype capable of delivering such features. The proposed real-time pupillometer is based on a high-performance SmartCam system with application-specific software. This prototype was developed for automatic determination of the pupil radius enabling the determination of important pupillometry parameters such as the maximum and the minimum pupil diameters, the latency time to start the pupil constriction as a response to light flash stimulus, the pupil constriction velocity, among others. This SmartCam-based prototype system using a digital signal processor can support real-time dynamic pupillometry at 30 frames per second using only 31.8% of the computational resources. Therefore, it could be used in our clinical studies with the capability to support additional features such as the real-time pupil light reflex evaluation in both eyes simultaneously.
Keywords— SmartCam, Real-time pupillometry, Pupil light reflex, High-performance DSP.

233 Automatic Segmentation and Measurement of the Lungs in healthy persons and in patients with Chronic Obstructive Pulmonary Disease in CT Images

J.H.S Felix[1], P.C Cortez[1], M.A Holanda[2] and R.C.S Costa[1]

[1] Federal University of Ceará / Department of Teleinformatic Engineering, UFC, Fortaleza, Brazil, [2] Federal University of Ceará / Department of Clinical Medicine, UFC, Fortaleza, Brazil

Abstract— Nowadays, Computed Tomography (CT) of the thorax is the most accurate image technique for the diagnosis of the majority of the lung and chest diseases. Despite of this fact there are still limitations of CT in diagnosing and specially quantifying lung diseases such as emphysema. The automatic segmentation and measurement of the lungs and thoracic structures can improve by image processing techniques. These techniques enhance the visualization of the lungs and the chest wall. The present paper presents a method of automatic classification capable to segment and measure the lungs and the thoracic cavity both in healthy volunteers and in

patients with Chronic Obstructive Pulmonary Disease (COPD) in prone positions based on technique of region growing. With the region growing method, based on computer programs, it is possible to segment and measure the aerated lung and the thoracic cavity.

Keywords — segmentation, measurement, lungs, region growing, disease.

237 Comparação das Técnicas Spin Eco e Fast Spin Eco nas Lesões Meniscais

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Abstract — Magnetic Resonance Imaging (MRI) is an important tool for diagnosing meniscal injuries. The use of improper techniques may compromise the diagnose. The typical protocols used to diagnose meniscal injury are conventional Spin Eco and Fast Spin Eco. This work compare both techniques using a computational program developed in JAVA. The analyses performed include the comparison of image sharpness, tissue distribution and the determination of the size of the harm obtained with each acquisition technique. The results showed the superiority of conventional Spin Echo techniques for diagnosing meniscal lesion.

Keywords— image quality, image of the knee, lesion meniscal and computerized

242 Post-Processing Analysis of Virtual Histology Images – A New Tool for Intra-Plaque Component Assessment

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Abstract— Virtual Histology (VH) is a new medical imaging technique that allows the assessment of atherosclerotic plaque composition, a potential useful tool for the evaluation of individuals with coronary disease. In its default output, VH provides a frame-by-frame assessment of the summed absolute and relative areas of each plaque component. However, no information is currently available on the intra-plaque distribution of each component. Also, current VH analysis lack information on the presence and extension of confluent pools, which may have important pathophysiological implications. We, therefore, developed a software to extract these informations from VH images. A total of 897 coronary cross-sections from 23 patients were analysed. Overall, 57% of patients were male, the average age was 58 ± 9 years and 39% were diabetics.

The number and size of islands varied significantly from frame to frame in all VH components. Also the absolute size of the largest island for each component markedly differed among the frames. Importantly, the number of islands of each component varied enormously, from a large single pool comprising the whole component to multiple tiny islands of tissue.

Keywords— Virtual histology, ImageJ Plug-ins, Vulnerable Plaque, Atherosclerosis and coronary disease.

248 Calibración Geométrica de un Equipo de Angiografía Digital

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Abstract— Digital X-ray angiography is a medical imaging modality that enables acquisition of high quality images of coronary vessels and heart cavities. The angiography images are used mainly for quantitative assessment of coronary obstructions. However, in clinical practice, the measurement of the lesion length is obtained by comparing the size of the lesion with respect to catheter width. These manual techniques add imprecision to the lesion measurements since they do not consider the acquisition geometry of the X-ray system. Furthermore, three-dimensional reconstruction techniques have emerged as a solution to obtain more reliable lesion length measurements. However, these techniques require the information about the X-ray equipment acquisition geometry in order to generate reliable 3D models. This article proposes a computational method to obtain intrinsic parameters of the X-ray angiography system, taking into account the image radial distortion. The goal of this method is the estimation of reliable calibration parameters in order to obtain the computational 3D model of the arteries. The calibration method is evaluated by estimating the distance, measured in pixels, between detected image points and projected ones.

Keywords— Extrinsic Parameters, Intrinsic Parameters, Image Distortion, Geometric Calibration.

271 Procesamiento de Imágenes para la Evaluación de la Integración de Implantes de Polímeros Semiconductores en un Modelo de Lesión Traumática de Médula Espinal

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Abstract— In this work an algorithm for the digital processing of hystological images is planted. Through of a transformations of space RGB to space HSV and bidimensional histograms is possible make a model of fuzzy logic which allows to identify the components of the implanted spinal cord (polymer, cellular tissue and bottom-cyst). The calculated index by the ratio area (area of the bottom-cyst over limited area) allows to know integration of the polymeric material in the tissular of the spinal cord.
Palabras claves—Procesamiento de Imágenes, Imágenes Histológicas, Lesión de médula espinal, polímero semiconductor.

306 Estimativa da Idade Óssea – Validação do método E&R3

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Abstract— This paper presents the behavior of bone age estimation using three methods. The skeletal assessment methods Eklof and Ringertz (E&R) simplification, Greulich & Pyle (G&P) and Tanner & Whitehouse (T&W) were used to analyze the hand radiographics of 197 peoples (98 boys, 97 girls; age: 7-16 years). Skeletal age obtained by methods was satisfactory, getting a powerful correlation (92%) with chronological age. Analyzing the results, it is possible to conclude that method E&R3 simplification is appropriate for bone age estimation, using fast e simplified configuration, with similar results.
Keywords— Bone Age, Greulich & Pyle, Eklof & Ringertz, Tanner & Whitehouse, Hand Radiography.

316 Region-Based Live-Wire for Segmentation of the Myocardium

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Abstract— This paper presents a technique to perform segmentation in images of human myocardium. Segmentation is one of the first steps of image analysis. Edge-based segmentation provides accurate localization of the region boundaries, but the contours are only based on local computations, and are very often sensitive to local variations in intensity, noise and physical artifacts. Problems like these fatigue the user and require many interventions at the contour delineation process. To reduce these problems, we propose the addition of two new features in the Live-Wire method: region intensity and proximity. Experimental results show that this alternative approach can achieve accurate edge localization and improved efficiency.
Keywords— dynamic programming, live-wire, distance transform, interactive segmentation, medical image

336 Avaliação da Doença de Alzheimer pela Análise Multiespectral de Imagens DW-MR por Mapas Auto-Organizados de Kohonen como Alternativa aos Mapas ADC

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Abstract— Alzheimer's disease is the most common cause of dementia, yet hard to diagnose precisely without invasive techniques, particularly at the onset of the disease. This work approaches image analysis and classification of synthetic multispectral images composed by diffusion-weighted magnetic resonance (DW-MR) cerebral images for the evaluation of cerebrospinal fluid area and its correlation with the advance of Alzheimer's disease. The MR images were acquired from an image system by a clinical 1.5 T tomographer. The classification methods are based on

multilayer perceptrons and Kohonen self-organized maps. The classification results are used as an alternative to the usual analysis of the ADC map.
Keywords— Alzheimer's disease, magnetic resonance imaging, multispectral analysis, Kohonen self-organized maps

10 Instrumentação para Análise do Tremor Humano: Desenvolvimento e Testes in Vitro e in Vivo

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Abstract - Tremor is defined as an involuntary motion, which results from alternating or synchronous contraction of agonist and antagonist muscle groups. Tremors and their characteristics are important clinical symptoms used by doctors when diagnosing illness. In order to quantify tremor, we designed a low-cost system in which tremor was detected by piezoelectric accelerometers and the processing, presentation and data storage functions are conducted by a virtual instrument. The system displays the peak frequency (fp), the amplitude in the frequency (Ap), the power in this frequency (Pfp), and the total power (Pt). After the design details are described, the system was evaluated by in vitro tests, which revealed a linear behavior between 0,03-0,45 G (R=0,99862). Experimental results obtained in 20 normal volunteers confirmed the good features achieved in engineering tests. These results are in close agreement with physiological fundamentals, supplying substantial evidence that this device can be a useful tool for the evaluation of tremor.
Palavras-chave - Instrumentação biomédica, tremor humano.

12 Desenvolvimento de um Sistema para Avaliação dos Sons no Ouvido Externo com Aplicação em Estudos de Apnéia do Sono

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Abstract: the monitoring of respiratory events during sleep is important in the diagnosis of sleep apnea. The methods used to accomplish this task, however, are invasive or inaccurate. The aim of this work is to investigate an alternative method based on the respiratory sounds measured in the external ear. The development of a system able to measure the cited sounds is described, as well as results associated with simulated conditions usually found in respiratory sleep diseases (hyperventilation, tidal breathing, hypopnea and apnea). In these simulations, the sounds at the external ear were compared with the respiratory flow measured by a pneumotachometer. These experimental results revealed a correlation around 0.90, confirming the high scientific and clinical potential of this system.
Palavras Chaves: Instrumentação biomédica, distúrbios do sono, sons respiratórios.

28 Desenvolvimento de Instrumentação para Análise da Força Muscular Respiratória: Avaliação do Desempenho e Proposta de Novos Parâmetros

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Abstract: The diagnostic of respiratory muscle dysfunctions is usually conducted using mechanical instruments. In order to improve the measurement systems used in these exams, a new system, based on a microcontroller and a PC, was developed in our laboratory. Theoretically, this system is able to overcome several limitations of the traditional system, as well as to allow the evaluation of the dynamic performance of the respiratory muscles. This work aims to evaluate the practical use of this new system and the performance of the inspiration (τi) and exhalation (τe) time constants to detect respiratory muscle limitations. The pressures measured by the new system were coherent with that measured by a traditional one ($R \cong 0.97$). The inspiration pressures (Pimax) were lower in patients ($p<0.0001$), and τi was higher in patients ($p<0.008$), results that were in close agreement with the physiology. The evaluation of the clinical usefulness showed that Pimax, measured with this new instrument, is sufficiently accurate for clinical use. We concluded that the developed system could be a useful tool for the evaluation of respiratory muscles.
Palavras Chaves: Instrumentação Biomédica, Força muscular, Testes de função pulmonar, Mecânica respiratória.

29 Instrumentação para Análise do Tremor Humano: Plataforma Vibratória para Testes in Vitro

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Abstract: The simulation of human tremor is important in the development and maintenance of systems used in the diagnosis of movement disorders. The aim of this work is to describe a vibration platform able to perform these tasks. The device consists of PC integrated to a loudspeaker and position and acceleration transducers. The software is developed in LabVIEW environment and manages the reception, analysis and storage of sampled signals. The system is able to provide adequate accelerations (0.35G) and is linear in the range of interest (R=0.99). The influence of mechanical loading was also investigated. The results showed that the developed device is able to keep accelerations similar to that observed in patients with Parkinson disease until 68 g. We concluded that the proposed system could contribute to a more accurate implementation and maintenance of instruments dedicated to the measurement of tremor and, therefore, to improve the diagnoses of tremor disorders.
Palavras Chaves: Instrumentação biomédica, tremor humano, vibração.

37 Sistema para evaluación de algoritmos de detección de los instantes de sístole y diástole.

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Abstract— Blood pressure measurements obtained by non –invasive methods are an indispensable procedure for evaluating and treating patients in a medical environment. At present this procedure has been implemented in much automatic equipment. All of them must pass a validation test using the AAMI standard SP10 or the BHS standard. In spite of such standards, equipment which pass the test, not always assure the accuracy in arrhythmias or movement artefacts environment. Besides, the success in validation test mainly depends of the experience and training of two observer who determinate the systole and diastole gold standard. This paper presents the algorithm and software to obtain a more accuracy and robust systole and diastole blood pressure, as a gold standard for validation; algorithms for detecting blood pressure and equipments.
Palabras claves— **procedimiento de validación, validación de dispositivos, presión sanguínea arterial, medición de presión sanguínea arterial.**

52 Método para Avaliar o Fator de Qualidade de Unidades Biotelemétricas Ressonantes.

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Abstract— Usually, biomedical injectable resonant sensors have a limited size. Thus, the necessary inductor is constructed using small gage wires (typically 0,254 to 0,079 mm in diameter), which increases its internal resistance, and consequently reduces sensor quality factor (Q). As Q decreases the signal to noise ratio is also reduced, difficulty the use of resistive transducers in the sensor. Under the above conditions the methodology employed to determine Q must be as accurate as possible in order to reduce measurement errors. In this paper the analytical solution of the biotelemetric equivalent circuit is presented, showing that its adequate use can allow remotely evaluation of Q with comparatively small errors (less than 3% for Q around 20).
Palavras chaves— Telemetria, freqüência de ressonância, fator de qualidade, circuito ressonante passivo.

56 Avaliação do desempenho de um sensor biotelemétrico passivo para monitoração da pressão arterial – testes estáticos

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Abstract—The purpose of this paper is to describe a passive biotelemetric sensor for arterial blood pressure monitoring. The sensor has been developed using a glass tube, sized 5.5 x 11 mm, closed at one side with the other covered by a thin poli-cys-isoprene membrane and, a ferrite core attached to it. The displacement of the ferrite core modulates the resonance frequency of LC circuit located at the tube bore, which can be evaluated remotely. The static results of the sensor are presented and discussed in details.
Keywords— Biotelemetry, Passive Sensor, Blood Pressure.

83 Sistema Para Ensaio De Funcionalidade De Incubadoras Neonatais

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Abstract— This work presents a prototype based on a microcomputer to assess the performance of newborn incubators in a semi-automatic way. It carries out the tests described by the Section 8 of the NBR IEC 601- 2-19/1999. The developed electronic circuit acquires data from the sensors using a microcontroller. A set of sensors are used: Five for temperature, one for humidity and one for air flow. The sampled data is sent to a PC via Bluetooth. The software running on the PC manages the data sampling, as well as guides the user through the test procedure by means of messages and sound alerts at the end of each stage. The acquired data is shown on the screen and also stored into a database that can be locally or remotely accessed. At the end, the results are presented on a graph where the measurements (temperature, humidity and air flow) performed during the whole test can be seen. The procedure to calibrate the sensors and the tests carried out with the developed system are presented.
Keywords— IEC 601-2-19, Bluetooth, neonate incubators, clinical engineering, assessment.

190 ECG Monitor with Heart Rate Variability and Temperature for Use in Anesthesiology: Front-End Based on DSP

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Abstract— The correct evaluation of the anesthetic state is an essential issue to avoid morbi-mortality in a surgical patient. Recent studies proved that the anesthesia analgesic aspect may be evaluated through the analysis of the heart rhythm variability. This work describes hardware and software design of an ECG, HRV and temperature monitor front-end, based on low cost DSP. It is able to show the patient's ECG signal, to compute and show the tachogram, and to show two different body temperatures. With cost similar to that of a conventional ECG monitor, this equipment is able to provide more information to the anesthesiologist.
Keywords: Anesthesiology, Heart Rhythm Variability, Multiparametric Monitor, DSP.

208 Diseño de un Electrocardiógrafo Digital

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Abstract— The goal of this paper is to discuss the main characteristics of the design of a new digital electrocardiograph, named CARDIOCID T50. This device acquires the twelve leads of the standard electrocardiogram (ECG) simultaneously and interprets its meaning diagnosis automatically. Also, it can store all the information associated to each patient and transmit it towards a computer through a RS-232 or USB channel. The equipment can be integrated to a Telecardiology system because it is able to transmit information through Internet or point to point by means of the connection to a telephone line. The technical characteristics of the equipment have been evaluated according to IEC 60601-2-51 standard with satisfactory results. The CTS database was used to evaluate the

measurement algorithms. The error in the amplitude measurements never exceeded the maximum set in the standard mentioned previously. At the moment, the test with the CSE database is being made to complete evaluation process.
Palabras claves— Electrocardiógrafo, electrocardiograma, Telecardiología.

256 ECG Monitor with Heart Rate Variability and Temperature for Use in Anesthesiology: Hardware and Software Architecture

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Abstract— This article describes electronic equipment being developed now to provide the anesthesiologist with additional information on the balance between sympathetic and vagal systems of the surgical patient, based on the electrocardiogram acquisition, temperatures and heart rate variability analysis. It is of extreme importance, during surgeries under general anesthesia, that the anesthesiologist has quantitative information aid him to evaluate the patient's anesthetic plan, allowing preventive and corrective interventions. The equipment is composed by a processing central developed around an ADSP-BF532 Blackfin processor and by a front-end based on MC56F8013 processor.
Keywords – ECG, Heart rate variability, Multi-parametric monitor, DSP, Anesthesia.

259 Simulación del Modelo Matemático de la Presión Muscular a la Inspiración Forzada por un Ventilador Mecánico

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Abstract— The work presents a theoretical mathematical model of an electrical circuit equivalent to the pulmonary system, model unicompartimental, in the above mentioned model there analyzes the behavior of the muscular pressure to the moment of the forced ventilatory inspiration generated by a mechanical ventilator. In the work it is realized the simulation of muscular pressure, and the effect that this one produces in the pulmonary distensibility.
Palabras claves— Presión, Ventilador Mecánico, Volumen, Distensibilidad Pulmonar.

302 Instrumentación Virtual, Control y Adquisición de Datos para Unidades de Cuidados Intensivos

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Abstract--- The disposition of tools of the industrial Automation, like SCADA (Supervision Control and Data acquisition), in the hospital services is a tendency, that optimizes the processes and services of the health; these tools, provide resources with support, validating, facilitating and making agile the processes, as much of diagnosis (monitoring), as of specialized intervention (control) and legal responsibilities (reports). This document presents/displays advances in the technological development of an application, where techniques oriented to the control, the communications, the virtual and conventional instrumentation take advantage of, the management and information processing, among others; proposing a system of monitoring, registry and control, reliable and flexible, improving the UCIN (Units of Intensive Cares Neonatal), as well as other processes in the clinical atmosphere.
Keywords--- Virtual Instrumentation, Bioengineering, Incubator, SCADA, LabVIEW.

323 Mecanomiografia Triaxial e Análise de Torque Isocinético: Resultados Preliminares

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Abstract— In mechanomyography (MMG), there seems to be more studies in isometric contractions than isokinetic ones. MMG amplitude can be used to track torque decline in fatiguing isokinetic contractions. This study aims to determine good MMG/torque correlation indicators. Three volunteers performed 50 isokinetic contractions at $300^{o}s^{-1}$. The MMG acquisition system is based on a triaxial accelerometer sensor. It was positioned on the belly of the rectus femoris muscle. The acquired RMS and derived signals were first analyzed for determining whether they have normal distribution. Then, the linear correlation coefficients were calculated. Sensor's axis 1 presented weaker correlation

with torque variables than axis 2 and 3. The modulus of the three signals (axes 1, 2, and 3) had the highest correlation values. The RMS MMG amplitude had better correlation with RMS torque than peak torque. However, with the averaged values, correlation coefficients were R=0.89 and R=0.89 ($p<0.01$) for peak torque and RMS value, respectively. Two main conclusions were drawn: the modulus is a good indicator of torque amplitude in isokinetic contractions at $300^{o}s^{-1}$, and peak torque and maximum RMS torque values occur after the first extension. However, tests with more volunteers are needed in order to precisely assess these results.

Palavras-chaves— mecanomiografia, acelerômetro, torque isocinético, correlação linear.

349 Desarrollo de un neuroestimulador para estudios de crisis epilépticas.

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Abstract— In this paper we present the development and use of an electrical physiological stimulator multichannel programmable. This stimulator was especially used in studies for detecting epileptic events and crisis prediction through rats' electroencephalograms. The animals were followed by the kindling model. The system allows to program different stimulation parameters (Wide of pulse, Separation between successive pulses, Intensity, Number of applied pulses total). Accurately limited and in digital form. This stimulator generates bipolar constant current pulses with maximum amplitude of 5 mA and resolution 50 uA, allowing a voltage with maximum amplitude of 150 V. The stimulator was made with and microcontroller (PIC18F4550) and if is controlled by PC. Rats were used on testing achieving epileptic events.

Palabras clave— stimulator, microcontroller, epilepsy

373 Diseño de un Sistema de Registro de Movimiento Para el Diagnóstico de enfermedades de trastorno de movimiento

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Abstract— The investigation of the variables that possesses an illness is good for the development of the diagnosis, prevention and cures of this illness. With base to this one investigates the variables that has the evil parkinson and another similar ones with the movement to be able to develop an electronic system for the diagnosis of these illnesses. The movement of the evil parkinson has an established range of frequencies and a scale of degree of the illness in funtion of the amplitude of the movement. With base of a sensor digital of acceleration captures the movement and through a circuit microcomputer to carry out the calculate of the acceleration to send it to the computer through the parallel port to carry out the processing of converting the changes of values of acceleration to values of amplitude and frequency, and with the help of an algorithm determines if the registration of the movement throws the evil parkinson. This team helped the specialist to have an diagnose differential with register of other diagnose and it facilitated the registration of the illness.

Palabras claves— Acelerómetro, PWM, temblor, alteraciones del movimiento, microcontrolador.

376 Módulo de Visualización Dinámica para Señales Biomédicas Empleando una Pantalla de Cristal Líquido Graficadora

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Abstract— The present paper describes the phases involved in the design and implementation of a Graphic Module, intended to the visualization of biomedical signals and alphanumeric information on a Dot Matrix Liquid Crystal Display. The processing tasks, oriented to transform the digitalized biosignal into the appropriated format, so that it can be displayed properly on a Graphic LCD, were carried out by a Field Programmable Gate Array FPGA. All the digital modules implemented in the FPGA were described using the Very High Speed Integrated Circuit Hardware Description Language VHDL. A methodological approach for the displaying of biomedical signal waveforms and related alphanumeric information on a Graphic LCD was included, as well as the way the characters, the numbers and

others special symbols were coded. The biomedical information provided by a Breath Rate Monitor, designed by the Research and Development Group, was used as a test signal, obtaining suitable results.
Palabras claves— Biosignal Displaying, Graphic LCD, FPGA.

412 CARDIOFILE: Un Registrador Multipropósito de Eventos para Empleo en Desfibriladores

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Abstract— In this paper a multipurpose event recorder for defibrillator applications is presented. CARDIOFILE has been conceived to record, in a fully automatic fashion, any event taking place after switching on the defibrillator, thus easing the out of line reconstruction of the case history. Recording is carried out in an internal flash memory, including any patient-related event as its ECG and heart rate, defibrillator-related events as pressed keys or energy values and, finally, operation-related ones. Thus it is a valuable tool that makes it possible, not only to reconstruct the case history, but also to use any recorded case for teaching or training purposes of medical, paramedical or technical personnel. As an important characteristic, it allows the technical repair and maintenance personnel to get a clear view of how the defibrillator is operating.
Palabras claves— Análisis, cardioversión, desfibrilador, eventos, registrador.

13:45 to 14:45, AUDITORIUM, PLENARY LECTURES, Chairman: Monica Huerta

Measurement Frontiers in Metabolism, Dr. Miguel Cadena, Mexico,

15:00 to 16:30 TECHNICAL SESSION

ROOM 1: TECHNICAL SESSION ELE, Chairman: Ana Maria Ferré; Fernando Morales

155 Paletas Pediátricas y de Adultos para Desfibrilación: una Comparación

A.E. Portela[1], J. Folgueras[1], O. Colorado[1], A. Milanés[1], M. Gómez[1], C. Sin-Chesa[2], R.L. Romero[2], J. Castro[2] y J.I. Martínez[2]

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Abstract—Transthoracic impedance influences the intensity of the discharge used for the external defibrillation of a patient. In this paper, the influence of gel and paddles used for the defibrillation or cardioversion of children is analyzed.
Results show that average measured values of transthoracic impedance in children, using pediatric paddles, are twice as high as those measured when using adult paddles, for both paddles placement positions AA ─ Anterior Apical─ [126 Ω vs 66 Ω; $p < 0{,}001$] and AP ─Anterior Posterior─ [120 Ω vs 60 Ω; $p < 0{,}001$], while the application of conductive gel to each paddle also influences the measured value by a factor of two. The influence of the gel on the measured impedance value increases with the electrode area, this fact is well expressed by the percent of change registered by the mean of the sample [33,1% and 9,9%] using gel or not, while using adult electrodes; referred to [20,7% and 5,1%] using gel or not for the case of pediatric paddles.
It is concluded that it is possible to decrease the impedance in pediatric patients significantly, by the proper use of adults paddle combined with gel (in any of the two positions). This reduction [248±100Ω vs 66±18 Ω; $p<0.018$] could increase almost four times the current applied to the thorax, for anyone of the two most common positions.
Palabras claves: desfibrilación, electrodos, impedancia transtorácica, pacientes pediátricos.

229 A Faísca Eletrocirúrgica como causa da Eletroestimulação e da Queimadura DC

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Abstract—The Electrosurgery is the technique that with the help of high voltages at high frequencies promote incision (cut) and/or hemostasis (coagulation) during surgeries. Although it has more than a century of history, many of its

aspects do not have an adequate scientific explanation. For instance, undesirable electrostimulation and DC burns that eventually occurs during surgery do not have a proper explanation, so that it is difficult to minimize theses effects. In this paper it is demonstrated that whenever an electrosurgical spark is generated between the active electrode and the biological tissue a DC voltage (as higher as 180 V) is formed on the output circuit, which may explain electrostimulation and DC burns. Experimental results are also provided.
Palavras chaves— Eletrocirurgia, Faísca, Descarga Elétrica, Eletroestimulação, Queimadura.

223 Incerteza De Medição Do Manômetro Usado Em Esfigmomanômetros

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Abstract— There is a growing interest on the measurement uncertainty determination for the conformity evaluation and quality assurance, mainly in the enviroment, safety and health sectors. In these areas the measurement result is considered critical since they deal directly with human beings. For the blood pressure measurement, according to studies accomplished in Australia, England and Brazil, a great concern is observed with the reliability of the results obtained by aneroid sphygmomanometers. In these studies, errors of up to 4,4 kPa (33 mmHg) were detected in the appraised sphygmomanometers, against the maximum value of 0,5 kPa (4 mmHg) standardized by OIML recommendation (R-16-1:2002). These errors result in a reduction of the sensitivity of hypertension diagnosis, with normal blood pressure patients being classified as hypertensive and vice versa. According to R-16, the evaluation of the reliability of these sphygmomanometers for medical diagnosis is obtained through the error measurement, and the uncertainty measurement is not required.
With the objective of contributing with an additional parameter to ensure metrological reliability of aneroid sphygmomanometers, it was developed a model for determination of the measurement uncertainty of the manometer used in these instruments. Based on the developed model, 15 aneroid sphygmomanometers were analyzed and the uncertainty of measurement of their manometers was determined. It was observed that, even when the error was within the allowed value of 0,5 kPa (4 mmHg), depending on the measurement uncertainty this limit could be exceeded, what can lead to incorrect clinical diagnosis.
Keywords— uncertainty, measurement, metrology, sphygmomanometer, biometrology

261 Estimación De La Incertidumbre En La Calibración De Equipos Electromédicos

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Abstract: The metrology laboratory of electrical variables in your electromedical metrology area, with base in a project approved by COLCIENCIAS, government entity directed to create favorable conditions for the national generation of scientific and technological knowledge, has designed the procedures of calibration/test for electro-medical equipment, in the areas of: Electric security, electrocardiography, fetal monitoring, pulsioximetría-SpO2, respiration, electro-scalpels, defibrillators/pacemakers, arterial pressure, infusion bombs, ultrasounds, incubators, rays X, among others. In the content of this article is presented the general procedure designed by the group that develops the project, to carry out the calculation of mensuration uncertainty in the processes of calibration of electromedical equipment.
K*eywords*: *Electromedical metrology*, *electrical safety, incertainty, trazability, calibration.*

293 Para auxiliar o treinamento de uso de equipamento eletromédico: um computador

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Abstract— This article presents a methodology for the development in the training system, to be applied in clinical staff, for the use the multiparametric monitor. This training system is personalized to the user's characteristic in the acquisition of information in the medical area, through the use in several ways of presentation of the content (text, flowcharts, drawings and animation), that would be based in the user's cognitive profile (their Multiple Intelligences (MI)). For the accomplishment of such adaptation the methodology proposes the use of MLP (Multi-Layer Perceptron)

and IAC (Interaction Activation and Competition) neural network. In an initial evaluation with some user, the adaptation system demonstrated to be more stimulating in the knowledge acquisition than a no adaptation system.
Key words— Training, medical equipment, clinical engineering

303 Avances Tecnológicos en Apoyo al Tratamiento de la Ictericia Neonatal

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Abstract At the total of the newborns births to 40 to 60% they present levels of hyperbilirrubinemia and in the premature ones this percentage even rises 80%, this state can appear in the first 24 hours of having been born and it is usually due to diverse such problems as sanguine incompatibility, immaturity of its organs, intolerance to the maternal milk. At the present time diverse therapies exist for the normalization of the levels of serum bilirrubin, among them the phototherapy is known like one of those most effective, and for their character non invasive its considered their high-priority one for the handling of these patients, in this work the new existent technologies are presented for the treatment of this pathology that can leave serious consequences in the patients if its not controlled and eliminated on time. Blue light lamp with different elements: fluorescents tube, optic fiber with halogen bulb and blue led with high efficiency are the most used technology actually.
Keywords: hyperbilirrubinemia, phototherapy, blue light, phototherapy lamp, blue light leds.

ROOM 2: TECHNICAL SESSION IMA 4, Chairman: Joaquin Azpiroz; Antonio Bosnjak

35 Real Time Cardiac SPECT and 2D Ultrasound Image Registration

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Abstract— In this paper we present a technique for fully automatic, real-time cardiac SPECT (Single Photon Emitting Computed Tomography) and 2D ultrasound image registration. Our registration algorithm allows a physician to perform an ultrasound exam after a series of ECG-gated SPECT images has been acquired and see in real time the registration of both modalities. A specific ECG segmentation algorithm has been developed in order to associate each US image acquired on the fly with the appropriate SPECT volume representing a heart-beat instant.
Keywords— Image registration, real-time, SPECT, ultrasound, ECG synchronization.

157 Comparison between Two Methods for Automatic Quantification of Myocardial Perfusion Single Photon Emission Computed Tomography

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Abstract - This work presents a comparison between automatic quantification of myocardial perfusion SPECT (MPS) using two approaches: Simplified Normal Limits (SNL) and Individual Stress-Rest Change (ISRC). The SNL method uses a quantifying scheme in which normal limits are derived without visual scoring of abnormal scans or optimization of regional thresholds. The ISRC is a technique based on image coregistration of stress and rest images and pixel-by-pixel estimation of differences without using reference databases. We implemented both techniques and compared the MPS quantification showing that the ISRC besides giving always better results than SNL method had the advantage of performing the MPS quantification without use of reference databases.
Keywords - quantification, perfusion, SPECT, ischemia

199 Quantitative Tool Design using Tomographic Brain Image Processing from SPECT to support Psychiatric Diagnosis

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Pontificia Universidad Católica del Perú-Grupo E-BIO, 3Pi Gestión Tecnológica Perú, Pontificia Universidad Católica del Perú-Grupo E-BIO

Abstract— Considering the advance in the knowledge of the psychiatric disease's physiopathology and its treatment, it becomes necessary the use of image processing algorithms in order to help the psychiatric diagnosis and to monitor the therapy. It is not but until the appearance of neuroimaging equipment that this branch of medicine "counts on" a support in engineering, emphasizing the technique of functional brain imaging in the neurological and psychiatric analysis. The purpose of this investigation is to create a tool composed by an image processing system, a dynamic information database and algorithms of comparative analysis, based on SPECT technology. The use of this tool allows to identify and compare common patterns and to obtain incidence levels in a quantitative form.
Keywords: SPECT

267 Time and frequency-domain characterization of the left ventricle torsion pattern of professional soccer players using speckle-tracking echocardiography

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Abstract— The left ventricle (LV) torsion is an important feature of the ventricle's biomechanics. Using speckle-tracking echography (STE) the assessment of LV torsion dynamics would be more available in clinical and research cardiology Particular features of the LV torsion have been described during exercise and in some sportsmen, but up to now the LV torsion dynamics has not been studied in soccer players. The aims were to characterize the LV systolic and diastolic torsion dynamic in professional soccer players using STE, and to analyze the main differences in torsion dynamics between soccer players and age-matched non-trained individuals. To this end the LV apical and basal rotation were quantified, and the systolic and diastolic torsion dynamic was characterized using a time and frequency-domain approach. The STE allowed characterizing the LV torsion level in both groups. The LV torsion level was lesser in soccer players than in non-trained individuals. Soccer players showed lesser amplitudes in the low frequency components of the LV torsion Fourier spectrum.
Key-words— Left ventricular torsion, speckle-tracking echocardiography, soccer players

34 Determinação automática da ansiedade por detecção computadorizada de sinais biológicos

M. L. Silva, H. N. Martucci, R. M. de Santi, A. F. Frère

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Abstract— This article refers to automatic determination of the anxiety of chemical dependents for detection of biological sensors as help tool in the treatment of the chemical dependence, enabling to the patient the perception in real time, about your emotional state in front of the situation of daily life and practice, could this way, foresee forms of working with their limits and assisting him in the maintenance of your abstinence. The obtained results point the help possibility to the chemical dependent in the comprehension of his difficulties and internal conflicts, providing for restructuring of their behaviors.
Palavras chaves— anxiety, biological signals and chemical dependence

291 Recortado E Inspección De Volúmenes De Imágenes Médicas Utilizando La Prueba De Plantilla De Opengl

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Abstract— Inspection and visualization of sections extracted from volume data help to improve the exploration of the information contained in the volumes, and to enhance the comprehension of it. Appearing of Graphics Process Units (GPUs) and specialized programming libraries has permitted the development of new techniques and algorithms for

interactive extraction and clipping of volumetric information regions. In this work, we present the implementation of an algorithm that uses the stencil test provided by the OpenGL API for clipping a volume of medical images, starting from a surface represented by a polygonal mesh. This surface is used as a mold for defining the shape of a region which will be extracted or clipped from the volume. This work is oriented to develop programming tools that could be applied in volumetric rendering, segmentation, exploration, manipulation and sculpting processes.
Palabras claves— Recortado de volúmenes, Visualización volumétrica, Volumen de interés, Imágenes médicas

ROOM 3: TECHNICAL SESSION INS 4, Chairman: Jose Folgueras; Renato Garcia

41 Automated Keratometer for Slit Lamps

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Abstract - An automatic keratometer module for slit lamp was developed and provides automatic measurements of the radii of the corneal curvature. The system projects 72 light spots displayed in a precise circle at the examined cornea. The displacement and deformation of the reflected image of these light spots are analyzed providing the keratometry. Measurements in the range of 26,8D – 75D can be obtained and a self-calibration system has been specially designed in order to keep the system calibrated. Infrared leds indicate automatically which eye is being examined.
Volunteer patients (492) have been submitted to the system and the results show that our system has a high correlation factor with the commercially available manual keratometers and the keratometry measurements from a topographer.
Our developed system is 95% in agreement with the corneal topographer (Humphrey - Atlas 995 CZM) and the manual keratometer (Topcon OM-4).
The system's nominal precision is 0,05mm for the radii of curvature and 1° for the associated axis.
Keywords: cornea, astigmatism, keratometry, slit lamp

48 Estudo de Sensores no Desenvolvimento de um Dispositivo Termográfico

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Abstract— The aim of this study is to demonstrate tests and calibrations of temperature sensors. An evaluation is made to identify which sensor is most adequate for development of a mesh of sensors. The mesh will generate a low cost thermografic images. The NTC 5 kΩ was better in the tests providing an uncertainty of 0.042 ºC.
Keywords— Temperature sensors, thermistor, thermography.

57 Simulação de um Transdutor Piezoelétrico Composto por Anéis Concêntricos com Vários Tipos de Camada de Retaguarda

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Abstract: This paper describes PZFlex simulation of high frequency (30MHz) 3mm radius annular array piezoelectric transducer. Kerf designs with various backing layers were simulated with PZFlex to compare the beam profile of annular array transducers configured with equal areas 5, 6, 7, 8 and 10 rings. In our simulations the transducer with 6 rings presented higher values for pressure peak than the others transducers configurations, and the transducer with 7 rings presented lower values. For all configurations simulated, those of transducers with backing layers made of epoxy presented the highest pressure peak values and transducers whose backing layer were made of tungsten showed weaker values of pressure peak.
Palavras-chave: high-frequency, ultrasound, transducer, annular array, backing layer.

61 Medição não-invasiva de ondas de pulso arterial utilizando transdutor de pressão MIG

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Abstract — This manuscript presents a high sensitivity pressure transducer, developed at the Biometrology Laboratory of PUC-Rio for biomedical applications and examined in this article for the registration of arterial pulse waves. Such transducer is based on the Giant Magnetoimpedance (GMI) phenomenon and is an evolution of an unit previously developed at the same Laboratory. Knowing the main characteristics of the the GMI strips used as sensors, the configuration which should yield the highest possible sensitivity has been implemented and tested. The upgrade introduced to the original project has increased its sensitivity and enabled us to record not just the carotid arterial pulse wave (as the previous transducer configuration did), but also the radial and brachial arterial pulse.
Keywords— Metrology, biometrology, giant magnetoimpedance, pressure transducer, Arterial pulse wave.

67 Circuito Biotelemétrico para Detecção do Complexo QRS em Câmaras Hiperbáricas

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Abstract - This paper presents a low power and low voltage biotelemetric circuit suitable for evaluation of the heart beat-rate of pacients which are under hyperbaric oxigenation treatment. The developed circuit is described in details, and experimental results provided.
Keywords— Hyperbaric Chambers, low power ECG circuit, biotelemetry acquisition.

95 Sensor de força passivo baseado em indutância mútua para aplicações em biotelemetria

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Abstract— Several kinds of sensors for oral applications (including pH, temperature and oclusal force sensors) have been reported in the literature. Unfortunately, most of them use cables to connect the sensor to the external processing circuits, so that patient mobility and comfort are restricted. This paper describes a novel oclusal force sensor based on an inductive transducer and a blocking oscillator. The sensor is passive, being powered from outside using an inductive link. The developed sensor features are presented and experimental results provided.
Keywords— Biotelemetry, Force Sensor, Displacement Sensor, Inductive Sensor, Passive Circuit.

ROOM 4: TECHNICAL SESSION CLI 2, Chairman: Antonio Cruz; Saide Calil

110 La Ingeniería Biomédica en Perú: retrospectiva y situación actual

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Abstract— The adapted formation in Biomedical Engineering that distribute the universities, have a great importance for the contributions that the Biomedical Engineering's specialists can do in the development and management of technologies applied to healthcare, in the different areas of application of the same one. Also they can contribute to improve the life quality of the society, that is the reason for which they need a disciplined formation in their careers. The present work describes in chronological order, the activities related to Biomedical Engineering in Peru up to coming to the actual situation. At the same time it shows information about the peruvian universities, as the most important actors in the human resources' formation and generation in the academic scope, around the undergraduate and postgraduate levels that some peruvian universities teach. In addition, this work compares the peruvian actual situation with some references of foreign universities that have careers and specialist courses in Biomedical Engineering. Finally, it presents some alternatives of solution that are applied into the Peruvian's Technologic University at this time, which will allow to lay the foundations for the adapted development of Biomedical Engineering in Peru in a short time and to revert the situation described before.

Key words—University, University, Biomedical Engineering, Technologies applied the Health, Planification, Solution Alternatives.

136 Soluciones de Ingeniería Clínica adaptadas a las Políticas Públicas de Salud

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Abstract— This paper proposes a methodology resulting from several studies based in medical technology management and Health Public Politics for the Health Ministry and Social Developments by the Simón Bolívar University, Venezuela. This research is based on the premise of an extensive analysis and a Quality Control of Health Institutions studying their politics, technology and procedures looking for an improvement in all different areas of Health Institutions. In the visits made to different Public Hospitals, several problems were detected at infrastructure, at the medical industry facilities and in their medical equipment. Therefore, we have elaborated a schematic methodology that helps to promote the development of efficient medical procedures and the improvement of the deficient areas of the Institutions. Public Health Institutions problems should be focused in a multifactorial perspective over all areas of the Institutions but it's known that this is an slow and complex process construction. Recommendations aimed to improve the basic institutional procedures, such as planning, budgeting, information and evaluation have been made.

Palabras claves— Health Institutions, Improvement, technology, quality control, institutional performance.

167 Gerenciamento de tecnologia para saúde: classificação de equipamentos médicohospitalares

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Abstract— This paper presents a method for ranking and classification of medical equipment according to three maintenance indicators: NC_C (number of corrective maintenance per year); TM_C (total maintenance time per year, divided by the median of the maintenance time for the specific maintenance group) and $\$M_C$ (maintenance cost, expressed as the total cost divided by 6% of the acquisition cost). A simple database containing equipment details and maintenance data, including the indicators and other relevant information, must be created. Equipment of the same type are separated in 3 age ranges (0-4, 5-9 and >10 years). In each range, mean ± SEM of NC_C, TM_C and $\$M_C$ are calculated to establish 3 classes (A , B and C). A is compatible with newer equipment and considered better than the other classes. These classes are then considered as standards to classify each equipment. A given equipment is ranked A if it is A for all indicators, C if it is ranked C for at least one indicator, and otherwise it is B. One-way analysis of variance revealed that indicators vary with age (in most cases, increase), for different equipment types (ventilator, physiologic monitor and infusion pump). As an application, the 75 ventilators from the medical area of the Universidade Estadual de Campinas (UNICAMP) were analyzed. Data were obtained from the database of the Centro de Engenharia Biomédica at UNICAMP. Equipment ranked as C had an average age of 10 years. About 42% of the equipments ranked B were above 9 years old. However, one of the ventilators ranked C was only 3 years old. It was concluded that the proposed indicators and classification are helpful to detect unexpected behavior and can be applied to both management and data mining concerning the performance of the medical equipment.

Keywords— Clinical Engineering, equipment maintenance, medical equipment, maintenance indicators, ranking.

236 Comparação das curvas sensitométricas dos anos: 2000, 2002 e 2004 de instituições de saúde do Estado de São Paulo.

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Abstract- Quality assurance of the radiographic images concerning to film processing and dark room installation conditions is essential for the health professionals in order to get a good image and consequently give a good diagnostic. The "Portaria 453" from June/1998 from the act of Brazilian Sanitary - Inspection Secretary of the Health

Department [1] determines that every radiology institution must have a Quality Assurance Program, which includes the quality assurance of the film processing and dark room installation conditions. In these work 507 technical reports of health institutions of the São Paulo State in Brazil, complying the total of 600 sensitometry curves from radiographic films, obtained from the SAPRA Assessoria data, were analyzed with the purpose of showing a comparative study between the real conditions of the health institutions and conditions required by the Sanitary - Inspection Secretary of the Health Department through, first of all, the Resolution SS.625 from 1994 of the Sanitary Inspection Center of the São Paulo State, and nowadays the "Portaria 453" from June/1998 of Brazil. In this study was found a sensitive improvement in the last few years, particularly 2000, 2002 e 2004, in most of the analyzed institutions concerning to film processing conditions, implantation of automatic processing and the processing parameters as H&D curves due to implantation of the Resolution SS.625 – São Paulo State and the "Portaria 453" - Brazil.

Keywords — quality control, radiographic film, film processor, sensitometric method.

305 Estrategia Para Adquisición De Tecnología Médica En La Provincia De Buenos Aires En La Crisis Financiera De 2002.

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Abstract: The Ministry of Health of Buenos Aires Province has 77 hospitals distributed in its area most of them being equiped with imported medical technology. This equipment had at that time, an average age of 8 years and owing to the great demand, an extremely intense use. Under these conditions, with budget devalued in relation to international prices and with an increasing demand, due to the current economical and social situation, a program including the purchase of medical technology in order to renovate and widen the one already in use was carried out. The selection of the technology was made according to the sanitary policies established for the regional health webs. This program took place between the years 2004 and 2007, with the intervention of Clinical Engineers who elaborated the technical specifications and gave the award, something never done before. The main aim of this piece of work is to demonstrate that with the intervention of Clinical Engineering in the processes of purchasing medical technology, the obtained results are highly satisfactory not only in quality but also as regards investments, that is to say, it is possible to develop an efficient process.

352 Ingeniería de Rehabilitación - Los primeros cinco años de la experiencia de México

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Abstract— People with disabilities in Mexico and Latin America have limited access to assistive technology. Assistive devices provide independence and access to educational, vocational, and social activities. This paper presents the Mexican experience establishing a rehabilitation engineering and technology center. This article describes some of the projects that have been developed at the Center and extends an invitation to join in the provision of assistive devices for people with disabilities.

Palabras claves— Ingeniería de Rehabilitación, ayudas técnicas.

ROOM 5: TECHNICAL SESSION APP 2, Chairman: Ricardo Bravo; Alexander Somarribas

193 Ambiente Virtual Para Verificar O Nível De Leitura De Crianças Com Limitações Motoras

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Abstract— The children with motor limitations are generally frustrated when, due to those limitations, their school performances are below their class colleagues. In this work it was developed a virtual environment with the goal of evaluating some initial knowledge of reading without generating stress and anxiety. This environment presents games tests with two phases implemented in Flash. The first phase evaluates if the children get to distinguish between letters and other expression forms (numbers, symbols and scribbles), and in the second phase it is noticed that the words can

be written in several ways without modifying the sense, such as capital, lower, hand letter and printed letters. For having been implemented in Flash, the executable file of the virtual environment was small, allowing that it is used in any computer. The game test was analyzed by a linguist and also a psychologist. The linguist concluded that the virtual environment can evaluate these capacities as efficiently as the conventional tests. The psychologist considered that the developed method should not provoke stress and anxiety because the children don't know that are being tested.
Key words — virtual environment, motor limitation, computerized evaluation.

196 Detecting the Mid-latency Auditory Evoked Potential during Stimulation at Several Different Sound Pressure Levels

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Abstract— Current approaches for auditory screening are usually based on the Brainstem Auditory Evoked Potentials or on the Otoacoustic Emissions, and hence are not able to detect pathologies that affect higher auditory centers. Therefore, the Middle Latency Auditory Evoked Potential (MLAEP) was investigated as a neurophysiologic acoustic threshold measure by using the "Evoked Potential Detector" (*EPD*) as an Objective Response Detection technique. The EEG was collected from ten adults during monaural click stimulation (left ear, using contralateral masking noise) with different sound pressure levels. Based on the statistical distribution of *EPD* under the null hypothesis (absence of response), the use of the critical value considering EEG as a colored noise and fitting the shape parameters for a Beta distribution resulted in an objective detection of MLAEP with a better specificity and a similar sensitivity than considering EEG as a white noise. Full detection over all the casuistry occurred for stimulation levels as low as those found in literature using expert-based analysis, particularly for the derivation contralateral to the stimulation. This finding suggests the use of *EPD* for detecting MLAEP response as an auxiliary tool for determining objectively the neurophysiologic acoustical threshold level.
Key-words— MLAEP, Objective Response Detection, Psycho-acoustic Threshold.

219 Modelo de Formación Integral Orientado a Incentivar la Investigación y Gestión en Pregrado de Ingeniería Biomédica. Experiencias de GUIA Biomédica

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Abstract— En este artículo, los autores exponen un modelo de grupo estudiantil, implementado en la Universidad Autónoma de Occidente Cali (UAO), el cual ha velado por la formación integral de cada uno de sus miembros y de la comunidad biomédica en general a través de la autogestión, el liderazgo estudiantil y la investigación, realizando actividades que ayuden al estudiante a fortalecer competencias que no son tan explicitas en la academia y brindando un espacio extracurricular para complementar su formación.
Palabras claves— Gestión, Grupos estudiantiles, Formación Integral, Liderazgo estudiantil.

230 Construção de Exercício para Verificação do Aprendizado Utilizando Redes Neurais Artificiais - Fase II Medula Espinhal

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Abstract— The disciplines that need human body parts to teach their programs have great problems dealing with obtaining and maintaining those organs. To avoid these difficulties this paper suggests a prototype constructed with Artificial Intelligence, through Artificial Neural Nets, used to develop a system with which the student can interact during his learning. The program has computer treated real images to substitute body parts and the user can point, given signals and symptoms, which areas of the organs are their cause. The constructed prototype is directed to the spinal cord and an Artificial Neural Net is developed with patterns obtained in normal Neuroanatomy books with an expert help. The user is presented, at each interaction, to a random set of signals and symptoms and then he is urged to indicate in a displayed image, which parts of the organ could be damaged. Tests with medicine students using this

dynamically conducted software had good results, showing that adequate systems could replace the usual methods or be used in cooperation with them, diminishing the related problems.
Keywords— Artificial Intelligence, Artificial Neural Networks, Cervical Spinal Cord, Long-distance learning, Neuroanatomy.

276 Sistema Hipermídia com Interface Adaptativa usando Redes Neurais Artificiais MLP e IAC

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Abstract— This article presents an interface adaptation methodology to hypermedia systems based on the methodology developed by Barbosa [1], where the site development with breast cancer contents is used to refine the students' knowledge of the healthy area of UFSC who receive in their classroom. While this system was been developed it was defined the adaptation will only occur in the interface shown to the user with the use of different medias during the presentation of the contents which are introduced according to the individual characteristics of the students based on the Multiple Intelligence Theory (MI).
Keywords— Hypermedia System, adaptive interface, breast cancer, Multiple Intelligence, artificial neural net.

281 Base De Datos Y Herramientas Para El Estudio De Las Señales Usadas En El Método Oscilométrico De Medir La Presión

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Abstract— In this paper, we present the development of a data base of signals used in the oscillometric method of blood pressure measurement in a human arm, the libraries with the interface functionalities to the unify access for the storage data and with the processing of that, besides we show a software implemented using these libraries. The data base include a wide variety of signals records taken to a simulator, in experimental environment and humans records taken in life real environment like hospitals, works and the home. The libraries permit the access to all data base information, such as the performance of digital processing techniques above that. This was programmed using the object oriented programming paradigm, which permit the reusability and extensibility of that. The software is a representative example of the libraries use and a useful tool to the development of investigations about these signals.
Key words— oscillmetric, pressure, libraries, signals, digital.

POSTER SESSION: SIG

88 Sistema semi-automático para el pesquisaje auditivo en recién nacidos sobre el electroaudiometro Audix V.

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Abstract— A new hearing screening semi-automatic system based on Multiple Auditory Steady-State Responses (MSSR) technique is presented here. It was implemented using the integrated development environment Delphi 7, and the specialized hardware AUDIX V (Neuronic S.A., Havana). For the MSSR testing we use a pre-set screening protocol and a semi-automatic algorithm. It was designed to be user-friendly and easy to operate for non-professionals, providing objective PASS/FAIL results that require no interpretation. This system can be a valid alternative for early detection of hearing impairments, and propose a methodology for a further development of fully automated screening equipment.
Palabras claves— Hearing loss, Hearing screening, Auditory Steady State Response, Evoked Potentials.

100 Aportes y alcances de las técnicas de procesamiento, clasificación y descomposición de señales electromiográficas

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Abstract— Electromyographic (EMGs) signals can be used in several clinical and biomedical applications, such as instruments development and EMG acquisition systems with modern man-machine interfaces. For new EMGs signals interpretations and application developments, data acquisition systems required advanced and precise signal processing, decomposition and classification methods that allow improvement of the understanding and knowledge of the EMGs signal behaviour. Generally signal analysis are carried out by Fourier, Gabor and Wavelet analysis, beside artificial intelligence techniques. The purpose of this article is to show how traditional techniques have been used in the processing, decomposition and classification of the EMGs signals, along with some results obtained by using wavelet analysis to study their dynamical behaviour (multi-resolution analysis). This results as a contribution can be applied to different types biomedical signals.
Palabras claves—Señales biomédicas, Electromiografía, Transformada wavelet.

134 Filtrado mediante SVD de la onda M del electromiograma de músculos estimulados eléctricamente

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Abstract— The goal of this preliminary study was to investigate the feasibility of using singular value decomposition to eliminate the M-wave from the surface electromyogram (EMG) of an electrically stimulated paretic muscle in order to extract the volitional response. An SVD-based algorithm combining the subspaces method and a subsequent filtering is presented. It was evaluated with EMG signals registered from surface electrically stimulated muscles with simulated paresis and its performance was compared with a conventional fixed comb filter. A power reduction index was calculated. The filtering strategy proposed showed a good performance in static conditions where there were no traces of the M-wave. In dynamic conditions, the SVD-based algorithm was robust but with some remaining M-wave traces. It would be as a consequence of modifications in the data matrix and, therefore, in the subspaces generator columns and the singular values. In general, the fixed filter was very sensitive to input signal disturbances. In all of these conditions there was a greater power reduction for the SVD-based filter than for the fixed filter. The following step would be to evaluate the algorithm with subjects who have muscle paresis and to test it in non-controlled environments.
Palabras claves— electromiograma, estimulación eléctrica funcional, onda M, descomposición en valores singulares.

145 Método estadístico-geométrico para medir la variabilidad de la frecuencia cardíaca

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Abstract— This paper presents a new statistical-geometric method to quantify the heart rate variability (HRV). The proposed method is intended to be robust in front to artefacts embedded in RR time series. It is performed in two steps: (a) automatic elimination of artefacts using a geometric method, based on the triangles areas, and (b) computation of the RR-series standard deviation. We compare the behaviour of two new indexes, derived from the proposed method, with other two robust indexes in front to artefacts, described in the literature. The obtained results show that the computations of statistical-geometric indexes preserve more diagnostic information than the others. The statistical-geometric method is very easy to implement and it is very familiar for the medical professionals.
Palabras claves— Artefactos, HRV, VFC, SDNN, SDSD.

146 Determinación de la posición del sonido S1 por promediado de puntos en la energía del fonocardiograma

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Abstract— In this paper, a method to determine the position of the heart sound S1 in the PCG signal is presented, in order to measure heart rate variability using PCG and ECG signals. The proposed method computes the position of the heart sound S1 in each beat by the average of three points on the PCG energy signal. The method was evaluated using two different approaches that were applied to the PCG records form a group of healthy volunteers. The results were excellent in comparison with other methods reported in literature.
Palabras claves— PCG, ECG, sonidos cardíacos, S1, HRV.

158 Dimension Analysis in Atrial Fibrillation's Spontaneous Termination

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Abstract— This work deals with the useful of geometric properties of the space phase representations, to characterize spontaneous termination of atrial fibrillation rhythms. The ECG signals are mapped into a reconstructed phase space using the method of time delays. In this space, the signals make trajectories associated to the dynamical behavior of cardiac rhythms. We estimate the box-counting (D_0) and information (D_1) dimensions for the learning set of an atrial fibrillation termination database. Main result indicates a topological dimension that increases closer to the extinction of atrial fibrillation rhythm.
Palabras claves— Atrial fibrillation, box-counting dimension, information dimension.

177 Caracterización de Espectrogramas Usando Análisis de Componentes Principales y Medidas de Energía para Detección de Soplos Cardíacos

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Abstract— A methodology based on spectral analysis of digitized auscultation signals is presented. Those signals are known as phonocardiographic signals (PCG), oriented to detection of cardiac murmurs originated by valvular pathologies. Initially, a filtration system based on the wavelet transform is developed to reduce the disturbances that usually appear in the acquisition stage. A between-beats segmentation algorithm is developed which uses information of the ECG signal previously acquired in a synchronous way to hook the beginning of the *QRS* complex with the beginning of the *S1* sound of the PCG signal. Intra-beat segmentation is proposed for detecting *S1*, *S2*, systole and diastole based on the relationship analysis of energy and threshold. Features derived from the spectral analysis are extracted using Principal Component Analysis applied to the spectrograms and energy measures over the segments were the murmurs are located. Feature effectiveness is evaluated by a *k*-NN type classification model for separating the classes: normal and murmur. The database of PCG records used belongs to the National University of Colombia; 164 records of this labelled database were used: 81 records labelled "normal" and 83 records labelled "murmur". Finally, with the help of specialist doctors, 180 representative normal beats and 180 representative beats with evidence of cardiac murmur were chosen. Classification precision, sensitivity and specificity results were obtained. The best result of classification precision was 95,6% with sensitivity and specificity values equals to 96,1% and 95%, respectively.
Palabras clave— Análisis espectral, caracterización, detección de patologías, soplos cardíacos y fonocardiografía.

179 Comparación Mediante el Espectro Multifractal de dos Señales Cardíacas

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Abstract— Frequently we must to analyze biomedical signals with irregular characteristics or noised but having useful information or underlying structures. Multi-fractal analysis is a powerful method to study complex dynamics and irregular phenomena. It provides the singular spectrum, giving us useful parameters for this interpretation.
In this sense, this spectrum can be considered an appropriate estimator of the physiologic system adaptability and it led us to conclude that complexity is correlated with the self-regulation.
There are many alternatives to estimate the spectrum. In this work we propose the Multi-fractal Detrended Analysis (MFDFA) for these purposes. It is applied to cardiac signals in order to explore the capacity and performance of the methodology in this field.
Palabras claves— ECG, HRV, espectro multifractal, regularidad Hölder.

197 Sistema para el monitoreo continuo de ECG: Cardioestudio

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Abstract— This work presents the main features of the Cardioestudio and the obtained results. The System is a windows application that can continuously monitor rest ECG signal from a patient analyzing possible variations of the ST segment and HR changes. It also allows to perform some other studies on the obtained signal like QT segment analysis, RR variability and the evaluation of myocardial infarct size area. It also has a database for storing the patient personal data, signal and the results of the different studies with advanced search capabilities. The ECG is obtained from an external amplifier, filtered and stored. The QRS detection and classification in normal and non-normal complex is performed in real time using a spatial velocity function. The QRS onset, offset and the end of T wave is performed separately for each lead. The system can also be integrated with existing Telemedicine projects.
Palabras claves— electrocardiografía, dispersion del QT, segmento ST, variabilidad del RR, puntuación de Selvester.

217 Promediación coherente mejorada mediante transformada wavelet de potenciales evocados auditivos de tronco cerebral

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Abstract—The brainstem auditory evoked potentials (BAEP) are immersed in physiological and non physiological activity. To estimate these potentials the coherent average is the most utilized and accepted technique. Nevertheless, it supposes that the evoked potentials signal is stable in each epoch, which is not certain in most cases and consequently the signal is distorted. Besides, the time required to obtain a reliable estimation of the signal and its reply is very long. For these reasons, it becomes necessary to find different alternatives to estimate the BAEP signal. In this work, a discrete wavelet transform is applied to improve the signal-to-noise ratio of the BAEP, looking for a considerable reduction in the estimation time required with the classical coherent average method. Through multiresolution analysis, the optimum coefficient's distibution for an accurate BAEP reconstruction was determined. Finally, a denoising process on averages of 200, 400, 600, 800 and 1000 epochs was implemented to determine the minimum number of epochs required for a reliable signal estimation. The results show that 800 epochs are enough to obtain equivalent results to the average of 2000 epochs.
Palabras claves Potenciales evocados, denoising, wavelets, promediación coherente.

224 Nova Metodologia para Isolar Sons Adventícios em Sons Pulmonares

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Abstract— This paper describes an investigation on techniques for analyses of lung sounds using wavelet decomposition. The proposed methodology, called filtering by selective spectral analysis, reduces the amplitude of the

heart sounds and the sounds generated by the airflow in the respiratory system, increasing the audibility of the adventitious sounds in digitally recorded lung sounds. The lung sounds digitally recorded have its spectra segmented using wavelet 4th level of decomposition. So, a spectral analysis is computed on the approximation signal, looking for the detection of this signal's main spectral components. This spectral components are used to guide the construction of a digital filter, which is applied to the approximation signal with the goal of eliminating all the low-amplitude spectral components. After the filtering procedure the lung sound signal is recomposed, by wavelet recomposition technique, using the filtered approximation signal. The resulting signals show a reduction in the heart sound and in the normal airflow signals in lung sounds. Otherwise, the adventitious sounds magnitude remain unchanged when their spectral components are located outside the approximation 4 spectral band. When the adventitious sound's spectral components are located into the approximation's band it shows a little reduction in its magnitude level, when compared to the reduction of heart and airflow signals.

Palavras chaves — Sons Pulmonares, Análise Espectral, Transformada *Wavelet* Discreta, Filtragem Digital.

255 Sistema de Identificação Automática de Complexos K e Fusos do Sono em Sinais de Eletroencefalograma

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Abstract - This work introduces a new approach for K complexes and sleep spindles detection, in order to assist the automatization of sleep staging in humans being. The methodology proposed here deals with the detection problem using canonical variate analysis (CVA). Besides it makes use of signal processing techniques, such as Fourier and wavelet transforms during the extraction of measures that compose the feature vector of EEG signals patterns, which are the input of the CVA. In order to evaluate the proposed methodology one calculates the sensibility, specifity, positive predictive value and negative predictive value of the recognizing scheme. The proposed methodology presented 66.79% and 98.33%, for sensibility and specificity, respectively.

Keywords - wavelet transform, canonical variate analysis, K-complexes, sleep spindles, EEG.

257 Diseño De Un Sistema Para Detección De Patologias Retinianas Mediante Técnicas De Electrorretinografía Multifocal

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Abstract— This Article shows the design of a system for detection of retinal diseases using stimulation and multiansuwer interpretation techniques, as the multifocal Electroretinogram (mfERG). Here is considered the design of a new computerized ophthalmologic instrument, for the evaluation of the electrophysiological answer of the retina that will make possible the development of future investigations that can conduct to the functional diagnosis of the visual field.

Palabras claves— mfERG, Kernel 1er orden, Kernel 2do orden, Kernel 3er orden, m-secuencia binaria, periodo base, flash.

270 Adquisición y procesamiento de la señal Electrocardiográfica, basado en la extracción de potenciales intra-QRS e índices de variabilidad del intervalo QT

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Abstract – This paper reports on the design and implementation of a 12 lead high resolution electrocardiograph. The proposed equipment incorporates advanced digital techniques enabling the estimation of intra-QRS potentials. The analysis software should perform in real-time the averaging of QRS complexes as well as digital filtering for extracting the intra-QRS potentials. Additionally, the time-series corresponding to the RR intervals should be estimated and processed in the frequency and time domain. One of the contributions of this research will consist on the development of a robust technique for the estimation of QT intervals operating simultaneously on each of the recorded

leads. Analysis of QT time-series intervals could be performed using either Principal Component Analysis (PCA) or wavelets, aiming at deducing quantitative indexes of heart pathologies. The proposed system is intended as tool for the early detection of Chagas disease and their stratification. For attaining this goal a fusion stage would be incorporated. During this stage the software should provide a quantitative index based on several electrocardiographic (ECG) quantitative parameters estimated from the recorded leads.

Palabras claves — Electrocardiograma, potenciales intra-QRS, variabilidad del QT, detección del mal de Chagas.

275 Análise Escalográfica de ECG para Detecção de Episódios Isquêmicos

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Abstract— This work shows how scalograms can be used to find fiducial points in ECG signals and relate ECG waveforms to ischemic episodes. The scalograms were generated with Paul basis functions. With ECG signals from the European ST-T Database as test data, it was possible to demonstrate that temporal scalogram analysis has some advantages over conventional ECG analysis, especially for cardiac problems of difficult visualization in plain ECG signals.

Keywords— scalogram, ECG, ischemia.

282 Detección de Soplos Cardíacos usando Medidas Derivadas del Análisis Acústico en Señales Fonocardiográficas

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Abstract— The cardiac mechanical information can be inferred from the sounds generated by the heart beats, which can be analyzed by signals known as phonocardiograms (PCG). A methodology based on acoustic analysis of digitized PCG signals is presented, oriented to detection of cardiac murmurs originated by valvular pathologies. Initially, a filtration system based on the wavelet transform is developed to reduce the disturbances that usually appear in the acquisition stage, adjusted and validated according to the clinical requirements. A between-beats segmentation algorithm is developed which uses information of the ECG signal previously acquired in a synchronous way to hook the beginning of the QRS complex with the beginning of the S1 sound of the PCG signal. Intra-beat segmentation is proposed for detecting S1, S2, systole and diastole based on the relationship analysis of energy and threshold. Features derived from the acoustic analysis are extracted on the segments. Feature effectiveness is evaluated by a linear Bayesian type classification model for separating the classes: normal and murmur. The used database of phonocardiographic records belongs to the National University of Colombia, having 164 records as follows: 81 records labelled as "normal" and 83 labelled as "murmur". Finally, 360 representative beats were chosen by specialist, 180 normal and 180 with evidence of cardiac murmurs. Classification precision, sensitivity and specificity results are obtained. The best result of classification precision was 93,1% with sensitivity and specificity values equals to 93,3% and 92,8%, respectively, using Bayesian classifier and cross-validation procedure of 10 folds.

Palabras claves— Análisis acústico, detección de patologías, soplos cardíacos y fonocardiografía.

285 Sistema para el cómputo del Índice de Aumentación y del Intervalo de Tiempo entre picos sistólicos y diastólicos. ¿Es útil en el diagnóstico del síncope vasovagal ?

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Abstract— A friendly application to compute AI (augmentation index) and TI (Time Interval between systolic and diastolic peaks) series from continuous arterial pressure signals, is presented. To obtain these signals a radial tonometry monitor was used. The waveforms were digitized and processed to extract characteristic points. For each of these points, the corresponding magnitude and time of occurrence were recorded. These points are the DBP (diastolic blood pressure), the SBP (systolic blood pressure), the dicrotic notch and the diastolic peak. For this task a computer

algorithm to be used with the analog output of the pressure monitor was developed. An early algorithm, upgraded to include the detection of the dicrotic notch and the diastolic
peak was used. Usually IA and TI are used as early markers of incremented arterial stiffness. Arterial pressures are synchronized averaged to obtain only one beat, to which both values are calculated. In our approach we first obtain these parameters for each cardiac cycle, and then we compute the mean for each series. Finally the system is used to verify a very interesting hypothesis from others authors: that AI and TI could be used as discriminating features to separate SVV (vasovagal syncope) patients from normal controls.
Palabras claves— Presión arterial, No invasivo, Índice de Aumentación, síncope vasovagal.

290 Compressão de Sinais de EMG isométricos utilizando JPEG2000

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Abstract— Despite the growing interest in the transmission and storage of electromyographic signals for long periods of time, only a few studies deal with the compression of these signals. In this article we study an algorithm for EMG signal compression using a successful method applied to still image coding, the JPEG2000 algorithm. Although the JPEG2000 codec is designed to compress images, we illustrate that it can also be used to compress EMG signals. For EMG signals acquired during isometric contractions, the proposed algorithm provided compression factors ranging from 75 to 90%, with an average PRD ranging from 3,75% to 13,7%. The compression results using the JPEG2000 algorithm were compared to other algorithms based on the wavelet transform.
Keywords— S-EMG, isometric electromyographic signals, compression, JPEG2000.

333 Metodología para el Análisis de Perfusión Miocárdica en la Coronariografía Mediante el Flujo Óptico

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Abstract— The main objective of this paper is to quantify the degree of myocardial perfusion, capillar phase, by means of the images obtained by coronary angiography. The coronary angiography uses an opaque contrast that is distributed proportional to the regional capillar blood flow, and allows obtaining an image of the vessels and of the myocardial perfusion phase. This image is used for diagnosis, functional valuation and prognosis of coronary diseases, acute myocardial infarction and evaluation of cardio surgical interventions. By means of digital imaging processing an index can be obtained that is able to value the degree of normal myocardial perfusion, which has been little studied.
The specialists have analyzed the degree of myocardial perfusion by the qualitative term "Myocardial Blush". This method, also known as TIMI (Thrombolysis In Myocardial Infarction) of Myocardial Perfusion Grade, uses the variation of the degree of image intensity (variations of the contrast of the medium) to characterize the capillary phase and to diagnose it as normal or pathological.
A methodology has been developed, to evaluate angiographic sequences, in the anterior right oblique projection, clinically valued as normal. Using movement analysis and the optical flow theory, the gray gradients contrast were obtained from the well defined images in phase of the angiographic sequence: systole and diastole in capillar phase.
As a result, the gray gradients displayed by the image sequences studied in systole and diastole, in capillary phase, where valued by digital coloration (blue, green and red) in several segmentations of the frame. A good correlation in all cases was observed. The maximum diastole in capillary phase, and the mechanical work of contraction and relaxation of the myocardium, are the main characteristics valued by this methodology. The development of the procedure was carried out using MATLAB as computing tool.
Palabras claves— Perfusión Miocárdica, Coronariografía, Análisis Digital, Secuencia Angiográfica, Cuantificación.

348 Implementación de una Interfaz Cerebro Computador Basada en la Interpretación del Electroencefalograma para el Control a Distancia de Dispositivos Electrónicos

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Abstract— This paper describes the design and implementation of a prototype off line brain computer interface (BCI) used to simulate the operation of a remote control operated only by means of brain activity. The system is based on the spectral analysis of brain activity during simple mental tasks performing. Seven independent modules were developed and implemented in the form of ActiveX controls. Every ActiveX control makes one processing stage required and when they are combined allows building the interface between the brain and the machine. The classification of the mental tasks associated patterns was done by a multilayer perceptron artificial neural network. The system implemented, can simulate the remote control of standard device like a TV or Radio by the brain.
Keywords— Brain Computer Interfaces, Mental Task Classification, Modular BCI.

353 Análisis de Movimientos "Respiratorios" Fetales obtenidos a partir de imágenes de video de ultrasonido en modo M

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Abstract. One of the main threaths of Obstetrics, since many yaers ago, has been the search of non-invasive mechanisms for evaluating the in-uterus foetal develope and conditions. One of this biophysical variables studied is the foetal respirathory movements (FRM), that can give us valuable physiological and clinical information of the fetus as a biophysical profile and an estimation of integration and conditions of respiartory centers until the muscles involucrated in the generation of the RFM during the prenancy period until the breathing after birth.
The goal of this proyect is to analize the FRM pattern obtained by processing 3.5 MHz M mode ultrasonic images. First of all we selected the part of the video related to the RFM, and it was filtered, adjusted in brigthness and contrast, eroted, dilated, in order to generated a signal associated to the movements of the foetal thorax or abdomen.
For this signals it can be obtained FRM parameters as "respirathory"frequency, inspyrathory and espirathory times. Thoes parameters has been obtained by deriving the RFM signal and standarizes it value, in order to make easier the claculation of the parameters.
Palabras clave: movimientos respiratorios fetales (MRF), ultrasonido modo M

361 Reducción De Espacios De Entrenamiento Dinámico En La Identificación De Disfonías

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*Abstrac*t— A method for training spaces reduction based on the features dynamic extraction is developed. The proposed orthogonal transformation turns out to be effective in the principal components determination with greater influence in the time process variability information that is used for both the features reduction and features selection with greater discriminative capacity. In particular, the contours effectiveness of acoustic features varied is analyzed in the hidden Markov model training for the hipernasal voices identification. An effectiveness of until 95% with a reduced set of not more than 2-3 features is obtained.
Palabras claves—Reducción de espacios, PCA, HMM, identificación de patologías.

367 Near-Lossless Compression of ECG Signals Using Perceptual Masks in the DCT Domain

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Abstract. - This paper describes a perceptual masking method to compress ECG signals. Perceptual mask definition demands a visual assessment of the resulting quality, instead of relying on purely mathematical distortion measures. The proposed method uses thresholding and numerical masks for DCT coefficients to obtain the maximum number of

zeroed coefficients without perceptual distortions in the reconstructed signal. An average 52.42% zeroed coefficients was achieved for average PRD equal to 1.24.
Keywords - ECG Compression, Signal Processing, Perceptual Masking.

387 Evaluación de dos Métodos para la segmentación del ancho de la onda T en el ECG

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Abstract— In this work, two methods for T wave segmentations were compared: classic method based on differentiator filter and the method based on slope estimation. This study was carried out on simulated electrocardiogram (ECG) signals with four simulated added noise types: (a) baseline wander due to breathing (0-0.5 Hz), (b) motion artifacts (3-5 Hz), (c) electromyography and motion artifacts (Gaussian white noise), (c) mixed effects (sum of the previous noises). Four conditions of Signal to Noise Ratio (*SNR*) were computed: 5, 10, 15, 20 and 25 dB. The beginning, the end and the width of the T wave was determined with both methods and the mean absolute error was computed for all signals. The slope estimation method shows a T wave width larger than the obtained with the differentiator filter. Both methods showed that the end location is easier to find than the beginning of the T wave. The achieved performance shows a satisfying behavior of both methods in favorable conditions of *SNR*. However, the differentiator filter method shows better performance that the method base on slope estimation. The noise due to motion artifacts affect greatly the mean absolute error in the beginning and end location of the T wave. An important increase of T wave width variability induced by the artifacts was observed.
Palabras claves— ECG, onda T, segmentación, repolarización ventricular, procesamien`o de señales.

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