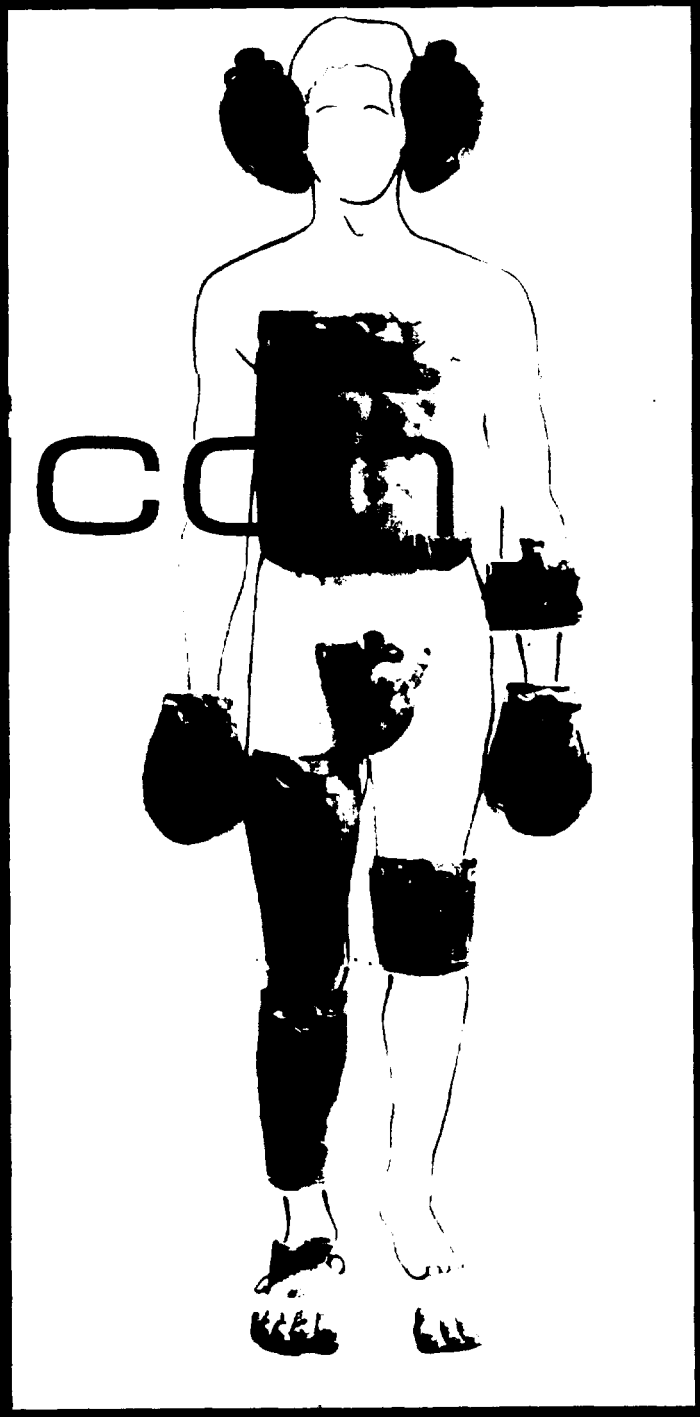
FINAL PROGRAMME AND ABSTRACTS OF PAPERS

JUNE
14-17

98



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Final Programme
and
Abstracts of Papers

VIII Mediterranean Conference on Medical and Biological Engineering and Computing

Medicon '98

June 14-17, 1998, Lemesos, Cyprus

Organised and Sponsored by

The Department of Computer Science, University of Cyprus
The Cyprus Association of Medical Physics and Biomedical Engineering

Co-Sponsored by

IEEE Engineering in Medicine and Biology Society
Institution of Electrical Engineers - IEE
IEE Professional Group J1 (Instrumentation & Measurement Systems)

In Co-operation with

International Federation for Medical and Biological Engineering (IFMBE)
European Society for Engineering and Medicine (ESEM)

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Croatian Medical & Biological Engineering Society
Greek Society for Biomedical Engineering
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Slovene Society for Medical & Biological Engineering
Societe des Electriciens et des Electroniciens (Club Francais des Technologies Biomedicales)
Spanish Society of Biomedical Engineering

Institution of Electrical Engineers (IEE Cyprus)
Institute of Electrical and Electronics Engineers (IEEE Cyprus Section)

Cyprus Institute of Neurology and Genetics
Higher Technical Institute, Cyprus
United Kingdom Liaison Committee for Sciences Allied to Medicine & Biology (S.A.M.B.)

Venue

Saint Raphael Hotel, Lemesos, Cyprus

The conference in under the auspices of
H.E. the Minister of Health of the Republic of Cyprus,
Mr. Christos Solomis

ISBN:9963-607-14-4

CONTENTS

Preface

Medicon'98 is the VIII in the series of regional meetings of the International Federation for Medical and Biological Engineering (IFMBE) in the Mediterranean. The goal of Medicon'98 is to provide updated information on the state of the art on Medical and Biological Engineering and Computing. The program consists of 190 invited and submitted papers on new developments in these fields.

The papers, more specifically, are presented in 29 sessions covering the topics of *Medical Imaging* (Radiography, Ultrasound, Nuclear Medicine, MRI, and Multimodality Imaging), *Biosignal Processing* (EEG, EPs, and the Cardiovascular System), *Intelligent Systems, Telemedicine, Cardiovascular System* (Experimental and Applied, and Heart Rate and Signal Analysis), *Nerve and Muscle Systems, Modelling in Biological Systems, Cellular Engineering, Implants, Biomechanics, Radiotherapy, Radiation Protection, Instrumentation, and Clinical Engineering*. In addition, the following two sessions which are directly related to European Union projects will be hosted: *Electronic Market for Medical Devices: Medicom Project*, and *Quantitative Analysis of Ultrasonic Imaging of Atherosclerotic Plaques*.

Furthermore, the technical program is highlighted by three plenary sessions, including presentations on *Information Technology in Biomedicine: The Next Step Beyond* by S. Laxminarayan, NextGen Internet and NJ Institute of Technology, USA, *Integrated Telemedicine Networks and Added Value* by S. Orphanoudakis, University of Crete, Greece, *Computers in Surgery and Diagnosis* by E. Micheli-Tzanakou, Rutgers University, USA, *Collaboration of Biomedical Engineering and Medical Informatics On the Road to Citizen-Centred Care* by Ilias Iakovidis, European Commission, DGXIII, Belgium, and *Education and Training Initiatives in Europe* by C. Roberts King's College School of Medicine and Dentistry, UK.

Also, a Meet the Editors session is hosted, where the participants will have the opportunity to meet the editors of three major Biomedical Engineering journals: *Medical Engineering & Physics*, Colin Roberts, *Medical & Biological Engineering & Computing*, Alan Murray, and *IEEE Transactions on Information Technology in Biomedicine*, Swamy Laxminarayan.

A student paper contest will take place during the Medicon'98 where 11 students will compete. The contest is carried out in memory of Dick Poortvliet, dinstinguished biomedical engineer and active member of IEEE Region 8.

The proceedings of the conference are available on CD ROM medium, providing the immediate access and the easy retrieval of information.

Medicon'98 is deeply honoured to host the IFMBE Administrative Council, as well as the National Secretaries Committee meetings.
Particular thanks are expressed to the kind support and efforts of M. Bracale, S. Cerutti, G. Dimitrov, N. Dimitrova, C. Hadjivasiliou, K. Kouris, D. Koutsouris, A. Nicolaides, N. Ouzounoglou, N. Pallikarakis, S. Sideman, V. A. Spasic, and N. Zamboglou for their valuable help in making this conference a success.

We would like to thank Frank Schnorrenberg and Soteroula Papademetriou for their exceptional work and technical assistance in managing the papers, as well as in preparing the final programme. In addition, we would like to extend our thanks to Elena Polykarpou for preparing the book of abstracts, and to Irene Abu-Rumman, Savvoulla Efstathiou, and Christina Hadjiyianni for their

dedicated work and secretarial support throughout the course of this conference.

Finally, a heartfelt thanks to all of you, the participants, wishing you every success in your work at the conference. We hope that Medicon'98 will offer opportunities for professional growth, and establishing new contacts with fellow colleagues. Our intention is to do all we can to make your participation in Medicon'98 worthwhile and your stay in Cyprus enjoyable.

Stelios Christofides
Constantinos S Pattichis
Christos N Schizas
Elpida Keravnou-Papailiou
Prodromos Kaplanis
Spyros Spyrou
George Christodoulides
Yiannis Theodoulou

Lemesos, June 1998

Acknowledgements

The organizing committee acknowleges with gratitude the additional sponsorship provided by the following organisations:

- Biomedical Research Foundaation (BRF) Cyprus
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Medicon '98
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Medicon '98 Technical Program Schedule

		PANORAMA	MEGARON A	MEGARON B	PHOENICIAN
MONDAY	08:20-10:30	1. Plenary Session 1			
	10:30-11:00	Coffee Break			
	11:00-13:00	2. Medical Imaging 1: Radiography	3. Cellular Engineering 1	4. Implants / Biomechanics 1	5. Modeling in Biological Systems
	13:10-14:00	Meet The Editors			
	14:15-16:15	6. Medical Imaging 2: Ultrasound and Other Modalities	7. Cellular Engineering 2	8. Implants / Biomechanics 2	9. Biosignal Processing 1: EEG & EPs
	16:15-17:00	Coffee Break			
TUESDAY	08:20-10:30	10. Plenary Session 2			
	10:30-11:00	Coffee Break			
	11:00-13:00	11. Medical Imaging 3: Nuclear Medicine & MRI	12. Nerve & Muscle 1	13. Biosignal Processing 2: Cardiovascular Systems	
	13:00-14:15	Lunch Break			
	14:15-16:15	14. Radiotherapy	15. Clinical Engineering	16. Biosignal Processing 3: Cardiovascular System	
	16:15-16:45	Coffee Break			
	16:45-18:45	17. Radiotherapy & Radiation Protection	18. Electronic Market for Medical Devices: MEDICOM Project	19. Biosignal Processing 4	
WEDNESDAY	08:20-10:30	20. Plenary Session 3			
	10:30-11:00	Coffee Break			
	11:00-13:00	21. Medical Imaging 4: Image Processing & Multimodality Imaging	22. Nerve & Muscle 2	23. Cardiovascular Systems: Experimental and Applied	
	13:00-14:15	Lunch Break			
	14:15-16:15	24. Intelligent Systems 1	25. Instrumentation 1	26. Cardiovascular Systems: Heart Rate-Signal Analysis	
	16:15-16:45	Coffee Break			
	16:45-18:45	27. Telemedicine / Intelligent Systems 2	28. Instrumentation 2	29. Quantitative Analysis of Ultrasonic Imaging of Atherosclerotic Plaques	
	18:50-19:00	Closing Remarks			

Medicon '98
Technical Programe

MONDAY 15 JUNE

Plenary Session 1

Time & Place: 8:20-10:30, Panorama

Chairman : *C. N. Schizas*
Department of Computer Science, University of Cyprus

8:20

1.1 ***Information Technology in Biomedicine: The Next Step Beyond***
S. Laxminarayan
NextGen Internet and NJ Institute of Technology, P.O. Box 3718, Princeton, NJ08543, USA

9:15

1.2 ***EUROMED - A WWW-Based Multi-Media Telemedical Information System***
A. Marsh, K. Delibasis, Ch. Michael, N. Mouravlianski, G. Matsopoulos, K. S. Nikita, N. Uzunoglu
Institute of Communication and Computer Systems, National Technical University of Athens, 9, Iroon Politechniou Street, 15773 Zographou, Athens, GREECE

9:40

1.3 ***Telemedicine Experiences in the Framework of TELEPLANS Concerted Actions and of the Video-Consultation Network of "Procida-Ischia-Pozzuoli-Giugliano"***
M. Bracale, A.Pepino
Univ. of Naples "Federico II", Dept. of Electronic Engineering, Bioengineering unit, Italy

10:05

1.4 ***Developing a Multimedia Atlas for Breast Cancer Pathology: Methodology and Preliminary Results from the Definition Phase of an EU Info2000 Project***
Roberto Sacile[1,2], Carmelina Ruggiero[1,3], Fabrizio Cardinali[4], Claudio Lombardo[2], Guido Nicolò[2], Barry Gusterson[5]
[1]Department of Communications Computer and System Sciences, University of Genova, Genova, Italy
[2]National Institute for Cancer Research, Genova, Italy
[3]Advanced Biotechnology Center, Genova, Italy
[4]Interactive Labs srl (Giunti Publishing Group), Genova, Italy
[5]Institute of Cancer Research, Haddow Laboratories, Surrey, UK

COFFEE BREAK

MONDAY 15 JUNE

Session 2: **Medical Imaging 1: Radiography**

Time & Place: 11:00-13:00, Panorama

Chairman : *M. Bracale*
University of Naples "Federico II", Electronic Engineering Dept., Bioengineering Unit Via Claudio, 21 - 80125 Naples, Italy

11:00

2.1 ***A Software Phantom: Application in Digital Tomosynthesis***
D. Lazos, Z. Kolitsi, C. Badea, N. Pallikarakis
Medical Phisics Laboratory, School of Medicine, University of Patras, Greece

11:15

2.2 ***Monte Carlo Modeling of Mammograms : Development and Validation***
G. Spyrou[1], G. Panayiotakis[1], A. Bakas[3], G. Tzanakos[2]
[1]University of Patras, School of Medicine, Medical Physics Department, 265 00 Patras, Greece
[2]University of Athens, Department of Physics, Div. Nucl. & Particle Physics, 157 71 Athens, Greece
[3]Technological Educational Institution of Athens, Department of Radiography, 122 10 Athens, Greece

11:30

2.3 ***Computer Aided Detection of Suspicious Regions on Digital Mammograms: Rapid Segmentation and Feature Extraction***
C. Ruggiero[1,2], M. Giacomini[1,2], R. Sacile[1,2], M. Rosselli Del Turco[3]
[1]DIST – Department of Communication Computer and System Sciences, University of Genova, Via Opera Pia 13, 16145 Genova, Italy
[2]DIST laboratory, Advanced Biotechnology Center, Genova, Italy
[3]Centro per lo studio e la prevenzione oncologica, Firenze, Italy

11:45

2.4 ***Resolution Effects on the Morphology of Calcifications in Digital Mammograms***
Maria Kallergi, Li He, Marios Gavrielides, John Heine, Laurence P. Clarke
Department of Radiology, College of Medicine, and H. Lee Moffitt Cancer Center & Research Institute at the University of South Florida, 12901 Bruce B. Downs Blvd., Box 17, Tampa, FL 33612

12:00

2.5 ***Simulation of the Radiography Formation Process from CT Patient Volume***
P. Bifulco, M. Cesarelli, E. Verso, M. Roccasalva Firenze, M. Sansone, M. Bracale
University of Naples "Federico II", Electronic Engineering Dept., Bioengineering Unit, Via Claudio 21, 80125 Naples, Italy

12:15

2.6 ***Estimation of the 3D Positioning of Anatomic Structures from Radiographic Projection and Volume Knowledge***
P. Bifulco, M. Cesarelli, M. Roccasalva Firenze, E. Verso, M. Sansone, M. Bracale
University of Naples "Federico II", Electronic Engineering Dept., Bioengineering Unit, Via Claudio 21, 80125 Naples, Italy

12:30

2.7 ***A Theoretical Model Predicting the Intensity of Emitted Light Per Unit of X-Ray Exposure in Radiographic Screens***

S. Tsoukos[1], A. Kateris[1], N. Kalivas[1], I. Kandarakis[2], D. Cavouras[2], G. Spyrou[1], G. Panayiotakis[1]

[1]Dept. of Medical Physics, School of Medicine, University of Patras, 265 00 Patras, Greece

[2]Dept. of Medical Instrumentation Technology, Technological Educational Institution of Athens, Greece

12:45

2.8 ***X-ray scatter signatures for enhanced breast imaging***

Ghirmay Kidane, Robert Speller and Gary Royle

Medical Physics & Bioengineering Department, University College London, 11-20 Capper Street, London WC1E 6JA, United Kingdom

MONDAY 15 JUNE

Session 3: **Cellular Engineering 1**

Time & Place: 11:00-13:00, Megaron A

Chairperson : *C. Ruggiero*
Dept. of Communication, Computer and System Sciences, University of Genoa, Via Opera Pia 13, 16145 Genoa, Italy

11:00

3.1 ***Modified Clonal Resistance Model of Tumor Electrochemotherapy in Mice***
Tomaž Jarm [1], Marie Kaung [2], Gregor Serša [3], Maja Čemažar [3],
Rudi Kragelj [1] and Damijan Miklavčič
[1]University of Ljubljana, Faculty of Electrical Engineering, Tržaška 25, SI-1000 Ljubljana, Slovenia,
[2]Johns Hopkins University, Dept. of Biomed. Eng., 3400 North Charles St., Baltimore, MD 21218, USA,
[3]Institute of Oncology, Department of Tumor Biology, Zaloška 2, SI-1000 Ljubljana, Slovenia

11:15

3.2 ***Computer Modeling of the Adhesion Behavior of Colloidal Dispersions Under the Influence of DLVO and Hydration Forces***
C. Ruggiero[1,2], M. Mantelli[1,2], A. Curtis[3], S. Zhang[4], P. Rolfe[5]
[1]Department of Informatics, Systems and Telematics (DIST), University of Genoa, via Opera Pia 13, 16145 Genova Italy
[2]DIST Laboratory, Advanced Biotechnology Center, 16145 Genova Italy
[3]Center for Cell Engineering, Joseph Black Building, Glasgow University
[4] Biomedical Engineering & Medical Physics, Keele University
[5]OBC Ltd., Daisy Lake Oakley, Market Drayton, Shropshire TF9 2QW, UK

11:30

3.3 ***Tissue Cultures for the Testing of Biocompatibility***
R. Poll, K. Brethauer, U. Roehlecke, I. Jummel
Department of Electrical Engineering Dresden University of Technology Mommsenstraße 13, Dresden 01069, Germany

11:45

3.4 ***The Influence of Mechanochemically Modified Syngeneic Tumour Cells on the Inhibition of the Tumour Growth and Metastasizing***
V. E. Orel, N. N. Dzyatkoskaya, Yu. A. Grinevich, M. I. Danko, S. V. Martynenko
Ukrainian Research Institute Oncology & Radiology, 33/43 Lomonosova Str., Kiev, 252022, Ukraine

12:00

3.5 ***An Artificial Neural Network Approach to "Key Residue" Identification in Globular Proteins***

R. Sacile, C. Ruggiero
Dept. of Communication, Computer and System Sciences, University of Genoa, Via Opera Pia 13, 16145 Genoa, Italy

12:15

3.6 ***A Computerized System for Assessment of Cancer Cell Movement***

A. Hoppe[1], D. Wertheim[1], W.G. Jiang[2], R. Williams[1], K. Harding[2]
[1]Department of Electronics and IT, University of Glamorgan, Mid Glamorgan, CF37 1DL, U.K.
[2]Department of Surgery, University of Wales College of Medicine, Cardiff, CF4 4XN, U.K.

12:30

3.7 ***Automatic Recognition of Malignant Lesions in Ultrasound Diagnosis of Breast Cancer***

C. Ruggiero[1], R. Sacile[1], M. Giacomini[1], M. Calabrese[2], F. Sardanelli[2]
[1]Department of Communications Computer and System Sciences, University of Genova, Italy
[2]Department of Radiology, University of Genoa Medical School, San Martino Hospital, Genova, Italy

12:45

3.8 ***A Decision Support System for Breast Cancer Chemotherapy***

C. Ruggiero[1,2], M. Giacomini[1,2], G. Bonadonna[3], P. Valagussa[3], R. Demicheli[3]
[1]Dep. of Comm. Comp. and System Sciences (DIST), University of Genova, Italy
[2]DIST Laboratory, Advanced Biotechnology Center, Genova, Italy
[3]National Cancer Institute, Milano, Italy

MONDAY 15 JUNE

Session 4: **Implants Biomechanics 1**

Time & Place: 11:00-13:00, Megaron B

Chairman : *C. Hajivassiliou*
University Department of Colorectal Surgery and University Department of Pædiatric Surgery, R.H.S.C., Yorkhill, Glasgow, G3 8SJ, Scotland.

11:00

4.1 ***The Development and Testing of an Artificial Sphincter***
C. A. Hajivassiliou, K. B. Carter, I. G. Finlay, D. G. Young
University Department of Colorectal Surgery and University Department of Pædiatric Surgery, R.H.S.C., Yorkhill, Glasgow, G3 8SJ, Scotland.

11:15

4.2 ***The Evolution and Results of Implantation of Mechanical Devices to Control Urinary Incontinence and Audit of 4000 Complications of the AMS 800 Artificial Urethral Sphincter***
C. A. Hajivassiliou, D. G. Young
University Department of Pædiatric Surgery, R.H.S.C., Yorkhill, Glasgow, G3 8SJ, Scotland

11:30

4.3 ***Non-Invasive Colonic Blood Flow Measurement by Laser Doppler***
C.A. Hajivassiliou, I.G. Finlay, D.G. Young
University Department of Pædiatric Surgery, R.H.S.C., Yorkhill, Glasgow, G3 8SJ, Scotland

11:45

4.4 ***Biomechanical Evaluation of Surgical Plantar Fascia Release Effects***
A. Gefen[1], M. Megido-Ravid[2], Y. Itzchak[3], M. Arcan[4]
[1]Biomedical Engineering Dept., Faculty of Engineering, Tel Aviv University, Israel
[2]Diagnostic Imaging Dept., Sheba Medical Center, Tel Aviv, Israel
[3]Diagnostic Imaging Dept., Sheba Medical Center, Tel Aviv, Israel
[4]Faculty of Engineering, Tel Aviv University, Israel.

12:00 *Student Paper*

4.5 ***Morphometrical Study of the Distal Femur Pertinent to the Design of Knee Prostheses***
N. Nuño-Siebrecht, A. M. Ahmed
Department of Mechanical Engineering, McGill University, Montreal, Canada

12:15

4.6 ***Biofeedback Techniques for Rehabilitation of the Lower Limb Prosthetic Subjects***
D. Zambarbieri[1], M. Schmid[1], M. Magnaghi[1], G. Verni[2], V. Macellari[3], A. Fadda[3]
[1]Dipartimento di Informatica e Sistemistica, Università degli Studi di Pavia, via Ferrata 1, 27100 Pavia, Italy
[2]Centro Protesi INAIL, Via Rabuina 14, 40054 Vigorso di Budrio (BO), Italy
[3]Laboratorio di Ingegneria Biomedica, Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Roma, Italy

12:30

4.7 ***The Influence of Shoes on Healthy Subjects' Gait: A Statistical Analysis of the Relevant Gait Parameters***

Claudia Giacomozzi, Velio Macellari
Biomedical Engineering Laboratory, Istituto Superiore di Sanita', Viale Regina Elena 299, 00161 Rome, Italy

12:45

4.8 ***Kinematics of the Cervical Spine Discectomy with and without Bone Grafting in a Sheep Model***

Guan-Liang Chang, E-Jian Lee[1], Yu-Chang Hung[1], Yin-Te Lee, Kao-Chi Chung[2]
[1]Institute of Biomedical Engineering & Division of Neurosurgery, Department of Surgery
[2]National Cheng Kung University, No.1, Ta-Hsueh Road, Tainan, Taiwan 701, R.O.C.

MONDAY 15 JUNE

Session 5: **Modeling in Biological Systems**

Time & Place: 11:00-13:00, Phoenician

Chairman : *V. A. Spasic*
Center for multidisciplinary Studies, University of Belgrade, Kneza Višeslava 1, Belgrade & Mathematical Institute, SANU, Knez Mihajlova 35, Belgrade

11:00

5.1 ***Numerical Problem in Mathematical Modeling of Live Systems***
Veljko A. Spasic
Center for multidisciplinary Studies, University of Belgrade, Kneza Višeslava 1, Belgrade & Mathematical Institute, SANU, Knez Mihajlova 35, Belgrade

11:15

5.2 ***A Simplified Monte Carlo Simulation Model and Virtual Reality Visualization of Tumour Growth in Cell Culture***
Georgios S. Stamatakos[1], Nikolaos K. Uzunoglu[1], Konstantinos Delibasis[1], Nikolaos Mouravliansky[1], Mersini Makropoulou[2], Andy Marsh[1]
[1]Department of Electrical and Computer Engineering, Division of Electroscience, National Technical University of Athens, Zografou Campus, GR-157 80 Zografou, Greece
[2]Department of Physics, National Technical University of Athens, Zografou Campus, GR-157 80 Zografou, Greece

11:30

5.3 ***Parametric Changes in the VOR During Adaptation and Habituation***
S. Ramat, R. Schmid, D. Zambarbieri
Dipartimento di Informatica e Sistemistica - Università di Pavia. Via Ferrata, 1 - 27100 PAVIA - Italy

11:45

5.4 ***Investigating of Focusing of Pulse Modulated Microwave Signals Inside Biological Tissues using HPC***
K.S. Nikita, A. Marsh
National Technical University of Athens, Department of Electrical and Computer Engineering, Iroon Polytechniou 9, Zografos 15773, Athens, Greece

12:00

5.5 ***Compartmental Principle in the Hierarchical Neuron Networks Modeling***
Valery M. Eskov
Surgut State University, Laboratory of Biophysics, 626400, Surgut, Energetikov 14, Russia

12:15

5.6 ***Mathematical Interpretation of Stationary Regime's of a Biological Systems***
S.V. Kulaev, O.E. Filatova, V.M. Eskov
Surgut State University, Laboratory of Biophysics, 626400, Surgut, Energetikov 14, Russia

12:30

5.7 ***Mathematical Model for Analysis of Environmental Bio-System***

Veljko A. Spasic
Center for multidisciplinary Studies, University of Belgrade, Kneza Višeslava 1, Belgrade & Mathematical Institute, SANU, Knez Mihajlova 35, Belgrade

12:45

5.8 ***Ecophysiological Modeling - Ecobase***

Veljko A. Spasic
Center for multidisciplinary Studies, University of Belgrade, Kneza Višeslava 1, Belgrade & Mathematical Institute, SANU, Knez Mihajlova 35, Belgrade

MONDAY 15 JUNE

Time & Place: 13:10-14:00, Panorama

Session name: **Meet the Editors**

Chair: *Evangelia Micheli-Tzanakou*
Department of Biomedical Engineering, Rutgers University, NJ, USA

Medical Engineering & Physics
Colin Roberts

Medical & Biological Engineering & Computing
Alan Murray

IEEE Transactions on Information Technology in Biomedicine
Swamy Laxminarayan

MONDAY 15 JUNE

Session 6: **Medical Imaging 2: Ultrasound and Other Modalities**

Time & Place: 14:15-16:45, Panorama

Chairman : *G. Matsopoulos*
Institute of Communication and Computer Systems, National Technical University of Athens, 9, Iroon Politechniou Street, 15773 Zographou, Athens, Greece

14:15

6.1 ***Technological Limits in Resolution of Contemporary Ultrasonographic Probes***
Haris Boko
Medical School University of Zagreb; Faculty of Electrical Engineering, University of Split, Zagreb, Croatia

14:30 *Student Paper*

6.2 ***Continuous Wave Ultrasonic System for Detection and Analysis of Ultrasonic Doppler Signals of Fetal Activity***
F. Afana, K. Kaluzynski, T. Palko
Institute for Precision and Biomedical Engineering, Warsaw University of Technology, Warsaw, Poland

14:45

6.3 ***Detection of the Descending Aorta Normal Lumen and with Aneurysm***
Ran Ravhon, Dan R. Adam
The Heart Research Center, Department of Biomedical Engineering, Technion , I.I.T. Haifa 32000, Israel

15:00

6.4 ***Automated Detection of Endovascular Contours from Intravascular Ultrasound Image Sequences using a Simulated Annealing Approach***
M. Schmauder[1], C. M. Gross[2], M. Firle[1], J. Waigand[2], R. Orglmeister[1]
[1]Technical University Berlin, Institute of Electronics and Light Technology. Berlin, Germany;
[2]Franz-Volhard-Clinic at the Max-Delbrück-Center for Molecular Medicine, Department of Cardiology, Angiology and Pneumology, Charite University Hospital Campus Berlin-Buch, Humboldt University of Berlin, Germany

15:15

6.5 ***3D, 4D & 5D Ultrasound for Abdominal and Cardiological Applications***
M. Grim, M. Richtscheid, G. Sakas
Strahlenklinik, Städtische Kliniken Offenbach, Starkenburgring 66, D-63069 Offenbach, Germany

15:30

6.6 ***Classification of Ultrasonic Liver Images using a Power Differentiation Estimator of Fractal Dimension***
P. Asvestas, G.K. Matsopoulos, K.S. Nikita
Department of Electrical and Computer Engineering, National Technical University of Athens, Greece

15:45

6.7 ***Radiometric System for Preliminary Detection of Tumors***

Hiie Hinrikus, Jevgeni Riipulk
Biomedical Engineering Centre, Tallinn Technical University Ehitajate, Tallinn, Estonia

16:00 *Student Paper*

6.8 ***High Resolution Imaging of Early Neoplastic Lesions using Optical Coherence Tomography***

Costas Pitris[1,2], Stephen A. Boppart[1,2], Debra Stamper[3], Mark E. Brezinski[4], James G. Fujimoto[1]
[1]Research Laboratory of Electronics, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology
[2]Harvard-MIT Division of Health Science and Technology;
[3]Kings College
[4]Cardiac Unit, Massachusetts General Hospital & Harvard Medical School

16:15 *Student Paper*

6.9 ***Three Dimensional Reconstruction with Linear CCD Cameras***

Roumen Georgiev[1], Patrick Gross[2], Christopher Vaughan[1]
[1]Department of Biomedical Engineering, University of Cape Town, South Africa; [2]Cambridge University, Cambridge, United Kingdom

16:30

6.10 ***Image Processing Techniques for the Quantification of Atherosclerotic Changes***

K.V. Chandrinos[1], M. Pilu[2], R.B. Fisher[3], and P.E. Trahanias[1]
[1]Institute of Computer Science, Foundation for Research and Technology - Hellas (FORTH), P.O. Box 1385, Heraklion, 711 10 Crete, Greece
[2]Digital Media Department, Hewlett-Packard Laboratories, Bristol, U.K
[3]Department of Artificial Intelligence, University of Edinburgh, Scotland

COFFEE BREAK

MONDAY 15 JUNE

Session 7: **Cellular Engineering 2**

Time & Place: 14:15-16:00, Megaron A

Chairman : *I. Krekule*
Inst. of Physiology, Acad. of Sci. of the Czech Rep., Prague Videnska 1083, 14220 Prague 4, Czech Rep.

14:15

7.1 ***A Conceptual Information Retrieval System for the Production of Guidelines on Cancer Biomarkers***

Carmelina Ruggiero[1,2], Roberto Sacile[1,3], Claudio Lombardo[3]
[1]Department of Communications Computer and System Sciences , University of Genova, Genova, Italy
[2]Advanced Biotechnology Center, Genova, Italy
[3]National Institute for Cancer Research, Genova, Italy

14:30

7.2 ***Digital Library Access in a Telepathology Network: Application in Gynecological Cancer***

F. Schnorrenberg[1], V. Tanos[2], C.S. Pattichis[1], F. Iacovou[3], K. Kyriacou[4],
C.N. Schizas[1]
[1]Department of Computer Science, University of Cyprus, Kallipoleos 75, P.O. Box 537, CY-1678 Nicosia, Cyprus
[2]Department of Obstetrics and Gynecology, Hadassah University Hospital, Ein-Kerem, P.O. Box 12000, Jerusalem 91120, Israel
[3]Department of Histology, Nicosia General Hospital, Nicosia, Cyprus
[4]Department of Electron Microscopy, The Cyprus Institute for Neurology and Genetics, P.O. Box 3462, Nicosia, Cyprus

14:45

7.3 ***Computer Analysis of Epithelium Cell Nuclei of Urinary Bladder for Cancer Detection***

A. Dulewicz[1], D.B. Pietka[1], P. Jaszczak[1], A. Nechay[1], W. Sawicki[2], E. Kozminska[3],
A. Borkowski[3]
[1]Department of Biomedical Information Processing Methods, Institute of Biocybernetics and Biomedical Engineering, PAS, 4 Ks.Trojdena str., 02-109 Warszawa, Poland,
[2]Department of Histology and Embryology, Institute of Biostructure, Medical Academy, 5 Chalubinskiego str., 02-004 Warszawa, Poland
[3]Clinic of Urology, Medical Academy
[4]Lindleya str.,Warszawa, Poland

15:00

7.4 ***BSE - Automatic Detection of Spongiform Change in Histological Samples of the Central Nervous System***

J. Saro[1], J. Bicho[1], M. Ramos[2], A. Galo[3], A. Fernandes[2], A. Alves[1], M. Pires[1],
P. Rodrigues[1], M. Reis[1], J. Rodrigues[1], P. Melo-Pinto[1], J. Bulas-Cruz[1]
[1]U.T.A.D., Quinta de Prados, Apartado 202, 5000 Vila Real, Portugal,
[2]Laboratório Nacional de Investigação Veterinária, Rua de Santa Catarina, 753, Porto, Portugal,
[3]Laboratório Nacional de Investigação Veterinária, Estrada de Benfica, 701, Lisboa, Portugal

15:15

7.5 ***The Digitalization of Microscopic Image in Determination of Fractal Dimension of Human Cerebellar Purkinje Cells***

Milos M. Tasic[1], Zoran M. Budimlija[1], Agneza F. Polzovic[1], Zoran L. Bozovic[2]
[1]Institute of Forensic Medicine and Department of Anatomy, Faculty of Medicine, University of Novi Sad, Hajduk Veljkova 3-9, 21000 Novi Sad, FR Yugoslavia
[2]Center for Multidisciplinary Studies, University of Belgrade, Kneza Viseslava 1, 11000, Belgrade, FR Yugoslavia

15:30

7.6 ***A Method of Segmentation of Neutrophils Images Observed in the Cell Movement Monitoring System***

Anna Korzyñska
Institute of Biocybernetics and Biomedical Engineering, Polish Academy of Sciences, ul. Trojdena 4, 02-109 Warszawa, Poland

15:45

7.7 ***Non-Stationary Texture Segmentation in Electron Microscpy Muscle Imaging using an AM-FM Model***

M. Pattichis[1], C. Pattichis[2], M. Avraam[2], Al Bovik[1], K. Kyriakou[3]
[1]Laboratory of Vision Systems, University of Texas, Austin, TX, USA
[2]Dept. of Computer Sciences, University of Cyprus
[3]Dept. of Electron Microscopy, The Cyprus Institute of Neurology and Genetics, Cyprus

COFFEE BREAK

MONDAY 15 JUNE

Session 8: **Implants / Biomechanics 2**

Time & Place: 14:15-16:15, Megaron B

Chairman : *M. Sawan*
Ecole Polytechnique de Montreal, P.O.Box 6079, Station Centre-ville, Montreal (Qc) Canada, H3C 3A7

14:15

8.1 ***Implantation of Vascular Prostheses: Mathematical Simulation of the Impact on Hemodynamic Parameters***
Robert Bauernschmitt[1], Stephan Schulz[1], Uwe Kiencke[2], Christian F. Vahl[1], Siegfried Hagl[1]
[1]Dept. of Cardiac Surgery, Experimental Laboratory, University of Heidelberg, INF 326, 69120 Heidelberg, Germany
[2]Institute of Industrial Information Technique, University of Karlsruhe, PO box 69 80, 76128 Karlsruhe, Germany

14:30

8.2 ***Spectral and Instantaneous Flow Characteristics of Vascular Anastomoses***
Ygael Grad, Shmuel Einav
Dept. of Biomedical Engineering, Tel-Aviv University, Ramat Aviv, Tel-Aviv 69978, Israel

14:45

8.3 ***Computer Aided Modeling and Stress Analyses of Restorative Treated Teeth***
Dr. Goran Tosic[1], Srdjan Glisovic[2], Danko Mijajlovic[3]
[1]University of Nis, Faculty of Medicine, Department of Dental Pathology, 18000 Nis, Serbia, Yugoslavia
[2]University of Nis, Faculty of Occupational Safety, 18000 Nis, Serbia, Yugoslavia
[3] University of Nis, Faculty of Mechanical Engineering, 18000 Nis, Serbia, Yugoslavia

15:00

8.4 ***Identification of Human Body Dynamics During Vibrations Induced by a Road Vehicle***
Roberta Pavesi, Massimo Di Michele, Giovanni Magenes, Antonio Tiano
Dipartimento di Informatica e Sistemistica, University of Pavia, Via Ferrata 1, 27100 Pavia, Italy

15:15

8.5 ***Multireceiver Infrared Biotelemetry for Monitoring Ambulatory Patients in Biomechanical Measurements***
Vedran Bilas, Ante Šantic
University of Zagreb, Faculty of Electrical Engineering & Computing Unska 3, HR-10000 Zagreb, Croatia

15:30

8.6 ***Implanted Materials and Bone, Tooth Tissues Compatibility Tested by Electron Spectroscopy***
E. Aleinikova, Yu. Dekhtyar, A. Katashev, A. Pavlenko
Electrotechnique and Electronic Materials and Technologies Institute, Riga Technical University, 1a Kalku St., Riga LV -1658, Latvia

15:45

8.7 ***Three Dimensional Finite Element Mesh Generation for Maxillary Second Premolar***

Chun-Li Lin[1], Chih-Han Chang, Chia-Shin Cheng[2], Huey-Er Lee[2]
[1]Institute of Biomedical Engineering, National Cheng Kung University, Taiwan
[2]Graduate Institute of Dental Sciences, Kaohsiung Medical College, Taiwan

16:00

8.8 ***A Tutorial Supporting System for the Evaluation of Fall Risk in Elderly Subjects with 3D Simulation***

Starita, S. Sessa, A. Torlini, D. Majidi
Computer Science Department, University of Pisa Corso Italia 40, 56125 Pisa, Italy

COFFEE BREAK

MONDAY 15 JUNE

Session 9: **BIOSIGNAL PROCESSING 1: EEG & EPs**

Time & Place: 14:15-16:15, Phoenician

Chairman: *S. Spyrou*
Higher Technical Institute, Cyprus

14:15

9.1 ***Unsupervised Identification and Classification of Event Related Brain Potentials***
Daniel H. Lange, Hava T. Siegelmann, Hillel Pratt and Gideon F. Inbar
Department of Electrical Engineering, Technion - Israel Institute of Technology, Haifa 32000, Israel

14:30 *Student Paper*

9.2 ***Detection and Processing of Single-Trial Evoked Potentials: A Nonparametric Approach***
Pavel Kisilev[1], Yehoshua Y. Zeevi[1], Hillel Pratt[2]
[1]Dept. of Electrical Engineering
[2]Evoked Potentials Laboratory, Israel Institute of Technology, Haifa, 32000, Israel

14:45

9.3 ***Analysis of Evoked Potentials by Expert System***
Josef Svehlik
Czech Technical University, Faculty of Elect. Eng., Dept. of Control Engineering, Technicka 2, 166 27 Praha 6, Czech Republic

15:00

9.4 ***Independent Component Analysis of Electroencephalographic Data using Wavelet Decomposition***
Bert-Uwe Koehler, Reinhold Orglmeister
Institute of Electronics and Light Technology, Technical University of Berlin, Einsteinufer 17, EN3, Germany

15:15

9.5 ***Neural Networks with Wavelet Preprocessing in EEG Artifact Recognition***
Rafal Ksiezyk[1], Katarzyna Blinowska[1], Piotr Durka[1], W. Szelenberger[2], W. Androsiuk[2]
[1]Laboratory of Medical Physics, Institute of Experimental Physics, Warsaw University, Hoza 69, 00 681 Warszawa, Poland
[2]Department of Psychiatry, Warsaw Medical Academy

15:30

9.6 ***QEEG-Based Methods for Diagnosing the Vigilance Levels***
A. Raja[1], V. Tuulik[2], E. Lossmann[1], A. Meister[1], R. Riisalo[2], E. Altrov[2]
[1]Institute of Radio and Communication Engineering, Tallinn Technical University, Ehitajate tee 5, EE0026 Tallinn, ESTONIA
[2]Institute of Experimental and Clinical Medicine, Hiiu 42, EE0016 Tallinn, ESTONIA

15:45

9.7 ***Localization of the EEG Rhythm Sources in the Brain***

Anna M. Bianchi[1,3], Marco Cursi[2], Fabio Minicucci[2], Sergio Cerutti[3]
[1]Lab. of Biomedical Engineering, IRCCS S. Raffaele Hospital, Milano, Italy
[2]Dep. of Neurophysiology, IRCCS S. Raffaele Hospital, Milano, Italy
[3]Dep. of Biomedical Engineering, Polytechnic of Milano, Italy

16:00

9.8 ***Heart Rate and Respiratory Regulations During Normal Sleep: Investigation by Spectral Analysis and Comparison with EEG Recordings***

B. Meziane[1], M. Billon[1], O. Sentieys[2], M. Corazza[2]
[1]Laboratoire d'Optronique, UPRESA 6082
[2]Laboratoire d'Analyse des Systemes de Traitement de l'Information ENSSAT, Université de Rennes I, 6, rue de Kérampont, 22305 Lannion, France

COFFEE BREAK

TUESDAY 16 JUNE

Plenary Session 2

Time & Place: 08:20-10:30, Panorama

Chairman: *S. Christofides*
Department of Medical Physics, Nicosia General Hospital, Cyprus

8:20

10.1 ***Integrated Telemedicine Networks and Added Value Services***
Stelios Orphanoudakis
Institute of Computer Science, FORTH, Heraklion, Crete, Greece, and Department of Computer Science, University of Crete, Heraklion, Crete, Greece

9:15

10.2 ***A GSM-Based Mobile System for Emergency Telemedicine -"AMBULANCE"***
S. Pavlopoulos, E. Kyriacou, A. Berler, D. Koutsouris
Biomedical Engineering Laboratory, Department of Electrical and Computer Engineering, National Technical University of Athens (NTUA), 9 Iroon Polytechniou St., GR-157 73 Zografou, Athens, Greece

9:40

10.3 ***A Perspective from Magnetoencephalography on the Consistency and Variability of Brain Responses and possible Applications***
Andreas A. Ioannides
Laboratory for Human Brain Dynamics, Brain Science Institute, Riken 2 - 1, Hirosawa, Wako - Shi, Saitama 351 – 0198, Japan

10:05

10.4 ***Education and Training Initiatives in Europe***
Colin Roberts
Kings College School of Medicine and Dentistry, London, UK

COFFEE BREAK

TUESDAY 16 JUNE

Session 11: **Medical Imaging 3: Nuclear Medicine & MRI**

Time & Place: 11:00-13:00, Panorama

Chairpersons: *M. Lyra[1] and K. Kouris[2]*
[1]University of Athens, Department of Radiology and Department of Mathematics, Athens, Greece
[2]Cyprus Association of Medical Physics and Biomedical Engineering

11:00

11.1 ***The Measurement of Blood Speed in the Pulmonary Artery Trunk***
J. P. Saro[1], J. Bulas-Cruz[1], J. A. Rafael[2], M. F. Botelho[3], J. P. Lima[3]
[1]UTAD – 5000 Vila Real, Spain
[2]Dep. Electrónica e Telecomunicações da Univ. de Aveiro, 3800 Aveiro, Spain
[3]IBILI - Faculdade de Medicina da Univ. de Coimbra, 3000 Coimbra, Spain

11:15

11.2 ***SPECT 3D Display Quantitative Evaluation in Renal DMSA Scintigraphy***
M. Lyra, K. Skouroliakou, I. Emmanouilides, I. Stratis
University of Athens, Department of Radiology and Department of Mathematics, Athens, Greece

11:30

11.3 ***Nuclear Medicine Image and Data Interchange Through E-Mail***
M. Lyra[1], K. Skouroliakou[1], C. Stefanides[2], A. Perris[1], C. Georgossopoulos[1], D. Pappas[1]
[1]Radiology Department, Athens University,
[2]Pediatric Hospital "Aglaia Kyriakou", Athens, Hellas

11:45

11.4 ***Optimal Use of Pre-Emphasis Gradients for Magnetic Resonance Imaging***
Vasiliki N. Ikonomidou, George D. Sergiadis
Aristotle University of Thessaloniki, Faculty of Technology, Department of Electrical Engineering and Computer Engineering, Telecommunications Division, 54006 Thessaloniki, Greece

12:00

11.5 ***Echo-Interleaved-Spiral MR Imaging***
Shirrie Rosenthal[1], Avram Montag[2], Haim Azhari[1]
[1]Department of Biomedical Engineering, Technion, Israel Institute of Technology, Haifa 32000, Israel
[2]Elscint Ltd. MRI division, Haifa, Israel

12:15

11.6 ***Geometry-Driven-Diffusion Filtering of MR Brain Images using Dissimilarities and Optimal Relaxation Parameter***
I. Bajla[1], I. Hollaender[2]
[1]Austrian Research Centers Seibersdorf, Department of High Performance Image Processing and Video-Technology, A-2444 Seibersdorf, Austria, (on leave from the Institute of Measurement Science, Slovak Academy of Sciences, Bratislava, Slovak Republic)
[2]Institute of Information Processing, Austrian Academy of Sciences,
Sonnenfelgasse 19/2, 1010 Wien, Austria

12:30

11.7 ***Real Time Implementation of the Parametric Imaging Correlation Algorithms***

Piotr Bogorodzki, Tomasz Wolak, Jaroslaw Wasielewski, Adam Piatkowski
Medical and Nuclear Electronics Division, Institute of Radioelectronics, Warsaw University of Technology, 00-665 Warsaw, Nowowiejska 15/19, Poland

12:45

11.8 ***Different Patterns of Auditory Cortex Activation Revealed by Functional Magnetic Resonance Imaging***

E. Formisano[1], A. Pepino[1], F. Di Salle[2], H. Lanfermann[3], F. E. Zanella[3], M. Bracale[1]
[1]Department of Electronic Engineering – Biomedical Unit, Universita' di Napoli Federico II, Italy, Via Claudio 21, 80125 Napoli, Italy
[2]Department of Biomorphological and Functional Sciences – Radiological Unit, Universita' di Napoli, Federico II, Italy
[3]Department of Neuroradiology, J.W. Goethe Universität, Frankfurt/M, Germany

COFFEE BREAK

TUESDAY 16 JUNE

Session 12: **Nerve & Muscle 1**

Time & Place: 11:00-13:00, Megaron A

Chairpersons: *G. Dimitrov and N. Dimitrova*
Centre of Biomedical Engineering, Bulgarian Academy of Sciences, Acad. G.Bonchev Str., Bl.105, Sofia 1113, Bulgaria

11:00

12.1 ***The Hodgkin-Huxley Neuron: A Simulink Implementation***
Constantinos C. Neocleous[1], Christos N. Schizas[2]
[1]Higher Technical Institute, Department of Mechanical Engineering, P.O.Box 423, Nicosia, Cyprus
[2]University of Cyprus, Department of Computer Science, 75 Kallipoleos, Nicosia, Cyprus

11:15

12.2 ***Registration of Neuron Networks Oscillation***
M.Y. Braginsky, V.A. Papshev, V.M. Eskov
Surgut State University, Laboratory of Biophysics, Russia

11:30

12.3 ***Modern Software and Hardware for the Neuron Networks Identification***
Olga E. Filatova
Surgut State University, Laboratory of Biophysics, 626400, Surgut, Energetikov 14, Russia

11:45

12.4 ***A Miniaturized Implantable Bladder Selective Electrical Stimulator***
M. Sawan, S. Robin, S. Bourret, S. Boyer
Ecole Polytechnique de Montreal, P.O.Box 6079, Station Centre-ville, Montreal (Qc) Canada, H3C 3A7

12:00

12.5 ***Electrode Characteristics at High Current Pulse Stimulation***
Elvis Pacelat[1] , Ratko Magjarevic[1], Velimir Isgum[2]
[1]Faculty of Electrical Engineering and Computing, University of Zagreb, Unska 3, Zagreb, Croatia
[2]Clinical Medical Centre, Dpt. of Neurology, Zagreb, Croatia

12:15

12.6 ***New Low-Noise, Low-Voltage Instrumentation Amplifier Dedicated to Nerve Signal Recording***
Adnan Harb, Mohamad Sawan
Ecole Polytechnique de Montreal, Department of Electrical and Computer Engineering, P.O.Box. 6097, Station "Centre-Ville", Montreal (Qc), Canada H3C 3A7

12:30

12.7 ***Estimation of Conduction Velocity Distribution of Peripheral Nerve Trunks***

Y.X. Tu, S. Honda, Y. Tomita
Department of Instrumentation Engineering, Faculty of Science and Technology, Keio University, 3-14-1, Hiyoshi, Kohoku-Ku, Yokohama 223, Japan

12:45

12.8 ***Analysis of the Quadriceps Muscles Control Strategy in the Anterior Knee Pain***

M. Cesarelli, P. Bifulco, M. Bracale
University of Naples "Federico II", Dept. of Electronic Engineering, Bioengineering Unit, Via Claudio 21, 80125 Naples, Italy

LUNCH BREAK

TUESDAY 16 JUNE

Session 13: **Biosignal Processing 2: Cardiovascular System**

Time & Place: 11:00-12:30, Megaron B

Chairman: *S. Cerutti*
Department of Biomedical Engineering, Polythecnic University of Milan, Italy, Via di Priscilla, 59 – 00199 Roma - Italy

11:00

13.1 ***An Algorithm for the Detection and Classification of Atrial Fibrillation from Intra-Atrial Electrograms***
V. Barbaro, P. Bartolini, R. Bernarducci, G. Calcagnini, F. Martelli, S. Morelli
Biomedical Engineering Lab. - Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Roma, Italy

11:30

13.2 ***An Algorithm for the Detection of the Atrial Fibrillation from the Surface ECG for an of Home-Care Evaluation of the Implanted Atrial Defibrillators***
M. Cesarelli, P. Bifulco, M. Bracale
University of Naples "Federico II", Dept. of Electronic Engineering, Bioengineering Unit, Via Claudio 21, 80125 Naples, Italy

11:45

13.3 ***Simultaneous Recordings of Spontaneous Fluctuation in Heart Rate, Blood Pressure, Peripheral Blood Flow and Pupil Diameter: Analysis in the Frequency Domain***
Giovanni Calcagnini[1], Stefano Lino[2], Federica Censi[1], Giuseppe Calcagnini[2], Sergio Cerutti[3]
[1]Department of Information and System Science "La Sapienza" University of Rome, Italy
[2]Clinical Pathophysiology, "La Sapienza" University of Rome, Italy
[3]Department of Biomedical Engineering, Polythecnic University of Milan, Italy, Via di Priscilla 59, 00199 Roma - Italy

12:00

13.4 ***Quantification of Respiratory Influence in Hear Rate Variability Through Wavelet Packets Decomposition Algorithm***
L.T. Mainardi[1], G. Anastasi, R. Comi , S. Cerutti
[1]Department of Biomedical Engineering, Polytechnic University, via Golgi 39, 20133 Milano, Italy

12:15

13.5 ***A Statistical Comparison of Signal Representations and Spectral Estimators of Heart Rate Variability in Hypertensive Patients***

Marco Congi[1], Giovanni Calcagnini[2], Stefano Lino[3], Silvio Damiani[1], Sergio Cerutti[4]
[1]Department of Statistic, Probability and Applied Statistic, "La Sapienza" University of Rome, Italy
[2]Department of Information and System Science, "La Sapienza" University of Rome, Italy
[3]Clinical Pathophysiology, "La Sapienza" University of Rome, Italy
[4]Department of Biomedical Engineering, Polythecnic University of Milan, Italy

LUNCH BREAK

TUESDAY 16 JUNE

Session 14: **Radiotherapy**

Time & Place: 14:15-16:00, Panorama

Chairman: *N. Zamboglou*
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66
D-63069 Offenbach, Germany

14:15

14.1 ***Clinical Investigations of a CT-Based Reconstruction and 3D-Treatment Planning System in Interstitial Brachytherapy***
N. Zamboglou
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66 D-63069 Offenbach, Germany

14:30

14.2 ***Imaging Tools for Treatment Planning in Brachytherapy***
D. Baltas, S. Giannouli, N. Milickovic, A. Tsalpatouros, C. Kolotas, N. Zamboglou
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66 D-63069 Offenbach, Germany

14:45

14.3 ***Application of the Monte Carlo Integration Method in Calculations of Dose Distributions in HDR-Brachytherapy***
D. Baltas, S. Giannouli, K. Geramani, G. T. Ioannidis, C. Kolotas, N. Zamboglou
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66 D-63069 Offenbach, Germany

15:00

14.4 ***Endovascular Irradiations with Beta Sources***
W.F.O Schmidt[1,5], K. Mueck[2], R. Hawliczek[1,5], D. Lehmann[3], L. Pichler[4]
[1]Inst F Radiooncology (IRO), Donauspital Vienna
[2]Austrian Research Center Seibersdorf (ARCS)
[3]Inst F Radiotherapy, Univ. Dresden, FRG
[4] Inst F Radiology, Donauspital
[5] Ludwig Boltzmann Institute For Endovascular Radiotherapy

15:15

14.5 ***IORT: Intra-Operative Radiotherapy System in Surgery***
H. Nier, C. Kolotas, G. Sakas, M. Schmit, G. Strassmann, S. Walter, N. Zamboglou
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66 D-63069 Offenbach, Germany

15:30

14.6 ***Report of an Underdose Radiotherapy Accident***
G. Christodoulides, S. Christofides
Department of Medical Physics, Nicosia General Hospital, Cyprus

15:45

14.7 ***Performance and Beam Characteristics of the PANTAK THERAPAX HF225 X-Ray Therapy Machine***

C. Yiannakkaras, N. Papadopoulos, G. Christodoulides
Department of Medical Physics, Nicosia General Hospital, Cyprus

COFFEE BREAK

TUESDAY 16 JUNE

Session 15: **Clinical Engineering**

Time & Place: 14:15-16:00, Megaron A

Chairman: *N. Pallikarakis*
Department of Medical Physics, University of Patras,
26500 Patras, Greece

14:15

15.1 ***Acceptance Inspections Of Medical Devices In Health Care Facilities -The Quality Control Approach***
Amit Gefen, Nurit Gefen, Nadav Sheffer
Medical Devices Dept., Pharmaceutical Administration, Ministry of Health, Sheba Medical Center, Bldg 130, Tel Hashomer 52621, Tel-Aviv, Israel

14:30

15.2 ***Quality Management for Clinical Engineering Departments in Greece. The Use of Quality Indicators and Software Tools***
P. Malataras, S. Gikas-Panousis, V. Griva, Z. Kolitsi, N. Pallikarakis
Institute of Biomedical Technology, Boukaouri 93, Patras 26225, Greece

14:45

15.3 ***Biomedical Business Reengineering in Reference to the Strategy and Architecture of the used Information Systems, and the Biomedical Procedures Reconciliation to the Business Activities***
A. Angelis, S. Pavlopoulos, D. Koutsouris
Biomedical Engineering Laboratory, National Technical University of Athens, Department of Electrical and Computer Engineering, 9 Iroon Polytechniou St., GR-157 73 Zografou, Athens, Greece

15:00

15.4 ***Best Practices and Benchmarking in Clinical Engineering: Design of Surveying Tools***
M. Glouhova, Z. Kolitsi, N. Pallikarakis
Department of Medical Physics, University of Patras, 26500 Patras, Greece

15:15

15.5 ***Design, Installation, and Testing of Medical Gases Installations***
Soteris Kalogirou
Department of Mechanical Engineering, Higher Technical Institute, P. O. Box 423, Nicosia 2152, Cyprus

15:30

15.6 ***In-House Development of Test Equipment for Quality Control and Training Case Study: A Prototype ECG Simulator-Tester***
N. Kontodimopoulos[1], N. Pallikarakis[1], I. Christov[2], I. Daskalov[2]
[1]Institute of Biomedical Technology, Boukaouri 93, Patras 262 25, Greece
[2]Center of Biomedical Engineering, Akad. G. Bonchev Str., Sofia 1431, Bulgaria,

15:45

15.7 ***Nitrocom2 - A Modified Version of the Drug Delivery System (Nitrocom)***

J. Blachowicz[1], P. Ladyznski[1], J. Wojciki[1], K. Slomka[2], G. Opolski3
[1]Institute of Biocybernetics & Biomedical Engineering PAS, Warsaw, Poland
[2]Department of Cardiology Medical Academy, Warsaw, Poland
[3]Institute of Biocybernetics & Biomedical Engineering PAS, 4 Trojdena St., 02-109 Warsaw, Poland

COFFEE BREAK

TUESDAY 16 JUNE

Session 16: **Biosignal Processing 3: Cardiovascular System**

Time & Place: 14:15-16:00, Megaron B

Chairman: *S. Cerutti*
Department of Biomedical Engineering, Polythecnic University of Milan, Italy, Via di Priscilla, 59 – 00199 Roma - Italy

14:15

16.1 ***High Resolution ECG Filtering using the Wavelet Shrinkage Technique***
M. Popescu B. Nicula, P. Cristea, A. Bezerianos
Dept. of Medical Physics, Medical School, University of Patras, Patras 26500, Greece

14:30

16.2 ***Digital Filter for Ventricular Late Potentials Study***
E. Piatkowska-Janko[1], A. Piatkowski[1], G. Opolski[2]
[1]University of Technology, nowowiejska 15/19, 00-665 Warsaw, Poland
[2]Dept. of Cardiology, medical Academy, St. Banacha 1a, 02-097 Warsaw, Poland

14:45

16.3 ***Coefficient of Right Decision and Degree of Patient Verification in Ventricular HR-ECG***
E. Piatkowska-Janko[1], A. Piatkowski[1], G. Opolski[2]
[1]University of Technology, nowowiejska 15/19, 00-665 Warsaw, Poland
[2]Dept. of Cardiology, medical Academy, St. Banacha 1a, 02-097 Warsaw, Poland

15:00

16.4 ***The Optimal Criteria of Late Potentials for Segregation Patients with Ventricular Tachycardia***
E. Piatkowska-Janko[1], A. Piatkowski[1], G. Opolski[2]
[1]University of Technology, nowowiejska 15/19, 00-665 Warsaw, Poland
[2] Dept. of Cardiology, medical Academy, St. Banacha 1a, 02-097 Warsaw, Poland

15:15

16.5 ***Arterial Blood Pressure Analysis by Artificial Neural Networks for the Prediction of Peri-Intra Ventricular Hemorrhage in Premature Newborn Infants***
G. Mondo, C. Ruggiero, R. Sacile
Dept. of Communication, Computer and System Sciences, University of Genoa, Via Opera Pia 13, 16145 Genoa, Italy

15:30 *Student Paper*

16.6 ***Bi-Dimensional Feature Selection of Electrocardiographic Data***
C.D Nugent[1], J.A.C Webb[1], N.D Black[1], M. McIntyre[2]
[1]The Northern Ireland Bio-Engineering Center, School of Electrical and Mechanical Engineering, University of Ulster at Jordanstown, Shore Road, Newtownabbey, BT37 0QB, Northern Ireland
[2] Cardiology Department, Royal Victoria Hospital, Belfast, Northern Ireland

15:45 *Student Paper*

16.7 ***Bi-Group Neural Network Classification of the 12-Lead ECG***

C.D Nugent[1], J.A.C Webb[1], N.D Black[1], M. McIntyre[2]
[1]The Northern Ireland Bio-Engineering Center, School of Electrical and Mechanical Engineering, University of Ulster at Jordanstown, Shore Road, Newtownabbey, BT37 0QB, Northern Ireland
[2]Cardiology Department, Royal Victoria Hospital, Belfast, Northern Ireland

COFFEE BREAK

TUESDAY 16 JUNE

Session 17: **Radiotherapy & Radiation Protection**

Time & Place: 16:45-18:45, Panorama

Chairman: *D. Baltas*
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66
D-63069 Offenbach, Germany

16:45

17.1 ***From 2D-Images to 3D Models, from Diagnosis to Treatment: IT-Based Methods in the Medicine of Tomorrow***
G. Sakas
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66 D-63069 Offenbach, Germany

17:00

17.2 ***EXOMIO: IT-Based Virtual Simulation goes Clinics***
D. Baltas, W. Cal, G. Karangelis, G. Sakas, N. Zamboglou
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66 D-63069 Offenbach, Germany

17:15

17.3 ***A Distortion Correction Method for Image Intensifier and Electronic Portal Images used in Radiotherapy***
G. T. Ioannidis, K. Geramani, N. Uzunoglu, N. Zamboglou
Stradtische Kliniken Offenbach, Strahlenklinik Stankenburgring 66 D-63069 Offenbach, Germany

17:30

17.4 ***Dose Calculations Algorithm for Narrow Heavy Charged-Particle Beams***
E.A. Barna[1], F. Scariat[2], C. Kappas[1]
[1]Department of Medical Physics, School of Medicine, University of Patras, Greece
[2]National Institute for Laser and Plasma Physics, Bucharest, Romania

17:45

17.5 ***Simulation Model for Predicting the Thermal Effects of a Focused Ultrasound Transducer with Internal Diagnostic Ultrasonic Element***
C. Damianou
Department of Electrical and Computer Engineering, Frederick Institute of Technology, 7 Yianni Frederickou, Pallouriotisa, Nicosia, Cyprus.

18:00

17.6 ***Results of a QC Program on Dental Radiography in Greece***
George Pappous[1], Zoi Kolitsi[1], Gerasimos Arvanitakis[2], Nikolas Pallikarakis[1]
[1] Medical Physics Department, Patras University, 26 500 Greece
[2] Achaia branch of Hellenic dental Association, Pantanasis 70-72, 262 21 Greece

18:15

17.7 ***Occupational Radiation Exposures in Cyprus***

P.A. Kaplanis, S. Christofides
Department of Medical Physics, Nicosia General Hospital, Cyprus

18:30

17.8 ***Program of Yugoslav Society for Additional Professional Education in Medical Physics***

S. Andric[1] , S. Stankovic[2] , R.Spaic[3] M. Veskovic[4]
[1]Institute of Nuclear Sciences "Vinca" Belgrade, Yugoslavia
[3]Military Medical Academy Belgrade
[2,4]Institute of Physics Novi Sad University

TUESDAY 16 JUNE

Session 18: **European Electronic Market Environment For Medical Devices-The MEDICOM Project**

Time & Place: 16:45-18:45, Megaron B

Chairman: *D. Koutsouris*
National Technical University of Athens, Biomedical Engineering Laboratory, 9 Iroon Polytechniou Str., Zografou Campus, H/Y Building, 15773 Athens, Greece

16:45

18.1 ***Requirements Analysis Of The Medical Devices Commerce Community***
O. Panou-Diamandi[1], N. Katevas[1], M.A. Bianchi[2], C. Andreucci[3] and S. Copelli[4]
[1]National Technical University of Athens, Biomedical Engineering Laboratory, 9 Iroon Polytechniou Str., Zografou Campus, H/Y Building, 15773 Athens, Greece,
[2]AUSL DI MODENA, Dept. of Direzione Sanitaria, Via S. Giovanni del Cantone 23, 41100, Modena, Italy
[3]ESAOTE S.p.A, Programmi R&S, Via Di Caciolle 15, 50127, Firenze, Italy
[4]R&S Informatica srl, Via Lazzaroni 4, 20124 Milano, Italy

17:15

18.2 ***Medical Products Electronic Commerce PROJECT : THE Approach***
D. Koutsouris, N. Katevas
National Technical University of Athens, Biomedical Engineering Laboratory, 9 Iroon Polytechniou Str., Zografou Campus, H/Y Building, 15773 Athens, Greece

17:30

18.3 ***Medical Products Electronic Commerce: Architectural And Functionality Issues***
N. Katevas[1], I. Vlachos[1], S. Palamas[1], E. Marinos[1], O. Panou-Diamandi[1], C. Zeelenberg[2], C. van Nimwegen[2] , S. Smith[3], J. Buerstenbinder[3] and N. Louail[3]
[1]National Technical University of Athens, Biomedical Engineering Laboratory, 9 Iroon Polytechniou Str., Zografou Campus, H/Y Building, 15773 Athens, Greece
[2]Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO)-Prevention and Health, Dept. of Technology in Healthcare, Zernikedreef 9, P.O. Box 2215, 2301 ce Leiden, Netherlands
[3]Pixelpark Multimedia - Agentur GmbH, Dept. of R&D, Ruechlinstr. 10-11, 10553 Berlin, Germany

18:00

18.4 ***Discussions on Medicom Market Place***
C. Bayart Noe[1], N. Benamou[2]
[1]Socit Electronique Informatique Systemes (SELISA), Cerisaie 207, 8/10 rue de Chevilly, 94262 Fresnes Cedex, France
[2]Business Flow Consulting (BFC), 41 bis avenue de l' Europe, BP264 78147 Velizy Cedex, France

TUESDAY 16 JUNE

Session 19: **Biosignal Processing 4**

Time & Place: 16:45-18:45, Megaron B

Chairman : *R. Magjarevic*
University of Zagreb, Faculty of Electrical Engineering and Computing, Unska 3, Zagreb, Croatia

16:45

19.1 A ***Stimulating Pulse Generation and Spectrogram Illustration for Cochlear-Implant Based on Filter Bank Design Approach***
Ahmed Ben Hamida
GRAMS (Groupe de Recherche en Appareillage Medical de Sherbrooke, Canada, Electrical Engineering Department, Sherbrooke University, Sherbrooke, QC, Canada J1K 2R1

17:00

19.2 ***Investigation of the Missing Fundamental by a Cochlea Model***
Takahide Matsuoka, Yoshihito Ono
Faculty of Engineering Utsunomiya University Utsunomiya city, Japan

17:15

19.3 ***EOG Basaline Oscillation in Congenital Nystagmus***
M. Cesarelli[1], P. Bifulco[1], L. Loffredo[2]
[1]Univ. of Naples "Federico II", Dept. of Electronic Engineering, Bioengineering Unit, Italy
[2]Univ. of Naples "Federico II", Inst. of Ophtalmology, Via Claudio 21, 80125 Naples, Italy

17:30

19.4 ***Evaluation of the Characteristics of Smooth Pursuit Eye Movements to Sinusoidal Stimulation by Means of an ARMA Model***
A.P. Accardo[1], S. Vlahinic[1], S. Pensiero[2]
[1]D.E.E.I., University of Trieste, Via Valerio, 10, I34100 Trieste, Italy
[2]Div. Oculistica, Children Hospital 'Burlo Garofolo', V. dell'Istria, I34100 Trieste, Italy

17:45

19.5 ***Use of Running Statistical Evaluation in Analysis of Electrohysterographic Signals***
Slawomir Graczyk, Krzysztof Horoba, Janusz Jezewski, Janusz Wrobel, Adam Gacek
Department of Biomedical Informatics, Institute of Medical Technology and Equipment, 345A Wolnosci St., 41-800 Zabrze, POLAND

18:00

19.6 ***New Methods for CTG Fetal Monitoring***
Giovanni Magenes[1], Maria G. Signorini[2], Piero M. Brambilla[3], Domenico Arduini[4], Sergio Cerutti[1]
[1]Dipartimento di Informatica e Sistemistica, Università di Pavia, via Ferrata 1, 27100 Pavia, Italy
[2]Dipartimento di Bioingegneria, Politecnico di Milano, Italy
[3]Hewlett Packard Italia, Cernusco S.N., Italy
[4]Clinica Ostetrica, Università di Roma "Tor Vergata", Italy

18:15

19.7 ***Intestinal Motility Recording and Analysis***

C. Pastiadis[1], G. Papanikolaou[2], C. Dimoulas[3], A. Kalampakas[4]
[1]Laboratory of Electroacoustics, Dept. of Electrical & Computer Engineering, Aristotel Univ. of Thessaloniki, Greece
[2]Laboratory of Electroacoustics, Dept. of Electrical & Computer Engineering, Aristotle Univ. of Thessaloniki, Greece
[3]Laboratory of Electroacoustics, Dept. of Electrical and Computer Engineering, Aristotle Univ. of Thessaloniki, Greece
[4]Medical School, Aristotle Univ. of Thessaloniki, Greece

18:30 *Student Paper*

19.8 ***Enhanced De-Noising of Bowel Sounds using a Wavelet- Based Filter***

C.N. Liatsos[1,3,4], L.J. Hadjileontiadis[2], C.C. Mavrogiannis[3], T.A. Rokkas[4], S.M. Panas[2]
[1]Athens University, Dept. of Pharmacology, 114 Vasilisis Sophias Ave., GR 11527, Athens, Greece
[2]Aristotle University of Thessaloniki, School of Technology, Dept. of Electrical & Computer Engineering, University Campus, GR 54006 Thassaloniki, Greece
[3]Athens University, Dept. of Internal Medicine, Faculty of Nursing, 114 Vasilisis Sophias Ave., GR 11527, Athens, Greece
[4]Army General Hospital, Mesogion and Kaehaki Ave., GR 11525, Athens, Greece

WEDNESDAY 17 JUNE

Plenary Session 3

Time & Place: 08:20-10:30, Panorama

Chairman: *C.S. Pattichis*
Department of Computer Science, University of Cyprus

08:20

20.1 ***Computers in Surgery and Diagnosis***
Evangelia Micheli-Tzanakou
Department of Biomedical Engineering, Rutgers University, NJ, USA

09:15

20.2 ***Problems and Tendencies in Application and Development of Expert Systems in Medicine***
Zoran Bozovic[1], Vladan Devedzic[2], Aleksandar Stojiljkovic[1]
[1]Center for Multidisciplinary Studies of the University of Belgrade, Kneza Viseslava 1, 11000 Belgrade, Yugoslavia
[2] Faculty for Organizational Sciences of the University of Belgrade

09:35

20.3 ***Clinical Data Warehousing - A Survey***
Torben Bach Pedersen[1], Christian S. Jensen[2]
[1] Kommunedata, Center for Health Informatics, P.O. Pedersensvej 2, DK-8200 Arhus N, Denmark
[2] Department of Computer Science, Aalborg University, Fredrik Bajers Vej 7E, DK-9220 Aalbor Ost, Denmark

9:55

20.4 ***Collaboration of Biomedical Engineering and Medical Informatics On the Road to Citizen-Centred Care***
Ilias Iakovidis
European Commission, DGXIII, Brussels, Belgium

COFFEE BREAK

WEDNESDAY 17 JUNE

Session 21: **Medical Imaging 4: Image Processing & Multimodality Imaging**

Time & Place: 11:00-12:30, Panorama

Chairman: *V. C. Roberts*
Kings College School of Medicine and Dentistry, London, UK

11:00

21.1 ***Medical Imaging Interpolation Technique Based on Mathematical Morphology***
G. Matsopoulos, N. Mouravliansky, K. Delibasis, K.S. Nikita
Department of Electrical and Computer Engineering, National Technical University of Athens, Greece

11:15

21.2 ***An Object-Oriented Client-Server System for Interactive Segmentation of Medical Images using the Generalised Active Contours Model***
Alan L. Scheinine, Marco Donizelli, Marco Pescosolido, Piero Pili, Andrea Giachetti, Massimiliano Tuveri, Gianluigi Zanetti
CRS4 (Center for Advanced Studies, Research and Development in Sardinia) via Nazario Sauro 10, 09123 Cagliari, Italy

11:30

21.3 ***Medical Imaging Interpolation Technique Based on Mathematical Morphology A Lossless Compression Algorithm for Medical Images using Variable Block Size Segmentation***
Z. Brahimi, K. Ait saadi, N. Baraka
Centre de Développement des Technologies Avancées, 128, Chemin Mohamed Gacem, B.P. 245 El Madania, Alger, Algerie

11:45

21.4 ***Hybrid Approach for Still Image Compression Based on Fractal Approximation and Vector Quantification***
K. Ait saadi, Z. Brahimi, N. Baraka
Centre de Développement des Technologies Avancées, 128, Chemin Mohamed Gacem, B.P. 245 El Madania, Alger, Algerie

12:00

21.5 ***A Hardware-Software System for Visualization and Imaging Human Electric Potential***
K. Delibasis, Ch. Michael, N. Mouravliansky, K. Papaodysseas
Department of Electrical and Computer Engineering, Institute of Communication & Computer Systems, National Technical University of Athens, Zografou 15773, Athens, Greece

12:15

21.6 ***A Three-Dimensional Correlation Method for Registration of Medical Images in Radiology***

Michalakis F. Georgiou[1], Joachim H. Nagel[2], George N. Sfakianakis[3]
[1,3]Department of Radiology, University of Miami / Jackson Memorial Hospital, Miami, FL 33136, USA
[2]Institute of Biomedical Engineering, University of Stuttgart, Stuttgart 70174, Germany

12:30

21.7 ***Restricted Surface Matching: A New Registration Method for Medical mages***

Jianxing Gong, Lucia Zamorano, Zhaowei Jiang, Fernando Diaz
Wayne State University, Detroit, MI 40201, USA

LUNCH BREAK

WEDNESDAY 17 JUNE

Session 22: **Nerve & Muscle 2**

Time & Place: 11:00-13:30, Megaron A

Chairman: *G. Dimitrov and N. Dimitrova*
Centre of Biomedical Engineering, Bulgarian Academy of Sciences, Acad. G.Bonchev Str., Bl.105, Sofia 1113, Bulgaria

11:00

22.1 ***Classifying Arm Movements in Tetraplegics with Artificial Neural Networks***
Radmila Maksimovic, Mirjana Popovic
Faculty of Electrical Engineering, Bulevar Revolucije 73, 11000 Belgrade, Yugoslavia

11:15

22.2 ***Recurrence Quantification Analysis of Surface Electromyograms***
G. Filligoi[1] , F. Felici[2] , M.Vicini[1] ,A. Rosponi[2]
[1]Dipartimento Infocom, Facoltà di Ingegneria Via Eudossiana 18, 00184 Roma Università "La Sapienza", Italy
[2]Dipartimento di Fisiologia, Biofisica e Nutrizione "Luigi Luciani", Università di Roma "La Sapienza", Italy

11:30

22.3 ***Bispectrum Analysis of Surface EMG***
P.A.Kaplanis[1,2], C.S.Pattichis[3], S.Spyrou[1,4], C.V. Roberts[1], C. Christodoulou[2,5]
[1]Kings College School of Medicine and Dentistry, University of London, U.K.
[2]The Cyprus Institute of Neurology and Genetics, P.O. Box 3462, Nicosia Cyprus
[3]Dept. of Computer Science, University of Cyprus, Kallipoleos 75, Nicosia, Cyprus
[4]Higher Technical Institute, Nicosia, Cyprus
[5]Queen's Mary College, University of London U.K.

11:45

22.4 ***A Fully Integrated, Intelligent and Quantitative Working Environment for the EMG Evaluation***
D. Majidi[1], E. Palanca[1], A. Starita[1], T. Marsili[2], F. Giannini[2], R. Cioni[2]
[1]Computer Science Department, University of Pisa, Corso Italia 40, 56125 Pisa, Italy,
[2]Clinic of Mental and Nervous Diseases, University of Siena, Viale Bracci, 53100 Siena, Italy

12:00

22.5 ***A Multi-feature / Multi Classifier System in EMG Diagnosis***
C.I. Christodoulou, C.S. Pattichis
Department of Computer Science, University of Cyprus, Kallipoleos 75, P.O. Box 537, Nicosia, CY1678, Cyprus

12:15

22.6 ***A Computer Aided Scanning EMG System***

S.P. Spyrou[1,4], C.S. Pattichis[2,3], E. Economou[2], V. C. Roberts[4], L.T. Middleton[3]
[1]Higher Technical Institute, Nicosia, Cyprus
[2]Dept. of Computer Science, University of Cyprus, Cyprus
[3]The Cyprus Institute of Neurology and Genetics, Cyprus
[4]Dept. of Medical Engineering, King's College School of Medicine & Dentistry, London, UK

12:30

22.7 ***Model Based Decomposition of MUAPS into their Constituent SFEAPS***

M. Xyda, C. S. Pattichis
Department of Computer Science, University of Cyprus, Cyprus

12:45

22.8 ***What Does 'Belly-Tendon' Recording of Single Fibre Action Potential Reflect?***

G.V. Dimitrov, N.A.Dimitrova
Centre of Biomedical Engineering, Bulgarian Academy of Sciences, Acad. G.Bonchev Str., Bl.105, Sofia 1113, Bulgaria

13:00

22.9 ***Calculation of the Potentials Produced by Inclined Muscle Fibres at a Rectangular Electrode***

N.A. Dimitrova, A.G. Dimitrov, G.V. Dimitrov
Centre of Biomedical Engineering, Bulgarian Academy of Sciences, Acad. G.Bonchev Str., Bl. 105, Sofia 1113, Bulgaria

13:15

22.10 ***On Two Approaches in Describing Biological Signals for their Classification Based on Shape***

Mihai T. Tarata
Medical Informatics, Faculty of Medicine, University of Craiova, Romania, Bul. Maresal Antonescu 62, Craiova, RO-1100, Romania

LUNCH BREAK

WEDNESDAY 17 JUNE

Session 23: **Cardiovascular Systems: Experimental and Applied**

Time & Place: 11:00-12:45, Megaron B

Chairman: *S. Sideman*
Julius Silver Institute of Biomedical Engineering, Department of Biomedical Engineering,, Technion - Israel Institute of Technology, Haifa 32000, Israel

11:00

23.1 ***Effect of Ejection Velocity on Pressure Generation in the Heart. In Situ Canine Studies***
A. Landesberg, P. Liu, O. Lichtenstein, R. Shofti, R. Beyarand, S. Sideman
Julius Silver Institute of Biomedical Engineering, Department of Biomedical Engineering, Technion - Israel Institute of Technology, Haifa 32000, Israel

11:30

23.2 ***Multipolar Transesophageal Pacing Leads Sensitivity and Selectivity***
Ratko Magjarevic[1], Igor Kršic[1], Bozidar Ferek-Petric[2]
[1]University of Zagreb, Faculty of Electrical Engineering and Computing, Unska 3, Zagreb, Croatia
[2]Medtronic B.V., Zagreb, Croatia

11:45

23.3 ***Autonomic Response to Transcranial Magnetic Stimulation: Adaptive Filtering of the Heart Rate Variability***
U.J. Scholz[1], L. Niehaus[1], L.C.G. Hahn[1], A.M. Bianchi[2], B.-U. Meyer[1]
[1]Dept. of Neurology, Charité, Humboldt-University, Berlin, Germany,
[2]Dept. of Bioengineering, Politecnico Milano, Italy

12:00

23.4 ***Using Computerized System for Measurement of Intima-Media Complex***
W. Kwiatkowska[1], J. Kwiatkowski[2], K. Kawa[2]
[1]Department and Cllinic of Angiology, Medical Academy of Wroclaw 50-326 Wroclaw, Poniatowskiego 2, Poland
[2]Computer Science Department, Wroclaw University of Technology, 50-370 Wroclaw, Wybrzeze Wyspianskiego 27, Poland

12:15

23.5 ***Whole Blood Viscosity at Low Shear Stresses in Hypertension***
G. Marinakis[1], S. Tsangaris[1], J. Barbenel[2]
[1]Fluids Section, Dept. Mechanical Engineering, National Technical University of Athens, 157 10 Athens, Greece
[2]Bioengineering Unit, University of Strathclyde, Wolfson Centre, 106 Rottenrow, Glasgow, G4 ONW, Scotland, U.K.

12:30

23.6 ***Comparison Between Numerical Flow Simulations and MR Measures on Glass Anastomosis Models***
A. Giachetti, G. Zanetti, S. Cadeddu, M. Tuveri[1], N-H. Staalsen, S. Ringgaard[2]
[1]CRS4 - Via N. Sauro 10, Cagliari, Italy
[2]Vascular Surgery Skejby Sygehus, Aarhus University Hospital, Denmark

LUNCH BREAK

WEDNESDAY 17 JUNE

Session 24: **Intelligent systems 1**

Time & Place: 14:15-16:15, Panorama

Chairman: *S. Panas*
Aristotle University of Thessaloniki, School of Technology, Dept. of Electrical & Computer Engineering, University Campus, GR 54006 Thassaloniki, Greece

14:15 *Student Paper*

24.1 ***Feature Selection for Multiple Binary Classification Problems in Biomedical Data Analysis***
Yair Shapira, Isak Gath
Dept.of Biomedical Engineering, Technion, Haifa 32000, Israel,

14:30 *Student Paper*

24.2 ***Knowledge Discovery in Electrocardiographic Data Based on Neural Clustering Algorithms***
F. Azuaje[1], W. Dubitzky[2], P. Lopes[1,3], N. Black[1] , K. Adamson[1,2], X. Wu[2], J.A. White[4]
[1]Northern Ireland Bio-Engineering Centre (NIBEC), University of Ulster, Newtownabbey, Co. Antrim BT37, 0QB, Northern Ireland
[2]School of Information and Software Engineering, University of Ulster, Newtownabbey, Co. Antrim BT37, 0QB, Northern Ireland
[3]Chelsea School Research Centre, University of Brighton, Eastbourne, England
[4]Dept. of Public Health Medicine and Epidemiology, University Hospital, Queen's Medical Centre, Nottingham, NG7 2UH, England

14:45

24.3 ***Fuzzy Rule Based Ranking of Parameters Influencing on Magnitude and Prognosis of Acute Myocardial Infarction Patients***
Slobodan Milutinovic[1], Milos Manic[1], Miloje Tomasevic[2], Milan Pavlovic[2], Bratislav Randjelovic[3], Danijela Djordjevic[3]
[1]Faculty of Occupational Safety, Univ. of Nis, Yugoslavia, add. Carnojevica 10a, 18000 Nis, Yugoslavia
[2]Faculty of Medicine, Univ. of Nis, Yugoslavia
[3]Hospital of Cardiovascular Diseases, KC of Nis, Yugoslavia

15:00

24.4 ***A Decision Support Software Package for medical treatment of I.C.U patients***
N. Sphiris[1], H. Paraskevopoulou[1], S. Nanas[2], A. Lymberis[1], Ch. Roussos[2]
[1]Hitech Consultants, 15 Akadimias str., Athens, Greece
[2]Department of Critical Care, Medical School, University of Athens, Athens, Greece

15:15

24.5 ***Fuzzy Neural Network Based Characterization of Diffused Liver Diseases using Image Texture Analysis Techniques on Ultrasonic Images***

E. Kyriacou[1], S. Pavlopoulos[1], D. Koutsouris[1], K. Blekas[2], A. Stafylopatis[2],
P. Zoumpoulis[3]
[1]Biomedical Engineering Laboratory
[2]Computer Systems Laboratory, National Technical University of Athens,Greece Department of Electrical and Computer Engineering, National Technical University of Athens,Greece
[3] Ultrasound Department, Eugenidion Hospital, University of Athens, Greece

15:30

24.6 ***Classification of Asthmatic Lung Sound Spectra***

M. Oud[1], E. H. Dooijes[1], M. J. van der Veen[2]
[1]Computer Science Dept., University of Amsterdam, Kruislaan 403, 1098 SJ Amsterdam, The Netherlands
[2]Dept. of Pulmonology, Academic Medical Centre, Amsterdam, The Netherlands

15:45

24.7 ***Determination of Suitable Markers by the GUHA Method for the Prediction of Bleeding at Patients with Chronic Lymphoblastic Leukemia***

Vaclav Sebesta[1], Libor Straka[2]
[1]Institute of Computer Science, Academy of Sciences of the Czech Republic Pod vodarenskou vezi 2, 182 07, Prague 8, Czech Republic
[2]Dept. of medical Biophysics, Faculty of Medicine, Charles University, Hradec Králove, Czech Republic

16:00

24.8 ***Establishing Criteria for Automated Evaluation of Non-Stress Test in Antepartum Cardiotocography***

Janusz Jezewski, Janusz Wrobel, Krzysztof Horoba, Slawomir Graczyk Department of Biomedical Informatics, Institute of Medical Technology and Equipment, 345A Wolnosci St., 41-800 Zabrze, Poland

COFFEE BREAK

WEDNESDAY 17 JUNE

Session 25: **Instrumentation 1**

Time & Place: 14:15-15:30, Megaron A

Chairmen: *A. Avgousti[1] and S. Spyrou[2]*
[1]School of Applied Physics, Kingston University, Penrhyn Rd, Kingston, Surrey, KT1 2EE UK
[2]Higher Technical Institute, Cyprus

14:15

25.1 ***Image Gating in MR Scanners using a Fiber Optic Respiration Monitor***
Andy T. Augousti, Ali Raza
School of Applied Physics, Kingston University, Penrhyn Rd, Kingston, Surrey, KT1 2EE UK

14:30

25.2 ***Optical Self-Mixing in a Diode Laser As a Method for No Touch Pulse Measurement***
Kalju Meigas, Hiie Hinrikus, Jaanus Lass Rain Kattai
Biomedical Engineering Centre, Tallinn Technical University, Ehitajate 5, EE0026, Tallinn, Estonia

14:45 *Student Paper*

25.3 ***Investigation of Photoplethysmographic Signals in the Human Oesophagus***
P.A Kyriacou[1], A. Gregg[2], R.M Langford[2], D.P Jones[1]
[1]Department of Medical Electronics & Physics, St. Bartholomew's & The Royal London School of Medicine & Dentistry, Queen Mary & Westfield College, Charterhouse Square, London EC1M 6BQ, UK
[2]Anaesthetic Department, Royal Hospitals NHS Trust, St. Bartholomew's Hospital, West Smithfield, London EC1A 7BE, UK

15:00

25.4 ***Device for Air In Line Detection (AILD)***
Yiannis Koumpouros[1,2], Dimitris Koutsouris[1]
[1]Biomedical Engineering Laboratory, Department of Electrical & Computer Engineering, National Technical, University of Athens, Zografou Campus, 9 Iroon Polytechniou Str, 157 73, Zografou, Greece, [2] 31 D. Gounari Str, 12131, Athens, Greece

15:15

25.5 ***Medical Devices Directives and their Implementation in the United Kingdom***
A. Kyrou
Medical Devices Agency, London, U.K.

WEDNESDAY 17 JUNE

Session 26: **Cardiovascular Systems: Heart Rate-Signal Analysis**

Time & Place: 14:15-16:00, Megaron B

Chairman: *D. Adam*
The Heart Research Center, Department of Biomedical Engineering, Technion - I.I.T. Haifa 32000, Israel

14:15

26.1 ***Autonomic Nervous Function in Rabbit Myocardium After Atropine Administration: Evaluation by Spectral Analysis of R-R Interval Variability***
Tanja Princi[1], Daniel Peterec[2]
[1]Dipartimento di Fisiologia e Patologia, Università degli Studi di Trieste, Via A. Fleming 22, 34127 Trieste, Italy
[2]Institute of Physiology, Faculty of Medicine, University of Ljubljana, Zaloška 4,1000 Ljubljana, Slovenia

14:30

26.2 ***Individualisation of Model for Reconstruction of Heart Rate***
Jaanus Lass[1], Hiie Hinrikus[1], Jüri Kaik[2], Kalju Meigas[1]
[1]Biomedical Engineering Centre, Tallinn Technical University, Ehitajate 5, EE0026 Tallinn, Estonia
[2]Estonian Institute of Cardiology 18 Ravi Str., EE0001, Tallinn, Estonia

14:45

26.3 ***Assessment of Heart Failure by Means of Beat-To-Beat Series of Left Ventricular Volume: A Preliminary Study***
E. G. Caiani[1], A. Porta[1], S. Cerutti[1], M. Turiel[2], S. Muzzupappa[2]
[1]Dipartimento di Bioingegneria, Politecnico di Milano, P.zza L. da Vinci, 32 - 20133 Milano, Italia
[2]Medicina II, Ospedale L. Sacco, Università di Milano, Via G. B. Grassi, 74 - 20157 Milano, Italia

15:00

26.4 ***A New Neural Network System for Arrhythmias Classification***
N. Izeboudjen[1], A. Farah[2]
[1]Centre de Developpement des Technologies Avancees Laboratoire Microélectronique 128, Mohamed Gacem, El madania Alger, Algerie
[2]Ecole Nationale Polytechniques Departement Electronique 10, avenue Hassen Badi El harrach, Alger, Algerie

15:15

26.5 ***Application of Recurrence Plots on Cardiovascular Pressure and Flow Signals***
Stephan Schulz[1], Robert Bauernschmitt[1], Andreas Schwarzhaupt[2], C.F. Vahl[1], Uwe Kiencke[2]
[1]Dept. of Cardiac Surgery, Experimental Laboratory, University of Heidelberg, INF 326, 69120 Heidelberg, Germany
[2]Institute of Industrial Information Technique, University of Karlsruhe, PO Box 69 80, 76128 Karlsruhe, Germany

15:30

26.6 ***Correlation Between the Invasive and Non-Invasive Parameters of Cardiac Ventricular Repolarization Prolongation and Inhomogeneity***

Jüri Kaik[2], Hiie Hinrikus[1], Kalju Meigas[1], Jaanus Lass[1]
[1]Biomedical Engineering Centre of Tallinn Technical University, Ehitajate 5 EE0026 Tallinn
[2]Estonian Institute of Cardiology 18 Ravi Str. EE0001, Tallinn, Estonia

15:45

26.7 ***Whole-Heart Modeling: integrating structure and Function***

G.P. Kremmydas[1,2], A.V. Holden[2], A. Bezerianos[3]
[1]Department of Computer Applications, L.U.M.C., Kefalonia, Greece
[2]Computational Biology Group, CNLS, University of Leeds, Leeds LS2 9JT, England
[3]Department of Medical Physics, Medical School, University of Patras, Greece

COFFEE BREAK

WEDNESDAY 17 JUNE

Session 27: **Telemedicine/Intelligent Systems 2**

Time & Place: 16:45-18:45, Panorama

Chairman: S. *Pavlopoulos*
Biomedical Engineering Laboratory, Department of Electrical & Computer Engineering, National, Technical University of Athens, Zografou Campus, 9 Iroon Polytechniou St., 157 73 Zografou Greece

16:45

27.1 ***Design and Development of an Intranet Hospital Information System***
S. Pavlopoulos, T. Tagaris, A. Berler, D. Koutsouris
Biomedical Engineering Laboratory, Department of Electrical & Computer Engineering, National, Technical University of Athens, Zografou Campus, 9 Iroon Polytechniou St., 157 73 Zografou Greece

17:00

27.2 ***Health Promotion Programme in Nutrition Through Telemedicine***
A.Tsarouhi, P. Chatzipantazi, K. Karamolegou, E. Lappa, M. Tsagaris, E. Kosmaoglou, V. Grapatza, P. Karamolegou, D. Tsantoulas
Advisory Centre of Nutrition, Sismanoglion Hospital, Telemedicine Centre , Simanoglion Hospital, Health Care Centre of Thira

17:15

27.3 ***Distance Information, Support and Communication for European Carers***
P. Angelidis, G. Anogiannakis, S. Maglavera
BIOTRAST S.A., Thessaloniki, Greece, Mitropoleos 111, GR54622 Thessaloniki, Greece

17:30

27.4 ***User Friendly Data Base for Automation in a Virological Laboratory***
M. Giacomini[1,2,3], C. Ruggiero[1,2], I. Martini[3], J.L. McDermott[3], O.E. Varnier[3,4]
[1]DIST - Department of Communication Computer and System Sciences, University of Genova, Via Opera Pia 13, 16145 Genova, Italy
[2]DIST laboratory, Advanced Biotechnology Center, Genova, Italy
[3]Molecular Virology Unit, Advanced Biotechnology Center, Genova, Italy
[4]Department of Clinical and Experimental Oncology, School of Medicine, University of Genova, Italy

17:45

27.5 ***Automatic Wheezes Detection using Wavelet Packets***
M. Bahoura, M. Hubin
Laboratoire Capteurs, Instrumentation et Analyse (LCIA), INSA de Rouen B.P. 08, F-76131 Mont Saint Aignan, France

18:00

27.6 ***Automatic Babbling Identification by Means of a Fractal Dimension Based Technique***
A. Accardo, A. Bisso
D.E.E.I., University of Trieste, Via Valerio, 10, I34100 Trieste, Italy

18:15

27.7 ***Survival Data Analysis Using Neural Networks***

Elena Ellioti
Aston University, Birmingham, UK

18:30

27.8 ***Vis Et Pressus in Coxa Simulator***

Vlado Stankovski[1], Aleš Iglič[2], Veronika Kralj-Iglič[3], Dragica Smrke[1], Boštjan Kersnič[1]
[1]Clinic of Traumatology, Zaloška 2, SI-1000 Ljubljana, Slovenia
[2]Faculty of Electrical Engineering, Trzaška 25, SI-1000 Ljubljana, Slovenia
[3]Institute of Biophysics, Medical Faculty, Lipiceva 2, SI-1000 Ljubljana, Slovenia

WEDNESDAY 17 JUNE

Session 28: **Instrumentation 2**

Time & Place: 16:45-18:00, Megaron A

Chairman: *A. Avgousti*
School of Applied Physics, Kingston University, Penrhyn Rd, Kingston, Surrey, KT1 2EE UK

16:45

28.1 ***2.45 GHz Telecommand for Ambulatory Patient Monitoring Applications***
G.C. Crumley, N.E. Evans, W.G. Scanlon
N Ireland Bioengineering Centre & School of Electrical and Mechanical Engineering University of Ulster, Shore Road, Newtownabbey, Co Antrim, N Ireland, UK, BT37 0QB

17:00

28.2 ***Reliability of Compartmental Syndrome Assessment using Bioimpedance Measurement***
Stanko Tonkovic[1], Denis Voloder[1], Ivana Tonkovic[2], Mladen Petrunic[2]
[1]Faculty of Electrical Engineering and Computing, 3 Unska, 10000 Zagreb, Croatia; [2]School of Medecine, Surgical Clinic, 12 Kispaticeva, 10000 Zagreb, Croatia

17:15

28.3 ***An Integrated Instrumentation Approach for the Study of Venous***
Leg Ulcers David Wertheim[1], John Melhuish[2], Andreas Hoppe[1], Robert Williams[1], Keith Harding[2]
[1]Department of Electronics and I.T., University of Glamorgan, Pontypridd. CF37 1DL. U.K.
[2]Wound Healing Research Unit, Department of Surgery, University of Wales College of Medicine, Cardiff, CF4 4XN. U.K

17:30

28.4 ***Measurement of Functional Parameters of Defibrillators***
Ivo Iliev[1], Spiridon Gikas Panousis[2]
[1]Department of Electronics, Technical University, Bulgaria, Sofia
[2]University of Patras, Laboratory of Medical Physics, Greece

17:45

28.5 ***IBM PC Based Rearl –Time TV Tracking & Electrical Activity Recording System***
Yu. Kaminsky, J.Bures and I.Krekule
Inst. of Physiology, Acad. of Sci. of the Czech Rep., Prague Videnska 1083, 14220 Prague 4, Czech Rep.

WEDNESDAY 17 JUNE

Session 29: **Quantitative Analysis of Ultrasonic Imaging of Atherosclerotic Plaques**

Time & Place: 16:45-18:30, Megaron B

Chairman: *A. Nicolaides*
Irvine laboratory for Cardiovascular Investigation and Research, Academic Surgical Unit, Imperial College School of Medicine at St Mary's, London, U.K.

16:45

29.1 ***Ultrasonic Image Standardisation***
A.N. Nicolaides
Irvine laboratory for Cardiovascular Investigation and Research, Academic Surgical Unit, Imperial College School of Medicine at St Mary's, London, U.K.

17:00

29.2 ***Restenosis after Percutaneous Transluminal Angioplasty; A Human Model***
Maura Griffin[1], Ganesh Ramaswami[1], Andrew N. Nicolaides[1], Surinder Dhanjil[1], Aghiad Al-Kotoubi[2], Thomas Tegos[1], Gerard Stansby[1], Robert Wilkins[3], John Lewis[4], Mitra Boolell[1], Michael Davies[1]
[1]Irvine laboratory for Cardiovascular Investigation and Research, Academic Surgical Unit, Imperial College School of Medicine at St Mary's, London, U.K.
[2]Department of Radiology, St Mary's Hospital, London, U.K.
[3]Department of Radiology, Northwick Park Hospital, Middlesex, U.K.
[4]Department of Surgery, Northwick Park Hospital, Middlesex, U.K.

17:15

29.3 ***Correlation of Microemboli Detected in the Middle Cerebral Artery on Transcranial Doppler with the Echomorphology of the Carotid Atherosclerotic Plaque***
T.J. Tegos, E Kalodiki, A.N. Nicolaides, M. Sabetai, S. Dhanjil, T.S. El Atrozy, G. Ramaswami, M. Daskalopoulos, P. Robless, G. Pare, S. Byrd, K. Kalomiris Irvine Laboratory For Cardiovascular Investigation and Research, Department of Anaesthetics, Surgery and Intensive Care, Department of Radiology, Department of Neurology, Bagrit Centre, Imperial College of Science, Technology and Medicine, St Mary's Hospital, Praed Street,W2, London, U.K.

17:30

29.4 ***Texture Analysis for the Classification of Carotid Plaques***
C. I. Christodoulou[1,2], C. S. Pattichis[3] , M. Pantziaris[2], T. Tegos[4], A. Nicolaides[4]
[1]Department of Electronic Engineering, Queen Mary and Westfield College, University of London, Mile End Road, London E1 4NS, U.K.
[2]Cyprus Institute of Neurology and Genetics, P.O.Box 3462, 1683 Nicosia, Cyprus,
[3]Department of Computer Science, University of Cyprus, 75 Kallipoleos Str., P.O.Box 578, 1678 Nicosia, Cyprus
[4]Irvine Laboratory for Cardiovascular Investigation and Research, St Mary's Hospital Medical School, Imperial College of Science, Technology and Medicine, Praed Street, London W2 1PG, U.K.

17:45

29.5 ***Shape and Texture Analysis of the Carotid Plaque, and its Correlation with Cerebral Infarctions on CT, and Cerebrovascular Symptoms***

Konstantinos Kalomiris, Thomas J Tegos, Michael Sabetai, Andrew N Nicolaides
Irvine Laboratory for Cardiovascular Investigation and Research, QEQM Wing, Imperial College School of Medicine at St Mary's, Praed Street, London W2 1NY, U. K.

18:00

29.6 ***Computer Simulation of Blood Flow Dynamics After Carotid Endarterectomy***

Stefano Michelagnoli[1], Gianni Pedrizzetti[2], Attilio Evangelisti[3]
[1]Dept. of Vascular Surgery, University of Firenze
[2]Dept. of Civil Engineering, University of Firenze
[3]Dept. of Systems and Computers, University of Firenze, Via S.Marta 3, 50139, Firenze, Italy

18:15

29.7 ***LDA and Ultrasonic Velocity Measurements in Models of Stenosed Carotid Bifurcation with Irregular Lesion Surface - Measurement Stand and Methodology***

B. Lesniak[1], D. Liepsch[2], K. Kaluzynski[1], T. Palko[1]
[1]Institute of Precision and Biomedical Engineering, Warsaw University of Technology, Chodkiewicza 8, 02-525 Warsaw, Poland
[2]Laboratory for Fluid Mechanics, Fachhochschule Muenchen, Lothstrasse 34, 80335 Munich, Germany

Medicon '98
Student Paper Contest

Coordinator: *S. Spyrou*
Higher Technical Institute, Cyprus

1. ***Enhanced De-Noising of Bowel Sounds using a Wavelet- Based Filter***
C.N. Liatsos[1,3,4], L.J. Hadjileontiadis[2], C.C. Mavrogiannis[3], T.A. Rokkas[4], S.M. Panas[2]
[1]Athens University, Dept. of Pharmacology, 114 Vasilisis Sophias Ave., GR 11527, Athens, Greece
[2]Aristotle University of Thessaloniki, School of Technology, Dept. of Electrical & Computer Engineering, University Campus, GR 54006 Thassaloniki, Greece
[3]Athens University, Dept. of Internal Medicine, Faculty of Nursing, 114 Vasilisis Sophias Ave., GR 11527, Athens, Greece
[4]Army General Hospital, Mesogion and Kaehaki Ave., GR 11525, Athens, Greece

2. ***Bi-Dimensional Feature Selection of Electrocardiographic Data***
C.D Nugent[1], J.A.C Webb[1], N.D Black[1], M. McIntyre[2]
[1]The Northern Ireland Bio-Engineering Center, School of Electrical and Mechanical Engineering, University of Ulster at Jordanstown, Shore Road, Newtownabbey, BT37 0QB, Northern Ireland
[2] Cardiology Department, Royal Victoria Hospital, Belfast, Northern Ireland

3. ***Bi-Group Neural Network Classification of the 12-Lead ECG***
C.D Nugent[1], J.A.C Webb[1], N.D Black[1], M. McIntyre[2]
[1]The Northern Ireland Bio-Engineering Center, School of Electrical and Mechanical Engineering, University of Ulster at Jordanstown, Shore Road, Newtownabbey, BT37 0QB, Northern Ireland
[2]Cardiology Department, Royal Victoria Hospital, Belfast, Northern Ireland

4. ***Three Dimensional Reconstruction with Linear CCD Cameras***
Roumen Georgiev[1], Patrick Gross[2], Christopher Vaughan[1]
[1]Department of Biomedical Engineering, University of Cape Town, South Africa;
[2]Cambridge University, Cambridge, United Kingdom

5. ***High Resolution Imaging of Early Neoplastic Lesions using Optical Coherence Tomography***
Costas Pitris[1,2], Stephen A. Boppart[1,2], Debra Stamper[3], Mark E. Brezinski[4], James G. Fujimoto[1]
[1]Research Laboratory of Electronics, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology
[2]Harvard-MIT Division of Health Science and Technology;
[3]Kings College
[4]Cardiac Unit, Massachusetts General Hospital & Harvard Medical School

6. ***Continuous Wave Ultrasonic System for Detection and Analysis of Ultrasonic Doppler Signals of Fetal Activity***
F. Afana, K. Kaluzynski, T. Palko
Institute for Precision and Biomedical Engineering, Warsaw University of Technology, Warsaw, Poland

7. ***Knowledge Discovery in Electrocardiographic Data Based on Neural Clustering Algorithms***
F. Azuaje[1], W. Dubitzky[2], P. Lopes[1,3], N. Black[1] , K. Adamson[1,2], X. Wu[2], J.A. White[4]
[1]Northern Ireland Bio-Engineering Centre (NIBEC), University of Ulster, Newtownabbey, Co. Antrim BT37, 0QB, Northern Ireland
[2]School of Information and Software Engineering, University of Ulster, Newtownabbey, Co. Antrim BT37, 0QB, Northern Ireland
[3]Chelsea School Research Centre, University of Brighton, Eastbourne, England
[4]Dept. of Public Health Medicine and Epidemiology, University Hospital, Queen's Medical Centre, Nottingham, NG7 2UH, England

8. ***Morphometrical Study of the Distal Femur Pertinent to the Design of Knee Prostheses***
N. Nuño-Siebrecht, A. M. Ahmed
Department of Mechanical Engineering, McGill University, Montreal, Canada

9. ***Investigation of Photoplethysmographic Signals in the Human Oesophagus***
P.A Kyriacou[1], A. Gregg[2], R.M Langford[2], D.P Jones[1]
[1]Department of Medical Electronics & Physics, St. Bartholomew's & The Royal London School of Medicine & Dentistry, Queen Mary & Westfield College, Charterhouse Square, London EC1M 6BQ, UK
[2]Anaesthetic Department, Royal Hospitals NHS Trust, St. Bartholomew's Hospital, West Smithfield, London EC1A 7BE, UK

10. ***Detection and Processing of Single-Trial Evoked Potentials: A Nonparametric Approach***
Pavel Kisilev[1], Yehoshua Y. Zeevi[1], Hillel Pratt[2]
[1]Dept. of Electrical Engineering
[2]Evoked Potentials Laboratory, Israel Institute of Technology, Haifa, 32000, Israel

11. ***Feature Selection for Multiple Binary Classification Problems in Biomedical Data Analysis***
Yair Shapira, Isak Gath
Dept.of Biomedical Engineering, Technion, Haifa 32000, Israel

SOCIAL PROGRAMME

Sunday 14 June, 18:00, Opening Ceremony at Ancient Theatre of Kourion

All delegates and accompanying persons are invited to the opening ceremony. At 6:00 p.m. buses will depart from St. Raphael Hotel, the Conference Venue, for the ancient city of Kourion some 30 Km to the west. The Conference Venue is some miles east of the town of Lemesos which is a city full of life, there to be explored. It has the main port of Cyprus and a number of industries. The main wineries and breweries are here. Some miles west of the town is the ancient city of Kourion which was destroyed by earthquake in ancient times. It is situated in a beautiful setting with lots of Graeco-Roman antiquities and some well preserved mosaics. The ancient theatre of Kourion has been chosen as the place to hold the opening ceremony of Medicon'98. A cultural programme of about half an hour is included. After the ceremony we shall enjoy a buffet dinner by the Mediterranean shore at a nearby seaside restaurant.

Monday 15 June, 17:00, Trip to Nicosia, the Divided Capital of Cyprus

On Monday afternoon, there is a trip to the capital of Cyprus, Nicosia, the only divided capital of Europe. Buses will depart from St. Raphael Hotel at 5:00 p.m. for a 50 minute ride to the centre of Nicosia, Eleftheria Square. Old Nicosia is surrounded by massive medieval walls that were built by the Venetians. Within the walls we shall first visit the Levention Museum where the visitor can see some of the history of Nicosia. After a short rest we shall walk through the narrow streets passing by many shops, taverns, picturesque houses and churches to arrive at a dead end. This is Ledra street which is abruptly cut by the infamous Green Line. This is the line that divides the city of Nicosia into two parts, the northern part controlled by the Turkish Army that has invaded Cyprus in the summer of 1974. We shall walk to the Famagusta Gate which is one of the three gates that exist in the old Venetian fortifications. The Famagusta Gate, that has won the Europa Nostra award for good restoration, is used today for theatrical performances, art exhibitions and concerts. The buses will be waiting to take us to the Ledra Palace Hotel area where is the only crossing point to the occupied north part of Cyprus. Then we shall proceed to the restaurant of the Cyprus Institute of Neurology and Genetics where we shall enjoy a light dinner, Souvlaki and drink before returning to St. Raphael Hotel by 11:30 p.m.

Tuesday 16 June, 21:00, Gala Dinner - Cyprus Night at the Seaside Taverna "Le Meridien" Hotel

People can walk to Le Vieux Village Taverna of the "Le Meridien" Hotel in 10 minutes by the coast. (Mini bus as shuttle service will be operating for the elderly). You will get a chance to taste the delicious Cypriot meze-a 21 selection of mouthwatering local specialities - and of course unlimited amount of local wine and beer. Live music and a local folkloric show will perform for our entertainment.

Opportunity of Fishing Trip

Mr Yianni Theodoulou will host 5 persons per day on his private boat between 6:00 and 9:00 a.m. Departure from the St. Raphael Marina. Interested people will have the opportunity to see Yiannis on Sunday in the hotel. If more details are needed you can contact Yiannis at his mobile plone no. : 09-661696.

ABSTRACTS OF PAPERS

Session 1
Plenary Session 1

1.1

Information Technology in Biomedicine: The Next Step Beyond

Swamy Laxminarayan

NextGen Internet and NJ Institute of Technology, P.O. Box 3718, Princeton, NJ 08543, USA,
Email: S.N.Laxminarayan@IEEE.Org

Abstract
Information technology (IT) is expanding by leaps and bounds. The continuing challenges that lay ahead of us are part of a 'main-stay' discipline that impacts all human development. As we approach the new millennium, it is critical that we understand this 'impact' factor and explore how best to position ourselves to take advantage of the new technologies that the future has in store. This presentation is aimed to provide an 'inventory' of information technology developments with particular emphasis on biomedicine: the past, present and the ones to come in the future.

1.2

EUROMED - A WWW-Based Multi-Media Telemedical Information System

A. Marsh, K. Delibasis, Ch. Michael, N. Mouravlianski, G. Matsopoulos, K. S. Nikita, N. Uzunoglu

Institute of Communication and Computer Systems National Technical University of Athens,
9 Iroon Politechniou Street, 15773 Zographou, Athens, Greece

Abstract
One important consideration for the 21 St century is the successful exchange of clinical and administrative information between different medical information systems. With the introduction of telematics into the healthcare community the urgent criteria is for organized standardization activities and for the common use of standards. The essence of a 21 st century medical information system is that multi-media systems will be accessible remotely via a homogeneous communication protocol. The objective of the Euromed project is to define such a protocol and its implications in creating a global telemedical information society. The aim of this paper is to illustrate how a telemedical information society of the future could be constructed and subsequently utilized by using the notion of Web-based telemedical services.

1.3

Telemedicine Experiences in the Framework of TELEPLANS Concerted Actions and of the Video-Consultation Network of "Procida-Ischia-Pozzuoli-Giugliano"

M. Bracale, A.Pepino

University of Naples "Federico II", Dept. of Electronic Engineering,
Bioengineering Unit, Italy

Abstract

The objective of TELEPLANS is to establish a forum that brings together national healthcare authorities, key decision makers and users of telemedical applications, to share their views and experiences on requirements, results of assessment studies and planning for the establishment of telemedicine services. TELEPLANS Forum consists of the various national actors in telemedicine from the EU member states as well as from Australia and Canada. In the project, national pilot implementations will be analysed and an European model for the provision of telemedicine services will be defined. Also, a special reference to the situation in the USA and Japan is made. Thus, though consensus on requirements and methodology TELEPLANS will support telemedicine by monitoring progress and validating results of the RTD&D projects on telemedicine. TELEPLANS will also draw the attention of influential national decision makers on the potential of telemedicine and will catalyse strategic actions at international, national and regional level.

The INTERNET technology is extensively used for sharing the information between the partners. The European Industries will have the references to orient the development of new applications, for instance for emergency applications, telemedicine in remote areas, islands, aircraft's, etc.

1.4

Developing a Multimedia Atlas for Breast Cancer Pathology: Methodology and Preliminary Results from the Definition Phase of an EU Info2000 Project

Roberto Sacile[1,2], Carmelina Ruggiero[1,3], Fabrizio Cardinali[4], Claudio Lombardo[2], Guido Nicolò[4], Barry Gusterson[5]

[1]Department of [1]Communications Computer and System Sciences,
University of Genova, Genova, Italy,
[2]National Institute for Cancer Research, Genova, Italy,
[3]Advanced Biotechnology Center, Genova, Italy,
[4]Interactive Labs srl (Giunti Publishing Group), Genova, Italy,
[5]Institute of Cancer Research, Haddow Laboratories, Surrey, U.K.

Abstract

We present a description and the results obtained from the definition phase of an European Union INFO2000 project – BREAK-IT (the BREast Cancer Pathology Information Kit using Off-line and On-line Information Technologies). This phase consists of the definition of the needs, of the setting up of the main aspects of the prototype, of the identification of the software and hardware environments, and of a market analysis.

Session 2
Medical Imaging 1: Radiography

2.1

A Software Phantom: Application in Digital Tomosynthesis

D. Lazos, Z. Kolitsi, C. Badea, N. Pallikarakis

Medical Physics Laboratory, School of Medicine, University of Patras, Greece

Abstract

A software phantom intended to be used in radiographic applications has been developed. The application was used for research in the field of Digital Tomosynthesis and specifically for studying tomographic noise removal methods. The application consists of a phantom design and a phantom imaging module. The radiation-matter interaction is based on the exponential relation of attenuation. Projections are formed by simulated irradiation with selectable geometrical parameters, source spectrum and detector response. Phantoms are defined either as sets containing certain geometrical objects or as groups of voxels. Comparison with real projections taken from a physical phantom with identical geometry and composition with the simulated one, showed good approximation with improved contrast due to the absence of scatter in the simulated projections. The software phantom proved to be a very useful tool for DTS investigations. Further development to include scatter is expected to expand the use of the application to more areas in radiological imaging research.

2.2

Monte Carlo Modeling of Mammograms : Development and Validation

G. Spyrou[1], G. Panayiotakis[1], A. Bakas[3], G. Tzanakos[2]

[1]University of Patras, School of Medicine, Medical Physics Department,
265 00 Patras, Greece,
[2]University of Athens, Department of Physics, Div. Nucl. & Particle Physics,
157 71 Athens, Greece,
[3]Technological Educational Institution of Athens, Department of Radiography,
122 10 Athens, Greece

Abstract

A software package using Monte Carlo methods has been developed for the simulation of x-ray mammography. A simplified geometry of the mammographic apparatus has been considered along with a software phantom of compressed breast. This phantom may contain inhomogeneities of various compositions and sizes at any point. Using this model one can produce simulated mammograms. Results that demonstrate the validity of this simulation are presented.

2.3

Computer Aided Detection of Suspicious Regions on Digital Mammograms: Rapid Segmentation and Feature Extraction

C. Ruggiero[1,2], M. Giacomini[1,2], R. Sacile[1,2], M. Rosselli Del Turco[3]

[1]DIST – Department of Communication Computer and System Sciences, University of Genova, Via Opera Pia 13, 16145 Genova, Italy,
[2]DIST laboratory, Advanced Biotechnology Center, Genova, Italy,
[3]Centro per lo studio e la prevenzione oncologica, Firenze, Italy

Abstract
A method is presented for rapid detection of suspicious regions which consists of two steps. The first step is segmentation based on texture analysis consisting of: histogram equalization, Laws filtering for texture analysis, gaussian blur and median filtering to enhances differences between tissues in different respects, histogram thresholding to obtain a binary image, logical masking in order to detect regions to be discarded from the analysis, edge detection. This method has been tested on 60 images, obtaining 93% successful detection of suspicious regions.

2.4

Resolution Effects on the Morphology of Calcifications in Digital Mammograms

Maria Kallergi, Li He, Marios Gavrielides, John Heine, and Laurence P. Clarke

Department of Radiology, College of Medicine, and H. Lee Moffitt Cancer Center & Research Institute at the University of South Florida,
12901 Bruce B. Downs Blvd., Box 17, Tampa, FL 33612

Abstract
The development of computer assisted diagnosis (CAD) techniques and direct digitalmammography systems have generated significant interest in the issue of the effect of image resolution on the detection and classification (benign vs malignant) of mammographic abnormalities. CAD in particular seems to heavily depend on image resolution, either due to the inherent algorithm design and optimization, which is almost always resolution dependent, or due to the differences in image content at the various resolutions. This twofold dependence makes it even more difficult to answer the question of what is the minimum resolution required for successful detection and/or classification of a specific mammographic abnormality, such as calcifications. One may begin by evaluating the losses in the mammograms as the films are Digitized with different pixel sizes and depths. In this paper we attempted to measure these losses for the case of calcifications at four different spatial resolutions through a simulation model and a classification scheme that is based only on morphological features. The results showed that a 60 μm pixel size and 12 bits per pixel should at least be used if the morphology and distribution of the calcifications are essential components in the CAD algorithm design. These conclusions were tested with the use of a wavelet-based algorithm for the segmentation of simulated mammographic calcifications at various resolutions. The evaluation of the segmentation through shape analysis and classification supported the initial conclusion.

2.5

Simulation of the Radiography Formation Process from CT Patient Volume

P.Bifulco, M. Cesarelli, E. Verso, M. Roccasalva Firenze, M. Sansone, M. Bracale

University of Naples "Federico II", Electronic Engineering Dept.,
Bioengineering Unit Via Claudio, 21 – 80125 Naples, Italy

Abstract

The aim of this work is to develop an algorithm to simulate the radiographic image formation process using volumetric anatomical data of the patient, obtained by 3D diagnostic CT images. It is of use to obtain whatever oriented radiographic projection of the same patient volume. Applications include radiographic driven surgery, virtual reality in medicine, radiologist teaching and training. The realised algorithm is able to simulate any type of real radiographic equipment, in any positioning. The cumulative absorption along X-rays is extensively computed forming the radiographic projection. The proposed technique is quite similar to those employed in Ray Tracing. In this study only CT images have been considered because providing directly the X-ray absorption values of the patient volume. To estimate X-ray absorption in a generic point of the patient volume, 3D interpolation have been adopted. To assess the reliability of the radiography simulation method as a measuring tool, simulated projections of a testing volume have been compared with correspondent mathematically computed projections. From errors statistical analysis emerges that the achieved accuracy of the radiographic simulation algorithm is largely confined within the adopted sampling step (1mm).

2.6

Estimation of the 3d Positioning of Anatomic Structures from Radiographic Projection and Volume Knowledge

P. Bifulco, M. Cesarelli, M. Roccasalva Firenze, E. Verso, M. Sansone, M. Bracale

University of Naples "Federico II", Electronic Engineering Dept.,
Bioengineering Unit Via Claudio, 21 – 80125 Naples, Italy

Abstract

The objective of this project is to develop a method to estimate the 3D positioning of an anatomic structure utilising the knowledge of its volume (provided by CT or MRI) combined with a single radiographic projection. This method could find application in stereo-tactic surgery or for 3D kinematics studies of body joints. The knowledge of the 3D anatomical structure, available from CT (or in future MRI), emulating the radiography formation process, is used to estimate the orientation of the projection that better match the actual 2D available projection. For this purpose it was necessary to develop an algorithm to simulate the radiographic projections. The radiographic image formation process has been simulated using volumetric anatomical data of the patient, obtained by 3D diagnostic CT images. The patient volume position respect to the radiological device is estimated comparing the radiographic projection with those simulated, maximising a similarity index. To assess the estimation the 3D positioning a segmented vertebra has been used as test volume. The assessment has been carried out only by means of simulation. Errors around predefined position have been statistically evaluated also in condition of mispositioning and noise.

2.7

A Theoretical Model Predicting the Intensity of Emitted Light per Unit of X-Ray Exposure in Radiographic Screens

S. Tsoukos[1], A. Kateris[1], N. Kalivas[1], I. Kandarakis[2], D. Cavouras[2], G. Spyrou[1], G. Panayiotakis[1]

[1]Dept. of Medical Physics, School of Medicine, University of Patras, 265 00 Patras, Greece,
[2]Dept. of Medical Instrumentation Technology, Technological Educational Institution of Athens, Greece

Abstract
A theoretical model predicting the intensity of light emitted by x-ray imaging phosphor screens per unit of area and time over incident x-ray flux (absolute efficiency) was developed. The model takes into account: A) the structure of the screens which consists of luminescent grains embedded in a binding matrix. B) the direct deposition of energy by x-ray absorption effects. C) the re-absorption of K fluorescence characteristic x-rays produced when the x-ray energy exceeds the energy of the K absorption edge of the phosphor material. To test the model a set of $(Gd,La)_2O_2S$:Tb phosphor screens was prepared by sedimentation in laboratory. Experimental absolute efficiency data were obtained at x-ray tube voltages range from 40 to 160 kVp. The coincidence between experimental and theoretical results was satisfactory.

2.8

X-Ray Scatter Signatures for Enhanced Breast Imaging

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Abstract
Conventional mammographic imaging suffers from a low specificity. The main cause is the small difference in the x-ray attenuating properties of healthy and diseased tissue leading to poor contrast in the image. It has been observed that additional information on breast tissue type can be obtained from x-ray diffraction effects. A study of excised normal and neoplastic breast tissue samples using x-ray diffraction apparatus has observed that significant differences exist in the measured spectra between carcinoma and healthy tissue adjacent to the carcinoma. Such a difference allows tissue type to be characterised according to its diseased state. Furthermore the information can be applied to improve diagnosis. It is proposed that collection and analysis of the scattered x-rays present during a mammographic procedure can supply the additional information and be used to improve the image contrast. The ultimate aim of the project is to improve the specificity of x-ray mammography.

Session 3
Cellular Engineering 1

3.1

Modified Clonal Resistance Model of Tumor Electrochemotherapy in Mice

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Abstract

Multi-directional electrochemotherapy is a variation of electrochemotherapy (ECT) in which one set of electric pulses is applied in one direction and another set of pulses in different direction, in the presence of a chemotherapeutic drug. Recent experiments have shown that this treatment yields better results in fraction of tumor cells killed, and longer growth delay of cells that remain, but the underlying mechanisms are still unknown. In determining a mathematical model with which to predict the results of such a therapy, it has been shown that the mechanism is not a simple matter of permeabilizing the same fraction in two consecutive treatments. This model would predict better results than actual experimental results. This would indicate that there is a factor which inhibits the fraction of cells remaining after the first treatment from being permeabilized as easily during the second treatment.

3.2

Computer Modeling of the Adhesion Behavior of Colloidal Dispersions Under the Influence of DLVO and Hydration Forces

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Abstract

A computer model has been set up in order to aid the understanding of the adhesion process between two particles. Each particle is represented as a hard sphere, without taking into account any change of conformation which may take place during the adsorption process. The spheres are assumed to be in a medium whose properties are described by the ionic strength , the pH and the dielectric permittivity. The model focuses on the total interaction energy between two particles. Two possible formulations of this energy are considered. One is based on the DLVO theory, which assumes that the behaviour of a particle in a medium is determined by the sum of the attractive van der Waals energy and of the repulsive electrostatic interaction energy. The other also takes into account the hydration energy, in addition to the DLVO energy. The conditions under which adhesion is prevented or favoured are examined, comparing the DLVO interaction energy function and the interaction energy function which also takes into account the hydration energy.

3.3

Tissue Cultures for the Testing of Biocompatibility

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Abstract
Experimental tissue cultures are necessary to evaluate new biomaterials and to check the compatibility of implanted medical devices. Tissue cultures are highly developed microsystems carrying out a Sophisticated intercellular exchange of information. The parameters of viability prove to be non-static. They have to be investigated empirically. It is the main problem to gain these parameters by dynamic examinations without biological interference. We used optically measuring methods to solve this problem. We developed a special technology which combines the measuring of regular spectral transmission and a modified flow cytometry. We demonstrate the construction of our bioreactor and give first results.

3.4

The Influence of Mechanochemically Modified Syngeneic Tumour Cells on the Inhibition of the Tumour Growth and Metastasizing

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Abstract
The objective of this work was to study the influence of the effect of mechanochemically modified (MCM) syngeneic (SG) tumour cells (TC) on the growth and metastases of the Lewis carcinoma. Bioengineering technology of MCM TC included the following. The suspension of TC were received by way the soft breaking through the sieve in solution 199, after which lyophilic was performed in the chamber the lyophilizer OE-950 (Hungary). Lyophilizate TC were performed on the microvibrotory mile MMVE-0.005 (Gefest, Russia). The intensity of energy was 20 Wt/g. The injection of SG TC was started in 24 hours after the inoculation of tumour to animals. The suspension of lyophilic non-modified or MCM TC (0,5 mg in 0,3 ml of physiological solution) was injected intraperitoneal. In total 8 injection with the interval of 48 h was made. We performed the investigation of mechanical emission (ME) of TC and whole blood in the radiorange using the device TRA-3 (Ukraine) for the evaluation of its mechanical and chemical characteristics on the basis of cell adhesion. MCM TC were accompanied with the increase of adhesion of conglomerates of separate cells.

3.5

An Artificial Neural Network Approach to "Key Residue" Identification in Globular Proteins

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Abstract
In globular proteins, some residues play the role of "key residues" in the folding, that is the local folding in the neighbourhood of that residues is not caused by a cooperation of forces among amino acids but by that very specific amino acids by itself. We present an approach to protein folding based on artificial neural network (ANN), which aims at finding "key residues" in globular proteins.

3.6

A Computerized System for Assessment of Cancer Cell Movement

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Abstract
The study of cancer cell motility is thought to be important in improving understanding of cancer metastasis [1-2]. Changes in movement, area and velocity of cancer cells may be an indicator of cell spreading. The movement behaviour of cells in clustered cell colonies is of particular interest.
A semi-automatic boundary description method based on two-dimensional rendering has been devised and incorporated in a software system. It provides tools for the analysis of movement, area and velocity of single cells in cancer cell colonies and may thus be a value in further understanding cancer cell motility.

3.7

Automatic Recognition of Malignant Lesions in Ultrasound Diagnosis of Breast Cancer

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[2]Department of Radiology, University of Genoa Medical School,
San Martino Hospital, Genova, Italy

Abstract
A method for the automatic detection of malignant lesions in ultrasound images by artificial neural nets is presented. The parameters used are texture related indicators. A three layered neural network with a back propagation algorithm has been used. The data set used contains 38 ultrasound images corresponding to 38 patients, 19 diagnosed as malignant and 19 as benign. 13 of the 15 cases of the testing set were correctly diagnosed by the ANN.

3.8

A Decision Support System for Breast Cancer Chemotherapy

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[2]DIST Laboratory, Advanced Biotechnology Center, Genova, Italy,
[3]National Cancer Institute, Milano, Italy

Abstract
A system is presented to assist physicians giving post operative adjuvant chemotherapy for breast cancer. This system has been implemented in Visual Basic 4 under Windows 3.x and under Windows 95. Each chemotherapy protocol in the system has been programmed as one code object which includes conditional statements. The system is being tested at the National Cancer Institute in Milan and will be made available to general hospitals in the future.

Session 4
Implants/ Biomechanics 1

4.1

The Development and Testing of an Artificial Sphincter

C.A. Hajivassiliou, K.B. Carter, I.G. Finlay, D.G. Young.

University Department of Colorectal Surgery and University Department of Pædiatric Surgery, R.H.S.C., Yorkhill, Glasgow, G3 8SJ, Scotland

Abstract

None.

4.2

The Evolution and Results of Implantation of Mechanical Devices to Control Urinary Incontinence and Audit of 4000 Complications of the AMS 800 Artificial Urethral Sphincter

C.A. Hajivassiliou, D.G. Young.

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Abstract

None.

4.3

Non-Invasive Colonic Blood Flow Measurement by Laser Doppler

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Abstract

None.

4.4

Biomechanical Evaluation of Surgical Plantar Fascia Release Effects

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[4]Faculty of Engineering, Tel Aviv University, Israel

Abstract
Abnormal foot structures are known to influence tension stresses carried by the plantar fascia. An excessive arched foot structure may lead to plantar fasciitis. When conservative treatment fails, surgical intervention called plantar fascia release is often used for reducing chronic heel pain. A finite element structural model for mechanical analysis of the human foot during standing was developed and applied to the investigation of plantar fascia release biomechanical effects. The model integrates a system of five planar structures in the foot rays directions. It includes linear and non-linear elements representing different foot tissue types as well as inter-linking elements. A detailed normal foot structure was obtained using the newly developed advanced MRI technique, called Open MRI. The model was validated by comparing its resulted ground reactions with foot-ground pressure measurements and its predicted displacements with radiological tests. Simulation of fascia release (partial or total) was performed by gradually removing parts of the plantar fascia in the model. Results show that fascia release cause large sagging of the arch. Tension stresses carried by the long plantar ligament increase significantly. As the plantar fascia contribution to foot load bearing capabilities is of major importance, its release should be obviously carefully considered, and the model may be used to help surgeons decide about the degree of release.

4.5

Morphometrical Study of the Distal Femur Pertinent to the Design of Knee Prostheses

N. Nuño-Siebrecht, A.M. Ahmed

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Abstract
A morphometrical study was performed on cadaveric, human distal femurs. A laser range finder was used to digitize the three-dimensional shape of their articular surfaces. An algebraic algorithm was developed to reconstruct the profile of the femoral condyles in the sagittal plane by means of two circular arcs. The results of this reconstruction have been shown to compare well with the actual measurements. A representative profile of all of the femoral condyles has been computed. No statistical differences in the ratio of the two circular arcs were found between the medial and the lateral condyles. A precise knowledge of the geometry of the distal femur is expected to aid the design of the femoral component of knee prostheses.

4.6

Biofeedback Techniques for Rehabilitation of the Lower Limb Prosthetic Subjects

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Abstract

An internal model of the human body is used by the central nervous system to decide the adequate motor commands needed to execute movements. Presence of lesions, such as limb amputation, induces a mismatch between the output predicted by the internal model and the movement actually executed by the body. Thus, a re-organisation of the motor strategies is needed that induces an update of the internal model. Rehabilitation of the prosthetic subjects can induce the update of the internal model. If the subject is provided with some kind of artificial sensory reafference, it is likely to assume that the process of updating the internal model can be improved. Moreover the availability of biofeedback can help the prosthetic subject during his everyday life activities. The aim of this paper is to describe a system especially designed to provide sensory biofeedback. Sensorized insoles are used that can provide on line evaluation of the centre of pressure position of the subject. The signal is used to realise different biofeedback techniques: visual, acoustic and tactile. Some of the proposed solution have been designed for use during the rehabilitation program, some others can be also implemented in such a way as to realise portable devices that can be worn by the subject during his everyday life activities.

4.7

The Influence of Shoes on Healthy Subjects' Gait: A Statistical Analysis of the Relevant Gait Parameters

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Abstract

In a previous study the main spatial and temporal parameters of gait in a population of about 600 healthy subjects were acquired while they were walking barefoot and with shoes. Barefoot data were used to set up a reliable reference data base for impairment assessment, at least for Western citizens aged 3-60. Natural asymmetries of bilateral parameters were also quantified. Statistical multiple linear regression models were applied to find eventual combinations among the above gait parameters and some of the relevant anthropometric characteristics of the subjects. In the present study extensive comparisons have been made to understand the effect of shoes on the absolute values of the gait parameters taken alone, and on the combinations among parameters themselves. Six classes were sorted on the basis of sex and age, and detailed comparisons are reported for each class. In general, the absolute values of the measured parameters confirmed a modulating effect of shoes; symmetries were improved in most cases but for toe-out angle; the fitting of the linear regression models was confirmed for all spatial parameters with the exception of contact area, while it was definitely bad for temporal phases. This suggests that data derived from gait with shoes should not be used for the construction of reliable reference data bases.

4.8

Kinematics of the Cervical Spine Discectomy with and without Bone Grafting in a Sheep Model

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Abstract

This study was conducted to evaluate the kinematic response of late fusion results for cervical spine discectomies with and without bone grafting. Fifteen Barbados Black Belly sheep were sacrificed at 10 months following sham operation (group A), C_{2-3} discectomy only (group B), and C_{2-3} discectomy with autologous iliac bone grafting (group C). For the injured segment (C_{2-3}), the results indicated that group C had the least motion ranges in flexion and lateral bending as well as rotation, but showed the largest motion range in extension among the three groups. Group B had a significantly larger motion range in rotation than group C ($P < 0.05$), and displayed the largest motion ranges in rotation and lateral bending. Compared to group A, group B had less motion range in flexion, but showed more motion ranges in extension and rotation. At the adjacent segment (C_{3-4}), both discectomy groups had significantly larger motion range in flexion than group A ($P < 0.05$), but showed smaller motion range in extension. Group B also exhibited larger motion ranges in all three testing directions than those of group C. For axial rotation of the injured segment, discectomy in isolation showed increased motion range while discectomy plus bone grafting had decreased motion range. The data may have clinical relevance regarding the role of bone grafting in cases of cervical spine disease.

Session 5
Modeling in Biological Systems

5.1

Numerical Problem in Mathematical Modeling of Live Systems

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Belgrade & Mathematical Institute, SANU, Knez Mihajlova 35, Belgrade

Abstract
Problem of numerical nature implicitly exists when time delay, which is the essential part of any live system, is included in computerized modeling and simulation. This problem is here precisely defined and mathematically treated.

5.2

A Simplified Monte Carlo Simulation Model and Virtual Reality Visualization of Tumour Growth in Cell Culture

Georgios S. Stamatakos[1], Nikolaos K. Uzunoglu[1], Konstantinos Delibasis[1], Nikolaos Mouravliansky[1], Mersini Makropoulou[2], Andy Marsh[1]

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[2]Department of Physics, National Technical University of Athens, Zografou Campus,
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Abstract
The aim of this paper is to demonstrate the impact that modern visualization techniques can have on the simulation of biological processes such as tumour growth. Therefore, a simplified three-dimensional cytokinetic Monte Carlo simulation model of tumour growth in cell culture has been developed. Results concerning the development of a small cell lung cancer (SCLC) tumour spheroid in vitro have been obtained and their behaviour has been compared with both published data and laboratory experience. A special visualization system allowing real time surface and volume rendering on inexpensive computer hardware has been proposed. Its application to the model has led to a spectacular three-dimensional visualization of both the external and the internal structure of a growing tumour spheroid.

5.3

Parametric Changes in the VOR During Adaptation and Habituation

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Abstract
The ability of the central nervous system to modify the characteristics of the response of the vestibulo ocular reflex (VOR) was extensively proved with a number of experimental studies over the last three decades. Many attempts to produce a mathematical model accounting for the observed phenomena were proposed. Most of these models were conceived in order to explain a single aspect (i.e.: either gain variations or phase modifications) of the observed adaptation processes. The mathematical model proposed in this paper accounts for most of the adaptive modifications experimentally observed in the VOR, including data on VOR habituation. The model's structure represents, up to a certain degree of approximation, the anatomical structure of the underlying neural mechanisms.

5.4

Investigating of Focusing of Pulse Modulated Microwave Signals Inside Biological Tissues using HPC

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Abstract
The use of High Performance Computing (HPC) is reported, in order to investigate the possibility to achieve focusing of pulse modulated microwave signals inside a cylindrical biological tissue model. A two-.level parallel implementation is proposed, first level referring to the parallel solution of the problem in the frequency domain, by applying a Method of Moments technique and second level referring to the parallel computation of the temporal field evolution in the space domain, by evaluating the associated inverse Fourier integrals. Numerical results are computed with linear speedup in a three-layer tissue geometry, irradiated by a multi-applicator concentric waveguide array.

5.5

Compartmental Principle in the Hierarchical Neuron Networks Modeling

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Abstract

The stationary regime and rhythmic activity of neuron networks of brain stem is a result of the specific configuration of interaction between neuron. The conception and the models of the respiratory neuron networks (RNN) with cycles and subcycles founded on the compartmental principle are advanced. The reducible and irreducible RNN with informational (inhibitory) and excitatory ties between pools (compartment) was examined. In the basis of the developed compartmental theory is the number of postulates about the organization of brain's neuron networks (NN). The main of them are discussed by us in present paper.

Our experimental investigation was aimed at testing the dynamics of inhibitory and excitatory processes in the respiratory neuron networks and qualitative analysis these processes using the microinjections technique. The resulting data suggest that there is a hierarchical organization of the RNN and that the whole RNN has a compartmental structure.

5.6

Mathematical Interpretation of Stationary Regime's of a Biological Systems

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Abstract

The problem is posed of the stationary regimes of biological systems (BS) and the automatic (computerized) structural identification of BS with a simple or hierarchical structure. When the BS are in the stationary regime one of the methods for automatic identification of multilevel BS is considered in detail. In the specific case of two-cluster compartmental BS functioning in a quasilinear mode, a solution is presented for the problem of the structural and parametric identification of a BS.

5.7

Mathematical Model for Analysis of Environmental Bio-System

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Abstract

Mathematical modeling of environmental and ecological systems, especially population dynamics modeling, is the research field of rapid development. Mathematical modeling relay upon either deterministic, or stochastic approach. Analysis is focused on population growth and extinction, monopopulated habitat, two interacting pray-predator species, and dynamics of population of many interacting species.

In this paper represent ECOLOG, our model of population growth which produced good simulation results. Mathematical model is of mixed deterministic-stochastic type and is related to habitat with one specie where all age groups are explicitly modeled. Model covers internal factors of population growth (aging, sexual maturity, survival, spawning,..) as well as external (food, carrying capacity, removal,...). Some simulation results are presented.

5.8

Ecophysiological Modeling - Ecobase

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Abstract

Good approach in ecophysiological analysis is to obtain row data by field measurements, then design and implement computer data base, and finally, to implement processing within the data base via various mathematical procedures that will produce some conclusions based on row data. We have followed such approach in one international five years project on pollution analysis and control. Within the Commission of the European Communities project, we developed data base and mathematical procedures for reconstruction of some aspects of ecophysiology related to water pollution dynamics over the period of up to ten years, preceding the moment of field measurements. In this paper we present mathematical methods, dedicated computer data base and some of the typical results obtained.

Session 6
Medical Imaging 2: Ultrasound & Other

6.1

Technological Limits in Resolution of Contemporary Ultrasonographic Probes

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Abstract

The paper presents own investigation of resolution of contemporary ultrasonic diagnostic probes and compare results with performances conducted in exactly same circumstances reported ten years ago. To neglect numerous disadvantages of artificial echoes, both studied examined the resolution of human tissue. The reported results are based on the same level of certainty evaluated by the ROC analysis. The 7.5 MHz electronic probe was employed in both cases. The results show that recent engineering improvements in the process of transducer manufacturing, production of extremely wide apertures and extended dynamic ranges made possible to increase resolution in human tissue from the previous limit of 2 mm to contemporary 0.8 mm.

6.2

Continuous Wave Ultrasonic System for Detection and Analysis of Ultrasonic Doppler Signals of Fetal Activity

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Abstract

Changes in fetal movements indicate biophysical condition and functional development of the fetus. This paper describes a basic study of fetal activity conducted by means of a system comprised of a Doppler module with transducers and a PC with a special software. The CW Doppler module works at an emitting frequency of 2MHz, its input sensitivity is better than 1μV and its acoustic bandwidth range from 20Hz to 200Hz. To separate directions a coherent quadrature detection and frequency-domain processing was applied. The system enables detection of fetal heart rate FHR, pseudo- breathing movements FBM and a classification of fetal gross movements FGM with respect to their duration. Although further studies are required for clinical application, it appears that automated assessments of fetal activity would be possible with this technique.

6.3

Detection of the Descending Aorta Normal Lumen and with Aneurysm

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Abstract
A simple method is presented for detection of boundaries, which is robust and requires only a minimal amount of parameters. The method is specifically applicable for segmentation of echo ultrasound images of transversal cross sections of an artery, either normal or one with an aneurysm, where segmentation of the lumen, embolism and arterial wall is required. The method is based on initial selection of the center of the lumen from the color Doppler information. The second step is implemented in polar coordinates, where a search is performed for minimizing a cost function, which includes a function that describes the boundary (based on a limited series of sine and cosine functions) and information from the image intensity gradients along radii. Results confirm the applicability of this approach for rapid segmentation of such images, with minimal operator intervention.

6.4

Automated Detection of Endovascular Contours from Intravascular Ultrasound Image Sequences using a Simulated Annealing Approach

M. Schmauder[1], C. M. Gross[2], M. Firle[1], J. Waigand[2], R. Orglmeister[1]

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[2]Franz-Volhard-Clinic at the Max-Delbrück-Center for Molecular Medicine, Department of Cardiology, Angiology and Pneumology, Charite University Hospital Campus Berlin-Buch,
Humboldt University of Berlin, Wiltbergstraße 50, 13122 Berlin, Germany

Abstract
We present a method for the accurate detection of endovascular contours in intravascular ultrasound image sequences. The method consists of three basic steps. First, a new preprocessing procedure is proposed to reduce quasistatic artefacts which disturb the detection process. Second, an inital contour estimation based on a radial search procedure is used to establish a search area. An energy function is defined within this image region. In our approach we use a linear combination of an optimal edge detector, an integral feature and a smoothing term. A local Gibbs sampler is used to measure the probability of a contour configuration. Finally, multi-temperature simulated annealing optimization is applied to search for the global minimum of the energy function which is equivalent to the search for the maximum probability. Image sequences of coronary arteries of five different patients were used to evaluate the reliability of the algorithm. The results show that the new method is well-suited to replace time consuming manual segmentation and measurements.

6.5

3D, 4D & 5D Ultrasound for Abdominal and Cardiological Applications

M. Grim, M. Richtscheid, G. Sakas

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D-63069 Offenbach, Germany

Abstract

None.

6.6

Classification of Ultrasonic Liver Images using a Power Differentiation Estimator of Fractal Dimension

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Abstract

In this paper, a new method, called the Power Differentiation Method (PDM), for estimating the fractal dimension from image's power spectrum density is presented. The method is firstly applied to data of known fractal dimension and then to quantised data (grey level images). The results obtained by the PDM are compared directly to the results using four other well known methods of fractal dimension. Finally, preliminary results for the classification of ultrasonic liver images, obtained by applying the new method, are presented.

6.7

Radiometric System for Preliminary Detection of Tumors

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Abstract

Microwave radiometric system for acquisition and visualization of microwave radiation emitted from tissues is presented. Theoretical background of radiometric measurement of subcutaneous temperature is descussed. The system is used for preliminary detection of anomalies in the breast. The system displays spatial distribution of measured radiometric signal as color map on the image of the breast. Image recognition software is used to trace position of the radiometer probe on the breast.

6.8

High Resolution Imaging of Early Neoplastic Lesions using Optical Coherence Tomography

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Abstract

Effective screening and detection of early neoplastic changes are important to improving cancer diagnosis. A diagnostic imaging technology that can perform real-time, high resolution tomographic imaging of the architectural morphology of tissue in situ could improve the diagnosis of early neoplasia and thus reduce morbidity and mortality. Optical Coherence Tomography is a relatively new imaging technique which provides cross-sectional tomographic images by recording the backscattering of light from tissue as a function of depth, while scanning the incident beam in the lateral direction. OCT imaging was performed in vitro on a series of human tissues of varying degrees of neoplastic infiltration, including colon, cervix, uterus and lung. Microstructural and epithelial changes associated with the neoplastic nature of the tissue, such as dilated and distorted glands, were readily imaged, with a resolution of 6 mm, and favorably matched to histopathology. OCT can be implemented using low cost fiber components allowing fast, real time acquisition, at 4-8 frames per second integrated with catheters/endoscopes (less than 1 mm in diameter). These features coupled with the recent experimental results suggest that OCT could provide an effective tool for the diagnosis and assessment of neoplastic changes of tissue.

6.9

Three Dimensional Reconstruction with Linear CCD Cameras

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Abstract

Computerized tracking systems based on rectangular CCD cameras currently exist and a variety of com- mercial systems are available. One example application is the location of a surgical instrument on a CT or MRI image during brain surgery. The present study is based on developing a system of linear CCD sensors for tracking passive markers for the needs of neurosurgery. First the spatial resolution of such sensors is better, since they consist of up to 4096 pixels and second the amount of data to be processed is many times less than with rectangular CCDs. Our experiments showed good linear resolution of 0.1mm using a 1D sensor. The signal processing before passing the data for reconstruction also includes extraction of peaks from the signal and determining the peak positions along the sensor. An algorithm to supress the background is suggested, together with a routine to separate peaks located close to each other. The measurements taken from passive targets illuminated by infrared (IR) light and active IR emitting diodes demonstrate that the passive targets are well detected by the system. A three dimensional (3D) reconstruction algorithm, based on the Direct Linear Transformation (DLT), calculated (X,Y,Z) coordinates of the target points. The absolute maximum error observed in this case was 2mm. We conclude that an improvement of the accuracy is necessary at this final step before it is possible to use the system in combination with a CT or MRI image.

6.10

Image Processing Techniques for the Quantification of Atherosclerotic Changes

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Abstract

This work aims at the design and implementation of an o_-line, non-invasive, automated method for the examination and follow up of the arteriosclerotic changes due to hypertension, with the help of digital image processing of fundus images. This would help a lot in evaluating the e_cacy of various treatments on the regression and reversion of arteriosclerotic lesions. This method, in interaction with appropriate knowledge bases, can be used at the clinical practice for monitoring hypertensive patients on a frequent basis, hence it aims at minimum discomfort of the patient, by-passing even the regular uorescein injection for fundus image enhancement. Our method amounts to segmenting the vasculature by identifying the centerline of each vessel utilizing the idea that vessels present a ridge in cross-sectional intensity pro_les. Therefore, such a ridge can be detected along the vessels, as if there was three-dimensional information. Once the vasculature issegmented wepresent image-based measuring techniques for length to next bifurcation, vessel calibre, wall thickness and we introduce a novel measure of tortuosity. All our measurements are automatic, with minimal assumptions, and they are calibrated bymeans of the papilla which is considered of standard size. To achieve this, we implement a locating technique for _nding and measuring the papilla on fundus images.

Session 7
Cellular Engineering 2

7.1

A Conceptual Information Retrieval System for the Production of Guidelines on Cancer Biomarkers

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Abstract

We present an approach to the production of guidelines on cancer biomarkers based on the CommonKADS methodology. This approach aims to define a conceptual information retrieval system that can be accessed in Internet and Intranet, where an author can test the conceptual content of his own work and where experts charged to define the guidelines can find a valuable help. A software tool based on this approach has been set up and may be found at http://bartolomeo.medinfo.dist.unige.it.

7.2

Digital Library Access in a Telepathology Network: Application in Gynecological Cancer

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Abstract

Gynecological cancer (breast, ovarian, endometrial, cervical) consists of a large number of tumors with variable presentation and often unpredictable malignant potential, making patient management demanding but also challenging. In addition, the necessity to preserve the patient's sexuality and fertility potential and the requirement to offer optimum treatment to combat malignancies complicate management decisions.

Surgery plays a significant role in the management of most gynecological benign and malignant tumors. Optimized first surgery may provide in this context a survival advantage. However, even the most experienced surgeon is totally reliant on intraoperative histopathological evaluation for distinguishing between malignant and benign disease. In practice, expert histopathologists with experience in each human body system cannot be found next to each surgeon. As a result in most cases, therapy is based on postoperative histopathological diagnosis including second opinions, such as consultations from experts at remote sites. Ideally, however, patient benefit should be optimized at first surgery through timely and accurate histopathological diagnosis. In general, a telepathology network will offer on-line dynamic intraoperative and postoperative consultations between a panel of experts via the transmission of video (laparoscopic scenes), still images (histopathologic specimen images), and clinical data. In this context a digital library can be used by medical experts to interactively examine past similar case studies for preparatory research, follow-up research, archiving, training, and standardization.

The main objective of this paper is to demonstrate the feasibility and need for specialized image content-based retrieval methods to a digital library for gynecological cancer within a telepathology network. The implemented context-based retrieval method presented in this paper is based on the Biopsy Analysis Support System (BASS). This system uses breast cancer biopsy images to demonstrate the functionality of content-based image retrieval methods.

Expected benefits of the telepathology network and the digital library will be focused on improving diagnostic standards. All participating histopathology laboratories will benefit from the standardization efforts regarding tissue processing which have to take place to enable specialized histopathologists from one site to assess images from specimens, processed at another site of the network. Additionally, the use of the network and library will lead to less radical operations, less hospitalizations, and less patient complications.

7.3

Computer Analysis of Epithelium Cell Nuclei of Urinary Bladder for Cancer Detection

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Abstract
The urinary bladder cancer belongs to the 12 most common cancers in Poland and it takes the fourth place in male population in respect to death rate. There is an urgent need to try to facilitate new methods for easy , early detection of the first stages of the illness. The objective of this paper is to introduce a new computer approach based on analysis of Feulgen- stained nuclei of urinary bladder cells of voided urine. Image analysis is performed on the basis of the DIPS (Digital Image Processing System) designed by authors as a software package for routine investigations of biomedical images but adopted with the help of additional procedures to solve the problem. Image analysis is focused on nuclei analysis performed on images of enlarged fragments of microscopic sections recorded by the help of TV camera and transmitted to the PC computer. Then a full cycle of pre-processing, object extraction and measurement of parameters is performed. Our initial results indicate that it is possible to diagnose the cancer from the analysis of cell nuclei.

7.4

BSE - Automatic Detection of Spongiform Change in Histological Samples of the Central Nervous System

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Abstract
Modernização Agrícola e Florestal (PAMAF), with the aim of developing a semi-automatic system to help in the diagnosis of BSE in histological samples of the central nervous system, using computer vision. A database of digital images of histological samples is in the process of being built, by a multidisciplinary team that includes anatomo-pathological doctors (including a referee). The database will contain both positive and negative samples. Up to now a trial version of the database, with images from around 40 animals, has been used to develop and test a prototype vision system.

7.5

The Digitalization of Microscopic Image in Determination of Fractal Dimension of Human Cerebellar Purkinje Cells

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Abstract
The fractal analysis of 200 human cerebellar Purkinje cells was done, using Golgi-stained material of the human cerebellar cortex and digitalized microscopic images. With the aim of determining fractal dimension as a quantitative measure of cells' shape complexity in parasagittal and frontal anatomical planes, the box-counting method was performed, followed by linear approximation of necessary numeric values by first degree polynoma. The average values of the fractal dimension presented are statistically different according to different anatomical planes of analysis.

7.6

A Method of Segmentation of Neutrophils Images Observed in the Cell Movement Monitoring System

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Abstract
There are descriptions of methodology used in neutrophils motility study and of the Cell Movement Monitoring System, which has been developed to these types of investigations. This is an image acquisition and analysis system adjusted to specific behaviour of one type of cells observed in bright field microscopy. The new semiautomatic segmentation method based on texture and local spatial and temporal context is proposed in this paper. The results of the segmentation are compared with used so far the interactive method of segmentation. The comparison based on over-merging and under-merging error shows that results of the proposed segmentation method are repeatable and reproducible, and they differ from manual segmentation not more than different manual segmentation results do.

7.7

Non-Stationary Texture Segmentation in Electron Microscopy Muscle Imaging using an AM-FM Model

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Abstract
We segment electron microscope images using a novel AM-FM representation for separating out the structural units of the muscle. This novel AM-FM approach is shown to be both effective and accurate in capturing sarcomeres and mitochondrial regions of the electron microscope images.

Session 8
Implants/Biomechanics 2

8.1

Implantation of Vascular Prostheses: Mathematical Simulation of the Impact on Hemodynamic Parameters

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Abstract

Objective: The implantation of noncompliant vascular prostheses for replacement of the great vessels has marked influence on arterial hemodynamics. We propose a mathematical computer simulation able to predict hemodynamic changes after simulation of vascular grafting. **Methods:** The human arterial tree was delineated according to a 128-branch model encompassing bifurcations and physical properties of the arterial wall. A digitized aortic flow wave was chosen as the input signal to the system. Replacement of the ascending aorta and aortic arch was simulated by increasing the elasticity in these parts. **Results:** During control conditions, the model displayed a physiologic distribution of flow and pressure waves throughout the arterial system. Simulated replacement of the aorta resulted in an increase of pressure amplitude and a partial loss of the aortic "Windkessel" function. Calculation of the aortic input impedance showed an increase of the characteristic impedance and the modulus of the first harmonic, while the peripheral restistance remained unaltered. **Conclusions:** The model displays hemodynamic changes after implantation of vascular grafts. The results are consistent with findings obtained from animal experiments.

8.2

Spectral and Instantaneous Flow Characteristics of Vascular Anastomoses

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Abstract

None.

8.3

Computer Aided Modeling and Stress Analyses of Restorative Treated Teeth

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Abstract
In order to analyze stress distribution in restorative treated teeth, finite element method had been applied. It have been noticed that the strength of treated teeth is subject to remaining tooth structure, and size and shape of implemented restoration. Knowledge on stress distribution could help determining suitable form of restorations, and so prevent occurrence of excessive stresses that lead to fracture. This paper describes procedure and techniques necessary to obtain three-dimensional model of treated tooth, and to provide FEM based stress analyses using PC based commercially available computer software. First step comprised creation of appropriate three-dimensional model that close enough describes intricate shape of restorative treated tooth. For the purpose, computer aided design software AutoCAD (R 12, Autodesk Inc.) was run on an IBM PC 486 compatible computer. Model is than transferred to ALGOR software, and loads of 10 dN were applied from the oclusal direction to the top of restoration, and in faciolingual section at 45-degree angle to the long axis of the tooth. Computer generated, colored stress maps were obtained using finite element method. Peak stress locations are noticed, and clinical considerations are analyzed upon obtained results.

8.4

Identification of Human Body Dynamics During Vibrations Induced by a Road Vehicle

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Abstract
Human reaction to vehicle vibration is largely reported in the literature, because vibrations induce stress and fatigue in the driver leading to a physiological and psychological discomfort. In this paper, a comparative experimental study of accelerations and displacements of human body submitted to vehicle seat vertical vibrations is presented, in order to give a faithful modelization of human body dynamics. Vibrations occurring at the base of the seat for tree different roadbeds (motor way, downtown road, country road) were recorded on a truck (FIAT Ducato) during an experimental campaign and were reproduced in laboratory by means of a hydraulic actuator. On a set of four subject of different mass, the body responses to the recorded vibrations were measured by a 3D camera system and by a set of accelerometers. The frequency responses were analyzed and compared for both accelerations and positions. Starting from the experimental data, the transfer functions between the seat and the different body segments were identified. A two-dimensional mechanical model of seat-man system has been developed in order to identify the human response to whole-body vertical vibrations. The evaluation of parameters characterizing the mechanical model will allow us to simulate the seat-man system in order to study and realize a controller able to minimize the effect of propagation of vertical vibrations from the vehicle to the driver.

8.5

Multireceiver Infrared Biotelemetry for Monitoring Ambulatory Patients in Biomechanical Measurements

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Abstract
Infrared biotelemetry enables patient's free moving in biomechanical measurements such as gait analysis. Low power transmitter gives nonuniform low irradiance, while there are strong noise and interference infrared radiation originated from ambient light sources. To improve signal to noise ratio of the diffuse, nondirected infrared link over the entire indoor environment, a diversity technique is applied. It consists of distributed multrireceiver system and logic unit (combiner) employing desired combination algorithm. We present experimental data of spatial noise and infrared signal distribution in a test room. According to the results, a multireceiver system with five receivers is organized and combiner with linear equal gain algorithm is used. Resulting received signal has uniform spatial distribution over the entire room.

8.6

Implanted Materials and Bone, Tooth Tissues Compatibility Tested by Electron Spectroscopy

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Abstract
Electron spectroscopy, provided contact potential difference, electron energy distribution and surface structural stability measurements, is demonstrated to compare biomaterial compatibility with bone and tooth tissues.

8.7

Three Dimensional Finite Element Mesh Generation for Maxillary Second Premolar

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Abstract

The finite element method (FEM) has established itself as a powerful tool in biomechanics. However, developing a finite element three dimensional mesh for irregular geometry object is still a labor intensive task hence limits the usage of the three dimensional analysis for dental structures. This study presented an automatic procedure to generate the three dimensional finite element mesh of a maxillary second premolar. Tooth embedding, image processing, three dimensional automatic meshing and convergence validation were the major phases of this study. Firstly, a second premolar was sliced and scanned parallel to the occulsal surface. A self-developed image processing system was employed to detect the boundaries of different material within each section. An automatic mesh generation program were employed on these boundaries to created tetrahedral elements based on a moving nodes of uniform cube approach. Six mesh models of the second premolar with linear and nonlinear element types were analyzed. Strain energy and vonMises stresses were reviewed for convergence in the crown regions. Results of the analysis indicated that this automatic meshing procedure can provide a feasible way to generate accurate three dimensional finite element mesh for dental biomechanics study.

8.8

A Tutorial Supporting System for the Evaluation of Fall Risk in Elderly Subjects with 3D Simulation

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Abstract

A tutorial supporting system for the evaluation of fall risk in elderly subjects, established by the evaluation of the functional motor ability, with 3D simulation supporting tools, is presented. The work is the result of a collaboration among different Italian bio-mechanical and clinical laboratories, adopting different protocols to evaluate the functional status of the motor system of the elderly population. Within this project aligned clinical and bio-mechanical protocols have been formalised. The clinical protocol, has been individuated in order to select and collect the real significant anamnestic and clinical data. The bio-mechanical protocol is composed by six simple motor exercises/tests, considered valid diagnostic tools to assess the motor ability of the elderly population. Aim of the system, through a friendly interface is: 1) to collect data with quantitative and standardised protocols of measurements coming from different laboratories, 2) to show, through a 3D interface the ongoing of the exercises belonging to the bio-mechanical protocol, 3) to screen and monitor different people, for inter and intra subject studies, and 4) to provide a supporting environment, validated among different laboratories, to teach to the less experienced physiatrists to practice the chosen protocols. The faced problems have high relevance mainly because they are devoted to establish a geriatric evaluation not necessarily linked to pathological situations.

Session 9
Biosignal Processing 1: EEG & EPs

9.1

Unsupervised Identification and Classification of Event Related Brain Potentials

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Abstract

We present a novel approach to the problem of Event Related Potential (ERP) identification, based on a competitive Artificial Neural Net (ANN). Our approach dismisses the, need for stimulus- or event related, selective, averaging, thus avoiding conventional assumptions airs on response invariability. The competitive ANN, often described as a winner takes all neural structure, is based on dynamic competition among the net neurons where learning takes place only with the winning neurons. In our case, the competition results, in network weights converging to the embedded ERP patterns, thus forming a matched filter bank which can also be utilized for optimal single-trial classification purposes.

The network performance is analyzed via a simulation study, exploring identification robustness under low SNR conditions and compared to the expected performance from an information theoretic perspective. The identified is applied to real event-related potential data recorded during a common odd-ball type paradigm. For the first time, within-session variable signal patterns are automatically identified, dismissing the strong and limiting requirement of a-priori stimulus-related selective grouping of the recorded data. The results present new possibilities in ERP research.

9.2

Detection and Processing of Single-Trial Evoked Potentials: A Nonparametric Approach

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Abstract

An algorithm for estimation and reconstruction of event related signals corrupted by colored noise (e.g. Evoked Potentials, masked by EEG activity and additional sources of clutter and noise) is proposed. The local Karhunen-Loeve (LKL) basis, derived from the noisy signal local autocorrelation function, is used for optimal signal representation (in minimum mean square error - MMSE - sense). The vector space of the noisy signal is decomposed by the LKL transform into the corresponding complementary orthogonal subspaces, i.e. the signal-plus-noise and the noise only. The event related signal is estimated from the signal-plus-noise subspace by modifying the corresponding LKL components with a Wiener-like gain function.

9.3

Analysis of Evoked Potentials by Expert System

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Abstract

Experiments were carried out to examine possibilities of diagnose support in the medical field of Brainstem Auditory Evoked Potentials (BAEP) at the Department of Control Engineering FEE CTU. This contribution introduced the experiment with expert system (ES) FEL-EXPERT ver. 3.5 aiming to compare neurologists diagnoses with the results of ES during analysies of BAEP.

9.4

Independent Component Analysis of Electroencephalographic Data using Wavelet Decomposition

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Abstract

In this paper, we present a new algorithm for the separation of a mixture of independent, time correlated signals. Recently, several 61gorithine for independent component analysis (ICA) have Peen developed, such aim [1, 2, 3, 4]. Our novel algorithm is based on an idea proposed in[4]. In (4] it was proven that in the case of time correlated signals source separation may be accomplished by only solving a joint eigenvalue problem of cross-correlation matrices. Using this technique we show that by employing a wavelet decomposition it is possible to get a similar eigenvalue problem. From our simulations we conclude that the new algorithm is very fast and provides excellent results. Our experiments an electroencephalographic (EEG) data show that the new algorithm can be successfully applied to EEG signal processing.

9.5

Neural Networks with Wavelet Preprocessing in EEG Artifact Recognition

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Abstract
Almost every evaluation of EEG signal is preceded by the elimination of artifacts, usually performed by a human expert. We have applied Artificial Neural Networks (ANN) for the automatization of this laborious task. Choice of input pre-processing has proven to be crucial for both the learning speed and performance of the network. Best results were achieved when as the input values certain combinations of signal's wavelet coefficients were used. The artifact detection obtained by us was comparable to human judgement.

9.6

QEEG-Based Methods for Diagnosing the Vigilance Levels

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Abstract
Psychological/psychometric test performing data and QEEG parameters can be viewed as the adequate features in order to estimate the changes of human central nervous system vigilance level during the long-range occupational contacts with neurotoxic stressors. There exists correlation between the test performing data and QEEG parameters, reflecting the vigilance level changes. Coherence between the bioelectrical activity of right and left hemisphere and rhythm acquisition ability during the photic stimulation decrease significantly as the CNS vigilance level deteriorates from mild to severe disorder. Ageing is also featured by decreasing coherence of bioelectrical activity. A fuzzy classifier was applied to make unsupervised computerized clustering of two-element vectors of the coherence factors between the channels Fd - Fs and Od - Os for 43 test subjects to the two classes of healthy CNS and CNS with functional disorders. The algorithm was only able to perform clustering of feature vectors corresponding to healthy CNS and CNS with severe disorder of vigilance level.

9.7

Localization of the EEG Rhythm Sources in the Brain

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Abstract
The study introduces a method for the source identification of the EEG rhythms in the brain. The EEG signal is classified on the basis of its frequency content and an equivalent source for each rhythm can be hypotyzed inside the brain. Normal subjects have been analysed both during intermitting light stimulation (ILS) (8 subjects) and during basal conditions (28 subjects). The EEG signal was recorded from 20 electrodes placed on the scalp according to the international 10-20 system. The frequency content of the EEG is evaluated through monovariate autoregressive spectral analysis, while bivariate spectral analysis allowed the calculation of the phase relationships. From these spectral and cross-spectral parameters, the constellation graphs were obtained and after a phase approximation to the best fitting line, the potential distribution related to a single oscillating electrical dipole was obtained. Finally the location of the source inside the brain value was determined by a spherical modelling of the head. During the ILS protocol the equivalent electrical source was localised in the occipital region, as expected for a visual stimulation. This result demonstrated the reliability of the whole procedure. The analysis of the basal EEG evidenced that only in the 36% of the total recordings the alpha rhythm can be described though a single dipole. However, when it is possible, the location of the alpha source is very stable from subject to subject.

9.8

Heart Rate and Respiratory Regulations During Normal Sleep: Investigation by Spectral Analysis and Comparison with EEG Recordings

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Abstract
This paper presents preliminary results obtained with an ambulatory multi-sensor based system in the form of a wrist watch connected to a portable PC Wrist activity measured with multi-sensor system allows for the monitoring of the main functional parameters (heart-rate and respiratory sinus arrhythmia). Spectral analysis of these two variables led to the definition of four state-variables that are shown to be connected to distinct sleep-stages. A one to one comparison with the corresponding hypnogram obtained simultaneously from polysomnographic recordings shows a clear evolution of the defined state-variables along with EEG sleep pattern. The presented results go beyond the usual activity-based sleep-wake identification but leads to the recognition of two main sleep states: deep stage and paradoxical (REM) stage.

Session 10
Plenary Session 2

10.1

Integrated Telemedicine Networks and Added Value Services

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Abstract

Health care is an important application domain in the emerging information society. In recent years, we have all been witnesses to the gradual transformation of health informatics into health telematics, a process that continues. For this transformation to be successful, a strategy is needed for the creation of an integrated healthcare information infrastructure, based on the functional and data integration of federated autonomous information systems. Furthermore, in developing such a strategy, one must also consider the need for integrating existing systems into the emerging infrastructure and using it to provide clinically significant added-value services that would justify its cost and ultimately benefit the patient. A fundamental problem for the establishment of a scaleable regional health telematics network is the development of an architecture and tools for the integration of specialized autonomous applications that, together with a shared healthcare record, will support the interoperability of functional units and services within a health care institution, the interconnection of different institutions, and the intelligent management of medical data within such an integrated network. From the technological point of view, the adoption of an open architecture and standards represents the only solution capable of ensuring the achievement of such objectives, allowing the integration of diverse system components through an incremental approach, consistent with evolving requirements. Using such an approach, individual information systems can be independently customized and their operation optimized with respect to the specific requirements of the functional units they serve.

Potential benefits of integrated telemedicine services include improved access to medical knowledge and expertise, a reduction in healthcare costs, reduced isolation for both patients and medical personnel, and improved quality of care. The above benefits will become evident after a transition period, during which users of telemedicine services receive proper training and learn to trust them, potential legal issues are resolved, and capital and operational costs are reduced, while service quality is improved with new technological developments.

The challenge is to keep up with these developments and to be creative in using the emerging information technology and telecommunications infrastructure to provide clinically significant and cost effective added-value telematic services to the healthcare community. At the same time, one must ensure that the potential benefits to be derived from technological advances also find their way to the scene of an accident and the home of all citizens.

10.2

A GSM-Based Mobile System for Emergency Telemedicine -"Ambulance"

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Abstract

Recent studies conclude that early and specialized prehospital management contributes to emergency case survival. Ambulance personnel, who usually are the first to handle emergency situations, do not have the required theoretical knowledge and experience. Financial and practical reasons do not allow the participation of specialized physicians on ambulance vehicles. We have developed a portable medical device that allows telediagnosis, long distance support and teleconsultation of mobile health care providers by specialized physicians. The device allows the transmission of vital biosignals and still images of the patient from the incident place to the hospital. The transmission is performed through the GSM mobile telecommunication network, standard spread out all over the E.C. countries. The device can telematically "bring" a specialist doctor at the site of a medical emergency, allow him to evaluate patient data and issue directions to the emergency personnel on treatment procedures until the patient is brought to hospital. Due to the need of storing and archiving data being interchanged during the telemedicine sessions, we have equipped the consultation site with a multimedia database able to store and manage the data collected by the "AMBULANCE" system. The performance of the system has been validated in four different countries using a controlled medica protocol.

10.3

A Perspective from Magnetoencephalography on the Consistency and Variability of Brain Responses and possible Applications

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Abstract

None.

10.4

Education and Training Initiatives in Europe

Colin Roberts

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Abstract

None.

Session 11
Medical Imaging 3: Nuclear Medicine & MRI

11.1

The Measurement of Blood Speed in the Pulmonary Artery Trunk

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Abstract
The paper describes a non invasive methodology for the measurement of blood speed in the pulmonary artery trunk. The methodology has been tested with a moving radioactive tracer (nuclear medicine). An image processing technique is proposed, for detection and analysis of a moving object with variable shape and intensity over time (radioactive bolus). Experiments on the application of the technique in nuclear medicine are critically analysed.

11.2

SPECT and 3D Display Quantitative Evaluation in Renal DMSA Scintigraphy

M. Lyra, K. Skouroliakou, I. Emmanouilides, I. Stratis

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Abstract
The evaluation of cortical damage to the kidneys, especially in children, is currently performed by means of Tc99m-DMSA renal scan. The routine involves the acquisition of planar images and their qualitative and quantitative evaluation. Many recent studies have dealt with the possible advantage that SPECT could possess on qualitative criteria. This study attempts to quantitatively deal with the issue by the calculation of an index. The results exhibit a clear advantage of tomographic and 3D reconstructed images over the conventional planar ones.

11.3

Nuclear Medicine Image and Data Interchange Through E-Mail

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Abstract

Prosperity of easy interchange in every day practice of Nuclear Medicine found its application through the INTERNET media.

We use a simple and safe way to interchange images and diagnostic information between the scintigraphic acquisition and processing location and the clinical department in order to improve patient's health care and young doctors' education, Images and patient reports are transferred and saved through dedicated software to a workstation that transform y-camera scintigraphic images in a PC readable format Diagnosis reports and scintigraphic images are incorporated to a database directory in hypertext form.

Usual WWW connection gives the possibility of patients' examinations transfer by email attachments as well as interchange of relative comments towards both directions, Cost effective solution has been achieved using standard hard- and software.

Furthermore, both patients' files and educational files can be downloaded, from our department ftp location, by a unique password.

11.4

Optimal Use of Pre-Emphasis Gradients for Magnetic Resonance Imaging

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Abstract

Selective excitation pulses are widely used in magnetic resonance imaging to excite only a specific region (slice) within the body of interest. Recently, a design algorithm has been developed [1,2] that provides a direct solution to the generally nonlinear design problem. However, as is the case in all differential problems, the result of the excitation is strongly dependent on the initial conditions. In this paper, we will show that when the magnetization is not initially at rest, the result of the radiofrequency pulse provokes a sinusoidal ripple depending on the excitation angle and the selection gradient. However, if viewed from a two-dimensional perspective, the ripple depends from the initial transverse phase, thus providing a second coding mechanism, that can be used to provide a general technique resulting in a uniform excitation.

11.5

Echo-Interleaved-Spiral MR Imaging

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Abstract

Interleaved-Spiral imaging is an efficient method for MRI fast scans. However, images suffer from blurring and artifacts due to field inhomogeneities and the long readout times. In this paper, we combine interleaved-spimls with spin-echo for 3D scans. The refocusing RF-pulses (echos) refocus off-resonance spins, thus allowing longer acquisition times per excitation, by limiting inhomogeneity effects. The total number of excitations for a 3D scan is reduced by half. The 3D Fourier transform of an object is divided into pairs of slices, one slice is scanned in an outgoing interleaved-spiral, Initiated after a 90° pulse has been applied. The second slice is scanned in an ingoing interleaved-spiral, after a 1800 pulse has been applied, thus reaching the slice origin at the echo time.

11.6

Geometry-Driven-Diffusion Filtering of MR Brain Images using Dissimilarities and Optimal Relaxation Parameter

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Abstract

A novel method of local adapting of the conductance using a pixel dissimilarity measure is developed. An alternative processing methodology is proposed, which is based on intensity gradient histogram calculated for region interiors and boundaries of a phantom which models real MR brain scans. It involves a specific cost function suitable for the calculation of the optimum relaxation pa-rameter K_{opt} and for the selection of the optimal exponential conductance. Computer experiments for locally adaptive geometry-driven-diffusion filtering of an MR brain phantom have been performed and evaluated.

11.7

Real Time Implementation of the Parametric Imaging Correlation Algorithms

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Abstract

A novel method for functional image evaluation from 'Image set obtained in contrast aided Ultrafast Computed Tornography and Magnetic Resonance Imaging will be presented. The method converts temporal set of images of first-pass transit of injected contrast, to a single parametric Image. The main difference between proposed procedure and other widely accepted methods Is fact, that our method applies correlation and discrimination analysis to each concentration-time curve, instead of fitting them to the given 'a priori' tracer kinetics model, A stress will be put on execution speed (i.e. shortening of the time required to obtain a perfusion relevant image) and easiest user interface allowing the physicians to utilize the system without any technical assistance. Both execution speed and user interface should satisfy requirements in the interventional procedures.

11.8

Different Patterns of Auditory Cortex Activation Revealed by Functional Magnetic Resonance Imaging

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Abstract

In the last few years, functional Magnetic Resonance Imaging (fMRI) has been widely accepted as an effective tool for mapping brain activities in both the sensorimotor and the cognitive field. The present work aims to assess the possibility of using fMRI methods to study the cortical response to different acoustic stimuli. Furthermore, we refer to recent data collected at Frankfurt University on the cortical pattern of auditory hallucinations. Healthy subjects showed broad bilateral activation, mostly located in the transverse gyrus of Heschl. The analysis of the cortical activation induced by different stimuli has pointed out a remarkable difference in the spatial and temporal features of the auditory cortex response to pulsed tones and pure tones. The activated areas during episodes of auditory hallucinations match the location of primary auditory cortex as defined in control measurements with the same patients and in the experiments on healthy subjects.

Session 12
Nerve & Muscle 1

12.1

The Hodgkin-Huxley Neuron: A Simulink Implementation

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Abstract
A SIMULINK network that models a Hodgkin - Huxley neuron has been generated. It is a simulation tool that can be used by a neuroscientist that wishes to investigate the expected behaviour of a real neuron when different parameters are systematically changed, or by a neural networks researcher that may wish to investigate the response of a realistic neuron prior to incorporating it in a more complicated neural network. Graphs of the time dependency of membrane potentials, for different operational parameters, have been produced and presented.These show the general, global time response of the neuron.

12.2

Registration of Neuron Networks Oscillation

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Abstract
Muscles and neuron networks oscillation has common roots. So, the new method and equipment for registration of such oscillation are presented. Equipments consist of some special ferromagnetic plate and magnetic sensor. The construction of such equipment are discussed.

12.3

Modern Software and Hardware for the Neuron Networks Identification

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Abstract

The conception and main problems of neuron network's (NN) experimental investigation with a simple and hierarchical structure are discussed and advanced. It was created some special software for the structure and parameter identification of NN with compartmental organization. The special hardware provides the registration of NN activity and direct and indirect control of a hierarchical NN's structure. We can cat and regulate other special structure of the brain with distance equipment by some program. The hardware provide a high technology in a biophysics and neurophysiology experiments.

12.4

A Miniaturized Implantable Bladder Selective Electrical Stimulator

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Abstract

A new miniaturized implantable stimulator dedicated to peripheral-neural stimulation applications is described in this paper. It is intended to restore normal bladder functions of paralyzed patients. The external part (controller) of the stimulation system is implemented in a single Field Programmable Devices. The heart of the implant is a full custom VLSI chip forming the main part of the stimulator. Eight user defined parameters allow the generation of a wide range of stimulation patterns. Thus, the system is adaptable to the patient's need and to future developments of stimulation algorithms. The whole implantable circuitry is externally powered and controlled by a radio-frequency 20 MHz carrier modulated in amplitude by a Manchester encoded data and clock.

12.5

Electrode Characteristics at High Current Pulse Stimulation

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Abstract
In contrast to peripheral nerves or open cortex stimulation where brief and weak stimuli are successful, the activation of the brain motor area during general anaesthesia in cases with the intact patient's head, very strong electrical stimulation pulses are needed. It is mostly because of the high scull and scalp impedance and therefore only about 10% of total stimulating current pass this barrier and effectively activate the neurones. In order to enable selective neural stimulation, small area electrodes are used. In this paper, the influence of pulse current stimuli parameters on the characteristics of cup EEG and corkscrew at high current densities are investigated. The cup electrodes, in contrast to the corkscrew electrodes, showed nonlinear properties, i.e. a significant increase in pulse voltage to current ratio at high current densities.

12.6

New Low-Noise, Low-Voltage Instrumentation Amplifier Dedicated to Nerve Signal Recording

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Abstract
In this paper we propose a new low-noise low voltage BICMOS instrumentation amplifier (IA) with high CMRR and exempted from resistance matching. This IA is dedicated to nerve signal recording as a part of implantable prostheses The IA design and the simulation with the BiCMOS 0.8 μm technology are presented The gain is programmable by sing a network of resistors The IA features a common-mode rejection ratio of more than 100 dB, The equivalent input noise is 1.4 μV rms.

12.7

Estimation of Conduction Velocity Distribution of Peripheral Nerve Trunks

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Abstract

In estimating the distribution of the conduction velocity (DCV) of peripheral nerve fibers, neither deteriorated results due to noisy data and nor horizontal shifts of DCVs due to inaccurate measurement of conduction lengths are negligible. In this paper, a Regularized-Least-Squares method with a smoothness constraint and a self-adaptation of regularization parameter was adopted and proved to be effective for noisy data. Besides, Although the conduction lengths of nerve fibers should be predetermination for estimation, because of the existence of the curve of fibers and the contraction of muscle due to electrical stimulation, it is impossible to measure the accurate lengths of the nerve fibers.

12.8

Analysis of the Quadriceps Muscles Control Strategy in the Anterior Knee Pain

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Abstract

Anterior Knee Pain (AKP), elsewhere called patello-femoral pain, is a common pathological condition, particularly for young people and athletes. In this pathology the more common problem is the abnormal motion of the patella during knee bending. It could depend on muscular or structural imbalance. Usually, the rehabilitative therapy consists of a conservative treatment of the AKP based on the strengthening of the Vastus Medialis. The aim of this article is to study the modification of the muscle control strategy in AKP patients. The analysis of the strategy of muscle activation is important for an objective measurement of the knee functionality as far as it helps in diagnosis and in monitoring the rehabilitative treatment. Surface Electromyography (EMG) from the three superficial muscles of the Femoral Quadriceps during a concentric isokinetic exercise has been analysed. To describe these modifications the Linear Envelope (LE) decomposition proposed by Chen and Shavi [8] has been used. Significant modification of the activity of the Vastus Medialis respect to other quadriceps muscle has been recognised in AKP patients. Such muscular unbalance results in abnormal motion of the patella.

Session 13
Biosignal Processing 2: Cardiovascular Systems

13.1

An Algorithm for the Detection and Classification of Atrial Fibrillation from Intra-Atrial Electrograms

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Abstract

Reliable detection of atrial fibrillation from intra-atrial signals is a central task in the development of implantable atrial defibrillators. Atrial rate (AR) and the amplitude probability density function (APDF) are normally used as parameters for discriminating between normal sinus rhythm (NSR) and atrial fibrillation (AF). We hereby propose a new peak-detection scheme based on threshold crossing. The main features of the algorithm are: prefiltering of the atrial electrograms magnitude with FIR band-pass filter and the combined use of root-mean square and of peak amplitude for the setting of an adjustable threshold. A blanking period and an exponential time decay of the threshold have also been introduced to increase peak-detection robustness. The classification of the AF rhythm, according to Wells' classes, has been obtained by the combined use of the coefficient of variation of AR (CV) and of APDF values. To find the optimal settings and to test the performance and robustness of the peak-detection algorithm we used data from intra-atrial recordings from chronic AF patients and from subjects with electrically induced AF. On the basis of these settings we implemented the classification scheme. The peak-detector revealed a 98.75% sensitivity, 98.33% specificity and 97.07% overall accuracy. Although CV and APDF satisfactorily matched the Wells' criteria, we feel that this should be further confirmed by a larger statistical analysis.

13.2

An Algorithm for the Detection of the Atrial Fibrillation from the Surface ECG for an of Home-Care Evaluation of the Implanted Atrial Defibrillators

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Abstract

The objective of this study is to develop an algorithm able to detect atrial fibrillation episodes monitoring a standard superficial ECG lead. This algorithm aims to be included in a microprocessor based portable monitoring unit able to assess atrial defibrillator performance. The automatic recognition of the atrial fibrillation from superficial ECG is critical mainly because of the small size of the atrial waves as compared to ventricular activity and to their chaotic nature. In this work a morphological detection of the fibrillatory waves to be combined to rhythm information is proposed for a reliable automatic detection of atrial fibrillation/flutter. A pre-processing of the raw ECG aims to cancel the ventricular activity (QRS-T complex). This operation is achieved using an adaptive recurrent filters. Afterwards, the recognition of atrial fibrillation episodes is achieved computing a ratio between predefined bands of the power spectrum. Particular care has been paid in the development of the algorithm to allow real-time operation. The sensitivity and the specificity of the presented algorithm has been tested utilising data provided by the MIT-BIH ECG-database and the IMPROVE data library.

13.3

Simultaneous Recordings of Spontaneous Fluctuation in Heart Rate, Blood Pressure, Peripheral Blood Flow and Pupil Diameter: Analysis in the Frequency Domain

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Abstract

We performed simultaneous recordings of heart rate, blood pressure, respiration, peripheral blood flow and pupil diameter in order to investigate common rhythms in the spontaneous fluctuations of these signals. In particular attention has been paid to the so called Low Frequency (LF, 0.04- 0.15Hz) and High Frequency (HF, 0.15-0.40Hz) band, which, in the heart period fluctuation, reflex the control of the Autonomic Nervous System to the heart. Peripheral blood flow was non invasively monitored with laser-Doppler technique, with the 2 probes located in the palmar site of the hand and in the sternum. We continuously assess the pupil diameter fluctuations by a custom, portable, infrared TV pupillometer. Spectral estimation was estimated by autoregressive modelling on 250 point segments. The respiratory rhythm (HF) was clearly detected in all the spectra. Oscillations in the LF band were detected in the laser-Doppler signal of the hand, as well as in the pupil diameter, but not in the laser-Doppler flow of the sternum. In this last signal an harmonic component at 0.16-0.17 Hz was clearly observed. These data confirms previous findings and observations, collected with different techniques and for different purposes. Whether these rhythms can be expression of central common oscillators or reflex mechanical factors is of primary importance for possible clinical applications of this approach.

13.4

Quantification of Respiratory Influence in Hear Rate Variability Through Wavelet Packets Decomposition Algorithm

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Abstract

Respiratory Sinus Arrhythmia (RSA) induces cyclic variations, synchronous with respiration, in the RR interval series. Quantification of RSA is important for the correct separation between sympathetic and parasympathetic components of HRV and for the analysis of Autonomic Nervous System (ANS) activity. In this paper we propose a Wavelet packets subband decomposition algorithm for the extraction of respiratory-related component of RR variability. Wavelet Packets are used to filter the RR interval and respiratory series and to generate a set of orthonormal sub-band signals. An Autoregressive with eXogenous input (ARX) model is used to describe the relationships between the two signals in the different sub-bands. Starting from the parameters of the different sub-band models it is possible reconstruct the respiratory related component in full-band. A few preliminary results will be presented to discuss the performance of the proposed approach and to show that the new approach is able to provide a better reconstruction of the RSA than tradition full-band methods.

13.5

A Statistical Comparison of Signal Representations and Spectral Estimators of Heart Rate Variability in Hypertensive Patients

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[2]Department of Information and System Science, "La Sapienza" University of Rome, Italy,
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Abstract

The study of short-term heart rate variability (HRV) by spectral analysis has gained increasing attention over the last years. Although large amount of data are now available in literature, the quantitatively comparison of the results obtained by different authors is difficult due to both the different HRV signals and spectral estimators which have been used. In these paper we statistically compared three HRV signals and two spectral estimators. HRV signals were: Interval Tachogram (IT), Cubic Spline Interpolation of discrete event series (CSI) and Low-Pass Filtering of Event Series (LPFES). Spectral estimation methods included parametric estimation via Autoregressive modelling (AR) and nonparametric estimation via Fourier Transform (FT). To this purpose we studied HRV spectral parameters in 32 essential hypertensive patients, in resting condition. The most relevant differences have been obtained when comparing the LPFES with IT or CSI. LPFES significantly overestimated the High Frequency component. When applied to the same HRV signal AR and FT gave comparable results. In conclusion, attention should be paid when quantitatively comparing spectral indexes obtained from LPFES with those obtained by IT or CSI.

Session 14
Radiotherapy

14.1

Clinical Investigations of a CT-Based Reconstruction and 3D-Treatment Planning System in Interstitial Brachytherapy

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Abstract

Purpose: Development, application and evaluation of a CT-guided implantation technique and a fully CT based treatment planning procedure for brachytherapy.

Methods and Materials: A brachytherapy procedure based on CT-guided implantation technique and CT based treatment planning has been developed and clinical evaluated. For this purpose a software system (PROMETHEUS) for the 3D reconstruction of brachytherapy catheters and patient anatomy using only CT scans has been developed. An interface for the Nucletron Plato BPS treatment planning system for optimisation and calculation of dose distribution has been devised. The planning target volume(s) are defined as sets of points using contouring tools and are used for optimisation of the 3D dose distribution. Dose-volume histogram-based analysis of the dose distribution enables a clinically realistic evaluation of the brachytherapy application to be made. The CT-guided implantation of catheters and the CT-based treatment planning procedure has been performed for interstitial brachytherapy and for different tumour and anatomical localisations in 197 patients between 1996 and 1997.

Results: The accuracy of the CT reconstruction was tested using a quality assurance phantom and an interstitial implant of 12 needles and compared with the results of reconstruction using radiographs.

Both methods give comparable results with regard to accuracy. The CT based reconstruction was faster. Clinical feasibility has been proved in pre-irradiated recurrences of brain tumours, in pre-treated recurrences or metastatic disease, and in breast carcinomas. The tumour volume treated ranged from 5.1–2741 cm3. Analysis of the implant quality showed a slightly significant lower COIN value for the bone implants, but no differences in respect to the planning target volume.

Conclusions: With the integration of CT imaging in the treatment planning and documentation of brachytherapy, we have a new CT based quality assurance method to evaluate implant quality.

14.2

Imaging Tools for Treatment Planning in Brachytherapy

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Abstract

None.

14.3

Application of the Monte Carlo Integration Method in Calculations of Dose Distributions in HDR-Brachytherapy

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Abstract

Source anisotropy is a very important factor in brachytherapy quality assurance of high dose rate (HDR) ^{192}Ir afterloading stepping sources. If anisotropy is not taken into account then doses received by a brachytherapy patient in certain directions can be in error by a clinically significant amount. Experimental measurements of anisotropy are very labour intensive. We have shown that within acceptable limits of accuracy, Monte Carlo integration (MCI) of a modified Sievert integral (3D generalisation) can provide the necessary data within a much shorter time scale than can experiments. Hence MCI can be used for routine quality assurance schedules whenever a new design of HDR or PDR ^{192}Ir is used for brachytherapy afterloading. Our MCI calculation results are compared with published experimental data and Monte Carlo simulation data for microSelectron and VariSource ^{192}Ir sources. We have shown not only that MCI offers advantages over alternative
numerical integration methods, but also that treating filtration coefficients as radial distance-dependent functions improves Sievert integral accuracy at low energies. This paper also provides anisotropy data for three new ^{192}Ir sources, one for the microSelectron-HDR and two for the microSelectron-PDR, for which data currently is not available. The information we have obtained in this study can be incorporated into clinical practice.

14.4

Endovascular Irradiations with Beta Sources

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[2]Austrian Research Center Seibersdorf (ARCS), Austria,
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Abstract

For treatment of restenoses tubes (inner/outer diameter 1 and 2mm; length 3 or 5mm) with Y-90 foils, shielded by thin Ti-layers on all sides have been developed (activity 0.5 – 2 GBq). Quality checks with plastic scintillators have been developed and are correlated to absolute dose measurements performed with TLDs (1*1 mm 2 ; 40mg/cm 2). TLD-handling and calibration for beta-dosimetry are described. Additional measurements for depth-dose and dose distribution around the tubes were done with GAFCHROMIC-films and compared to Monte-Carlo calculations with the MCNP4-code, yielding a half-value depth of 0.8mm from the tube-surface. Manufacturing and delivery of the sources including leakage tests has been standardized, treatments (irradiation times <5min; irradiation length <30mm) are planned to start in spring '98.

14.5

IORT: Intra-Operative Radiotherapy System in Surgery

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Abstract

None.

14.6

Report of an Underdose Radiotherapy Accident

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Abstract

Reporting information on accidents and incidents involving radiation sources provides a body of Knowledge which can help to prevent accidents of a similar nature. Accident information has to be made available to Users, Manufacturers and Regulators. An international effort to pool and analyse incident and accident information will provide more complete and reliable indicators of root causes and trends and recommendations for future accident avoidance. An accident due to human error involving a Superficial x-ray Therapy machine and patients treated for postoperative breast cancer is reported here. 43 women receiving radiotherapy treatment have received significantly less radiation dose than the prescribed dose. The worst dose percentage within the radiation field was 20% of the prescribed dose. The worst dose percentage on the operation scar of the breast was 52% of the prescribed radiation dose. The response to accidents/incidents in Radiotherapy is discussed.

14.7

Performance and Beam Characteristics of the PANTAK THERAPAX HF225 X-Ray Therapy Machine

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Abstract

The performance and beam characteristics of the new PANTAK THERAPAX HF225 X-ray therapy machine have been measured, evaluated and discussed. Eight beam qualities within the working range of generating potentials between 50 and 225 kVp are used in our department. These beam qualities have been investigated in order to provide a data base specific to our machine. Beam Quality, Central axis Depth Dose, Output, Relative Output, Field Uniformity and Timer Error were investigated.

Session 15
Clinical Engineering

15.1

Acceptance Inspections of Medical Devices in Health Care Facilities - The Quality Control Approach

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Abstract

The acceptance procedure of medical devices for usage in health care facilities is of a significant effect on patients treatment quality, personnel safety and maintenance cost. An acceptance inspection is needed when new or repaired medical devices are received by the institute. It may discover equipment failure or dysfunction, and thus prevent false diagnosis, an inefficient or dangerous treatment, risking the patient or staff. Nevertheless, a general and comprehensive inspection procedure of medical devices has not yet been described, and there are no publications regarding the quality control of the process. We therefore suggest a quality controlled inspection process, which can be easily applied in hospitals and sick funds. The process refers to portable and non-mobile, new and repaired medical equipment. The means and instruments needed for the process application are detailed.

15.2

Quality Management for Clinical Engineering Departments in Greece. The Use of Quality Indicators and Software Tools

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Abstract

Within the framework of the Greek national project BIOTECHNET II, design and detailed description of the services to be offered by Clinical Engineering Departments (CED) in a modern hospital, has been worked out, taking into account local particularities and needs in Greece. The services incorporate a Quality Assurance program which includes ongoing monitoring, evaluation and improvement of the department's activities and performance in terms of effectiveness, efficiency, and productivity. For this purpose, a set of quality and cost indicators has been identified and selected, Furthermore a software tool, has been designed, that keeps track of the CED's every day tasks and monitors the performance as well as, analyzes the collected data and finally leads to conclusions for the overall performance of the department aiming to its continuous improvement. Finally, the services and tools derived have been evaluated in a number of Greek hospitals. In this article the design procedure followed is presented as well as the conclusions extracted from the work performed.

15.3

Biomedical Business Reengineering in Reference to the Strategy and Architecture of the used Information Systems, and the Biomedical Procedures Reconciliation to the Business Activities

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Abstract

The economic, political and social environment is changing dramatically and Business in Biomedical Structured Corporations (BBSC) is adapting to this change. An important role to this change is done by information technology (IT). This part of the strategic plan of an entire biomedical corporation focuses on how Information Systems (IS) will support the organization's strategic activities. The basic technologies should be combined into software applications, the relational data base management systems and others, which are the tools for supporting patient care. More over the future trends of the whole "Biomedical Corporation Business Sector" (BCBS) are taken into deep consideration making hospitals thinking of out-soursing, flattening, benchmarking, and Business Process Reengineering (BPR). In addition there are the management disciplines applied within the three different entities of a biomedical-characterized structure: the entity of the data, the entity of the business procedures, and the entity of the technology applied are also crucial. All these merge together under the sphere of the control architecture, which is easy to be set, when the centralization of the organization is significant. Taking into consideration all these, Total Quality Management (TQM) can be easily set, making it possible for the organizations to develop the appropriate for themselves strategic plan. The experience gained from the application of BPR in an acute hospital is presented.

15.4

Best Practices and Benchmarking in Clinical Engineering: Design of Surveying Tools

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Abstract

Benchmarking as a tool for quality improvement, is a relatively new element in clinical engineering. The need of updated information on the current status of services and use of quality indicators, has lead us to launch an international survey of the current practices in clinical engineering departments. The survey which will address around 1000 participants all over the world, will be performed by written questionnaires. Its aim is to record the current situation and propose a set of quality indicators, which could be widely applied and could facilitate the process of benchmarking.

15.5

Design, Installation, and Testing of Medical Gases Installations

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Abstract
This paper describes in brief the procedures to be followed for the design, installation and testing of a medical gases installation. Some basic design concepts are presented followed by the design characteristics of the most basic components on an installation. The testing procedure to be followed is then presented. This paper is intended for giving some of the most important characteristics of amedical gases installation and is certainly not a complete guide for such operations.

15.6

In-House Development of Test Equipment for Quality Control and Training Case Study: A Prototype ECG Simulator-Tester

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Abstract
The support services for biomedical technology, address a variety of technical and administrative issues, concerning the safe and efficient operation of medical equipment over the period of its intended use and the training of hospital personnel in issues concerning safety and quality. Clinical Engineering Departments undertake the responsibility of developing and operating training programmes in medical equipment utilisation apart from the traditional role of training and supervising technicians involved in testing, calibration and preventive / corrective maintenance of electromedical equipment.
In view of the above, the Institute of Biomedical Technology and the Center of Biomedical Engineering collaborated for the design and development of a prototype digital ECG and arrhythmia simulator. In the absence of internationally accepted inspection protocols for ECG simulators, the verification phase of the project involved mainly the inspection of the device's conformity to its initial technical specifications. The results demonstrated that this tester, due to simplicity in construction and easiness in use can be a practical, reliable and economical solution for ECG monitor testing and waveform recognition training.

15.7

Nitrocom2 - A Modified Version of the Drug Delivery System (Nitrocom)

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Abstract

None.

Session 16
Biosignal Processing 3: Cardiovascular Systems

16.1

High Resolution ECG Filtering using the Wavelet Shrinkage Technique

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Abstract

The performance of the High Resolution ECG analysis for prediction of ventricular tachycardia is strongly dependent on the quality of the signal, i.e. Signal-to-Noise Ratio. The classical technique of signal-averaging is a statistical estimation procedure which requires long data records of 200 to 600 beats. This study proposes a wavelet shrinkage method which accelerate noise reduction and provide a high-fidelity signal using only 84 beats. Wavelet shrinkage involves a dyadic wavelet decomposition of the original noisy signal, followed by shrinking the empirical wavelet coefficients towards zero using carefully selected thresholds, followed by inverse transformation, A performance evaluation of several wavelet bases as well as of different thresholding types and threshold values has been carried out using controlled simulation experiments. The quality of the wavelet denoised signals has been assessed through the remaining noise level as well as their diagnostic values. We conclude that the mixed wavelet shrinkage-64 beats averaging technique can provide similar results for the late potentials assessment as, the time-consuming 400 beats averaging procedure.

16.2

Digital Filter for Ventricular Late Potentials Study

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Abstract

The aim of our study was to discuss the problem of digital filter for ventricular late potentials detection. We have arranged program for generation simulated QRS complex and late potentials. We have studied several IIR filters and also FIR filters. We have concluded that the best filter have to be characterized by: linear phase characteristic, deep and steep slope frequency characteristic and narrow amplitude characteristic. The IIR filter as bi-directional Butterworth filter are prone to ringing effects and phase shifting, change the shape of filtered signal, change the spectral characteristic of filtered signal, change the time position of micropotentials in vector magnitude of filtered QRS complex.

16.3

Coefficient of Right Decision and Degree of Patient Verification in Ventricular HR-ECG

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Abstract
In this paper we try to find method giving the objective answer, which method of digital filtration of QRS cornplex gives the best separation between different groups of patients (pts), and answers how rnany parameters enables good patients (pts) groups separation in ventricular HR-ECG.

16.4

The Optimal Criteria of Late Potentials for Segregation Patients with Ventricular Tachycardia

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Abstract
The principal aim of our study was to analyze if the greater number of parameters, which describe the vector magnitude (VM) of QRS complex increase the value of percent of right decision. We have used for this purpose up to 11 parameters. We conclude that the higher value of right decision percent can be obtained by using compound method of QRS complex filtration and more than 3 parameters of VM of QRS complex.

16.5

Arterial Blood Pressure Analysis by Artificial Neural Networks for the Prediction of Peri-Intra Ventricular Hemorrhage in Premature Newborn Infants

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Abstract

We have used back propagation artificial neural networks (BP ANN) to analyze long term arterial blood pressure (ABP) recordings of 16 premature newborn infants. Our purpose was to predict the onset of peri-intra ventricular hemorrhage. BP ANN's have been trained using respiratory and cardiac spectral peak amplitudes, their frequencies, the pulse intervals, the ABP interval's minimum, maximum, mean and variance. The classification capability of the ANN's show a high variability depending on the choice of parameters.

16.6

Bi-Dimensional Feature Selection of Electrocardiographic Data

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Abstract

A number of bi-dimensional feature selection techniques were investigated to provide a suitable input feature vector to Neural Network classification models to allow segregation between a number of disjoint cardiac abnormalities based on 12-Lead Electrocardiographic data. Multiple linear regression feature selection techniques were employed for both unscreened and screened training databases. A simple feature selection method employing visual linear segregation of Box Plots was also employed. Results indicate that it is possible to reduce the number of input features to a classifier without loss of classification accuracy. The beneficial effects of statistically screening prior to generation of the classification model were also noted. It was found that the selection technique of Box Plot analysis proved to be the best overall average method of feature selection for the neural classifiers. The superior discriminatory powers of Neural Networks in comparison with regression models were also demonstrated.

16.7

Bi-Group Neural Network Classification of the 12-Lead ECG

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Abstract

The ability of a multi-output Neural Network (NN) classifier is hindered by the scenario of non-mutual exclusion within the possible classification space. A framework has been proposed consisting of a bank of bi-group NN and an error control module employing Dempster-Shafer (D-S) orthogonal summation to accommodate the classification of unknown 12-lead ECG signals for both mutual and non-mutual exclusion scenarios. The bi-group NN segregate the entire n dimensional classification space into a number of bi-dimensional problems. The D-S summation accommodates the error situation where more than one mutually exclusive bi-group classifier asserts its output simultaneously. The entire framework was compared with a conventional multi-output NN and a framework of bi-group NN with the D-S error control substituted with Majority Rule. The framework attained a classification level of 85.71% compared with 67.14% for the multi-output NN and 82.86% for the framework employing majority rule.

Session 17
Radiotherapy & Radiation Protection

17.1

From 2D-Images to 3D Models, from Diagnosis to Treatment: IT-Based Methods in the Medicine of Tomorrow

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Abstract

None.

17.2

EXOMIO: IT-Based Virtual Simulation goes Clinics

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Abstract

None.

17.3

A Distortion Correction Method for Image Intensifier and Electronic Portal Images used in Radiotherapy

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Abstract

At the most of radiation departments a simulator and an "online" verification system of the treated volume, in form of an electronic portal imaging device (EPID), are available. Networking and digital handling (saving, archiving etc.) of the image information is a necessity in image processing procedures in order to evaluate verification and simulation recordings at the computer screen. Distortion correction is on the other hand prerequisite for quantitative comparison of both image modalities.

Another limitation factor, in order to make quantitative assertions, is the fact that the irradiation fields in radiotherapy are usually bigger than the field of view of an image intensifier. Several segments of the irradiation field must therefore be acquired. Using pattern recognition techniques these segments can be composed into a single image.

In this paper a distortion correction method will be presented. The method is based upon a well defined Grid which is embedded during the registration process on the image. The video signal from the image intensifier is acquired and processed. The grid is then recognised using image processing techniques. Ideally if all grid points are recognised, various methods can be applied in order to correct the distortion. But in practice this is not the case. Overlapping structures (bones etc.) have as a consequence that not all of the grid points can be recognised. Mathematical models from the Graph theory are applied in order to reconstruct the whole grid. The deviation of the grid points positions from the rated value is then used in order to calculate correction coefficients. This method (well defined grid, grid recognition, correction factors) can also be applied in verification images from the EPID or in other image modalities, and therefore a quantitative comparison in radiation treatment is possible.

The distortion correction method and the application on simulator images will be presented.

17.4

Dose Calculations Algorithm for Narrow Heavy Charged-Particle Beams

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Abstract
The dose distributional advantages of the heavy charged-particles can be fully exploited by using very efficient and accurate dose calculation algorithms, which can generate optimal three-dimensional scanning patterns. An inverse therapy planning algorithm for dynamically scanned, narrow heavy charged-particle beams is presented in this paper. The irradiation 'start point' is defined at the distal end of the target volume, right-down, in a beam's eye view. The peak-dose of the first elementary beam is set to be equal to the prescribed dose in the target volume, and is defined as the reference dose. The weighting factor of any Bragg-peak is determined by the residual dose at the point of irradiation, calculated as the difference between the reference dose and the cumulative dose delivered at that point of irradiation by all the previous Bragg-peaks. The final scanning pattern consists of the weighted Bragg-peaks irradiation density. Dose distributions were computed using two different scanning steps equal to 0.5 mm, and 1 mm respectively, Very accurate and precise localized dose distributions, conform to the target volume, were obtained.

17.5

Simulation Model for Predicting the Thermal Effects of a Focused Ultrasound Transducer with Internal Diagnostic Ultrasonic Element

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Abstract
This paper describes a simulation model for determining the thermal effects of a 10 cm diameter spherically focused transducer which includes an internal disk used as a diagnostic element. The model evaluates the Power density based on a Guassian equation. Based on the power density the temperature is predicted using the Bioheat transfer equation. Based on the temperature and time history the equivalent thermal dose at 43 o C is estimated. The Boundaries of necrosis is evaluated by considering a threshold of necrosis of 240 min at 43 o C on the thermal dose distribution. The transducer simulated has a focal length of 5 cm and was focused 2 cm deep into the tissue. By decreasing the internal disk diameter the lesion length and width are increased since more surface area is allocated for therapy in the transducer. The smallest internal disk diameter that was used was 2 cm (f-number is 2.5). By using this internal disk diameter, levels of power and pulse duration are suggested that will produce lesions of at least 5 mm in length.

17.6

Results of a QC Program on Dental Radiography in Greece

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Abstract
Quality Control (QC) performed on 99 intraoral dental X-Ray units, installed in equal in number dental offices, at the Achaia prefecture, a region of south west Greece. The QC procedure includes collect of general information, radiation safety checks, beam qualitative and quantitative characteristics checks, and film processing cheeks, according to international established protocols. The collected data are characterized by a non-uniformity and in some cases indicate a poor performance level. The results of study on a representative sample of dental X-Ray units helps to map the existing situation and may be useful in the reviewing and optimization of the applied process.

17.7

Occupational Radiation Exposures in Cyprus

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Abstract
For the first time ever the occupational radiation exposure data of all the radiation workers of Cyprus, as obtained by the personnel monitoring service of the Dosimetry Laboratory of the Medical Physics Department of the Ministry of Health, is published and compared with that of other countries.
The presented data shows a systematic trend of improvement both with regards to the methodology of monitoring and data recording. The efforts of the past few years in educating and training the users of ionising radiation with regards to the importance of the personnel monitoring service and the hazards of ionising radiation, has paid off and this is evident from the doses recorded in the past three years which are compared favourably with those of other countries, as given by the UNSCEAR 1993 report.
The introduction of extremity monitoring, promises even better improvement in the methodology of monitoring the doses received by personnel working in Interventional Radiology, as well as other groups whose hands, unavoidably, come close to radiation sources.

17.8

Program of Yugoslav Society for Additional Professional Education in Medical Physics

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Abstract

During first annual meeting of Yugoslav Society for Biomedical Engineering and Medical Physics (YUBEMP) it was established the preliminary Additional Program for Professional Education (APPE) in medical physics. Program was directed toward basic knowledge refreshment and new methodology introduction. Program was created as continuing process for each particular field of medical physics (ionizing and non-ionizing radiation applied in medicine for therapeutic and diagnostic purposes). The very first part of program is directed to the official promotion of APPE as continuing process in close collaboration with relevant authorities. The cross section of present situation, which refers both to the number and qualifications of physicists employed in hospitals and affiliated institutions, as well as to global analyze of educational network with levels of competency, was presented. In the conclusion it was pointed out the intention of YUBEMP directed to further APPE development and realization with aim to attain the official recognition of the medical physics profession at government authority level.

Session 18
Electronic Market for Medical Devices: MEDICOM Project

18.1

Requirements Analysis of the Medical Devices Commerce Community

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Abstract
The development of a Europe wide telematics application for electronic commerce of medical devices targets a broad variety of users from single users to huge organisations (customers or suppliers), and aims at concentrating the forces of organisations interested in globalisation of medical products market for establishing an environment hosting all the interactions of customer-supplier. In this study the user profiles involved in Medical Devices electronic commerce are addressed and assessed in correlation with the procedures followed today. Description of the medical products assessment and planning procedures performed up-to-date by large medical product consumers is given, as well as, their selection criteria and procedure. The description highlights those points related to the integrated environment electronic commerce/presentation of medical products and the way an electronic environment can benefit the procedure. The right information to the buyer is considered the key issue for a medical products electronic commerce system. This can enlarge the market to the size of its own potentials and thus perform the target of trade: sales that satisfy buyer needs.

18.2

Medical Products Electronic Commerce Project: The Approach

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Abstracts
The main objective of Medical Products Electronic Commerce (MEDICOM) is to concentrate the forces of organisations interested in globalisation of medical products market for establishing a universal environment hosting all the interactions of medical products producers-consumers. MEDICOM project will study and develop a European Market Place where all actors holding stakes in the European market of medical devices can interact. The paper describes the approach employed to structure the integrated environment hosting all facilities implied by the electronic nature of the target. The overall system architecture and the modules adapted in the system design phase are reported. The approach highlights the special requirements of European industry in several fields as products sales, information exchange facilities for both marketing and security purposes, on-line communication within the healthcare community, post market surveillance etc.

18.3

Medical Products Electronic Commerce: Architectural and Functionality Issues

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Abstract
The Medical Products Electronic Commerce (MEDICOM) system establishes a universal environment hosting all the interactions of medical products providers –consumers. MEDICOM system consists of three levels, the Hypermedia Medical Catalog (HMC), the Post Market Surveillance (PMS) and the Virtual Medical Exhibition (VME). In this paper, the functionality of these three levels is described in detail. The first level, HMC, will include a database containing information on medical devices and consumables. It will provide browsing and searching capabilities, discussion groups, document libraries and web pages presenting the data. The second level, PMS, will provide a mechanism for reporting incidents concerning device usage among users of the device, manufacturers/suppliers and authorities. The third level, VME, will provide, through the use of Virtual Reality techniques, an additional tool for sales promotion, but also after sales support to the customers.

18.4

Discussions on MEDICOM Market Place

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Abstract
The main objective of Medicom is to build/establish an environment hosting all the customer-supplier interactions of organisations interested in the market of medical products, thus offering products sales information, together with exchange facilities for both marketing and security purposes. This study is focused on the MEDICOM market oriented objective, which is the assessment of the market potential of the future MEDICOM solution, with particular emphasis on the identification and assessment of an adequate market segmentation for Healthcare organisations & professionals, segmented on their usual characteristics and purchasing processes and Medical equipment manufacturers, segmented on the "benefit" gained with MEDICOM.

Session 19
Biosignal Processing 4

19.1

A Stimulating Pulse Generation and Spectrogram Illustration for Cochlear-Implant Based on Filter Bank Design Approach

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Abstract

The Cochlear implant is a hearing prosthesis based on electrical stimulation of hearing nerves in the cochlea to rehabilitate cases where conventional hearing prostheses are inefficient. The pulse generation process requires a stimulation algorithm implementation based on different techniques of speech processing. This paper presents a speech processing approach for cochlear implants based on FIR-Filter bank design applied for Graphical spectrogram illustration and for stimulating-pulse generation. Digital filters designed for this application could be chosen optionally in different types such as Remez, Butterworth, Chebychev or Elliptic. Before implementing a stimulation algorithm on a Digital Signal Processor 'DSP' of cochlear implant device, it was interesting to simulate the speech processing approach. The simulation was done by designing a graphical spectrogram to illustrate stimulating pulses' levels on computer screen, which was useful for speech-processing test, and later for clinical survey of electrical charges injected. stimulation-algorithm-functionality tests as well as programming handiness led to satisfactory results in stimulating pulse generation and permitted to confirm that our speech processing approach was efficient for rehabilitating deafness.

19.2

Investigation of the Missing Fundamental by a Cochlea Model

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Abstract

We have investigated the relation between the frequency information in the phase locked pulse train at the peripheral auditory nerves and the missing fundamental at the central auditory nerves by a cochlea model. We can have seen the information of the missing fundamental in the output pulse trains from primary auditory nerves by agregated autocor-releograms. It has been found that the information of the missing fundamental (the period of a complex tone signal) is contained in the phase-locked pulse train by Integral Pulse Frequency Moduration with a Refractory Period at primary auditory nerves.

19.3

EOG Basaline Oscillation in Congenital Nystagmus

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Abstract
Visual acuity in congenital nystagmus is primarily related to the duration of the foveation periods, during which the image of the target is placed on the fovea area and the eye velocity is low. This is true only if the subject is still able to place the target image on the centralmost fovea during the foveation period. In presence of a high variability of the foveation position the target image could not be placed on the centralmost fovea during many foveation periods. An associate vertical nystagmus or a slower horizontal eye movement combined to the horizontal nystagmus could cause such high variability. In several eye-movement recordings of patients affected by congenital nystagmus a very slow oculographic baseline fluctuations have been detected. In these patients the ability to foveate the target seems to depend mainly by the amplitude of the baseline fluctuation. The aim of this paper is to Describe and quantitatively characterise these slow movements and try to associate them with the patient visual acuity. Furthermore a method to automatically separate the slow baseline oscillation from the nystagmus is proposed. Our findings suggest that for these patients the maximum effort could be concentrated on the reduction of the eye-position variability during foveation.

19.4

Evaluation of the Characteristics of Smooth Pursuit Eye Movements to Sinusoidal Stimulation by Means of an ARMA Model

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Abstract
Eye movement recordings during sinusoidal smooth pursuit stimulation were performed in two adults and two children. To evaluate smooth pursuit characteristics (gain and phase) of the ocular responses, an ARMA model was used. From the velocity signal, after suitable elimination of saccades, order and coefficients of the model were evaluated. The values obtained with the ARMA model were similar to those calculated using a trigonometric approximation, demonstrating the goodness of this type of approach in the evaluation of smooth eye movements. This work represents a first step toward the application of this kind of model in a black-box modelling of the smooth pursuit system.

19.5

Use of Running Statistical Evaluation in Analysis of Electrohysterographic Signals

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Abstract

Spontaneous depolarisation and repolarisation due to the ionic currents are the main properties of smooth muscle cells in uterus. Their functioning as a contractile tissue depends on intercellular electrical and metabolic communication. Due to the lack of depolarisation conducting system the relationship between electrical and mechanical activity of the uterus is determined by the amount of contractile cells being activated at a time. The change in the distribution of electrical charges creates the electric fields that are manifested as an electrohysterogram (EHG). Since waveforms observed in electrohysterograms are subject dependent they cannot be compared between patients. However, for reliable application of electrohysterography in obstetrics there is a strong need to establish methods of tracking the selected parameters of EHG signal. In paper we describe a procedure designed and built in LabView environment. It performs the running estimation of standard deviation to mean in the signal provided and semi-automatically selects portions of signal corresponding to periods of increased uterine activity. In signal epochs chosen, the power carried by the signal in specified frequency band is estimated, which enables power spectrum density tracking for consecutive contractions.

19.6

New Methods for CTG Fetal Monitoring

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Abstract

Antepartum fetal monitoring based on the classical cardiotocography (CTG) is a non-invasive and low-price tool for checking fetal status. Its introduction in the clinical routine limited the occurrence of fetal problems leading to a reduction of the precocious child mortality. Nevertheless very poor indications on fetal pathologies can be inferred from the actual CTG analysis methods, either they consist of the clinician eye inspection or of automatic algorithms. It is certain that fetal heart rate and uterine contraction carry much more information on fetal state than it is extracted by classical analysis methods. In particular Fetal Heart Rate (FHR) signal has demonstrated to provide consistent indication of his well being status and in case of fetal stress, during labor, the FHR usually shows some morphological alterations. As the methods actually used for judging a CTG trace as "abnormal" give a too low predictive value for fetal dangers, we started to develop a new computerized system for the CTG analysis. The fetal monitoring system is based on a new multiparametric analysis of FHR which includes non-linear analysis algorithms (Approximate Entropy and space state maps) of FHR. The analysis is coupled with a classification of fetal states (ABCD) by means of Neural Networks. A comparison between supervised and unsupervised networks has been done on the same set of recordings. A prototype of this new monitoring system will be implemented on the basis of HP Traceview distributed architecture.

19.7

Intestinal Motility Recording and Analysis

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Abstract
The present work is focused on the design and implementation of non-invasive techniques for the recording and analysis of human bows; sounds. A new computer-based analysis system is presented. A dedicated hardware device for the recording of bowel sounds at the abdominal area, together with a computerised system for the off-line analysis of the recorded gastrointestinal activity was designed and. implemented. Novel measures and representations are employed for the results' exposition, Special care is also given to the elimination of undesirable noise signals. Long-time recordings are currently taking place for the foundation of a suitable database for the investigation of major features of gastrointestinal sounds, such as frequency components, duration, levels, e.t.c.

19.8

Enhanced De-Noising of Bowel Sounds using a Wavelet- Based Filter

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Abstract
An enhanced method for de-noising bowel sounds (BS), based on wavelet transform, is presented in this paper. The proposed algorithm (WTST-NST filter) combines multiresolution analysis with hard thresholding in *order* to compose a wavelet transform-based de-noising filter, and was initially proposed by Hadjileontiadis'and Panas [14]. Applying the WTST-NST filter to I3S, recorded from controls and patients with gastrointestinal dysfunction, the coherent structure of BS is revealed and the background noise is waived, The quality of the de-noising procedure is evaluated through qualitative and quantitative analysis that proved an excellent performance of the WTST-NST filter in de-noising BS. Since It does not require any noise reference signal it could be implemented faster than other adaptive do-noising tools, while due to its simplicity it can easily be used in clinical medicine.

Session 20
Plenary Session 3

20.1

Computers in Surgery and Diagnosis

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Abstract

Recent advances in image and signal processing have created a new challenging environment for biomedical engineers. Methods that were developed for different fields are now finding a fertile ground in biomedicine, especially in the analysis of bio-signals and in the understanding of images. More and more, these methods are used in the operating room, helping surgeons, and in the physician's office as aids for diagnostic purposes.
We have used advanced signal processing and innovative image processing methods that are used along with computational intelligence for diagnostic purposes and as visualization aids inside and outside the operating room. The software is written in C^{++} in a windows environment and can be used on any PC. We will demonstrate some applications on a laptop. Applications to be demonstrated on a laptop, include blood cell classification, mammography, evoked potentials, EEG and field potentials in Parkinson's disease. The latter methods along with 3D reconstruction of MRI images of Parkinsonian patients, are currently used in the operating room for Pallidotomies.

20.2

Problems and Tendencies in Application and Development of Expert Systems in Medicine

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Abstract

Expert systems are programs which, using expert knowledge in precisely defined narrow domain of activities, resolve problems associated with that particular domain. Properties, structure and application in medicine, as well as their possibilities and examples of such programs are described in this paper.

20.3

Clinical Data Warehousing - A Survey

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Abstract
In this article we present the concept of data warehousing, and its use in the clinical area. Clinical data warehousing will become very important in the near future, as healthcare enterprises need to gain more information from their clinical, administrative, and financial data, in order to improve quality and reduce costs. Adoption of data warehousing in health care has been slowed by lack of understanding of the benefits offered by the technology. This paper contributes by providing needed understanding, by introducing the opportunities offered by data warehousing, describing current efforts in the area, and providing criteria for comparing clinical data warehouse systems.

20.4

Collaboration of Biomedical Engineering and Medical Informatics On the Road to Citizen-Centred Care

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Abstract
The citizen-centred care come as a new scenario in the classical struggle in all health care delivery systems between access and quality on one side and cost-containment on the other. This citizen centred care is a result of growing trend of a greater involvement of patients or citizens in receiving information, in decision making, and in responsibility for their own health. It builds on health telematics networks and services, linking hospitals, laboratories, pharmacies, primary care and social centres, in other words regional healthcare networks. These networks will provide possibility of telemedicine services to homes, work places, etc with new innovative services such as personal health monitoring and support systems and user-friendly information systems for supporting health education and awareness. These new innovative systems will require the integration of the new advanced sensors and micro systems, normally results of classical biomedical engineering research, with information systems and electronic health records which are major topics of medical informatics. This stronger co-operation between biomedical engineering and medical informatics is supported by European Commission in the new (5th) Framework Programme in the proposed Programme "Creating user-friendly Information Society".

Session 21
Medical Imaging 4: Image Processing & Multimodality Imaging

21.1

Medical Imaging Interpolation Technique Based on Mathematical Morphology

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Abstract

A new interpolation scheme is developed for interpolating medical data. The new interpolation algorithm is based on Mathematical Morphology operations and it can handle various cases occurring on medical data, including the branching and holes problem as well as accurate volume representations. The scheme is implemented in JAVA and its output is in VRML 1.0 format; therefore it can be executed over the Internet and implemented for Telemedicine applications.

21.2

An Object-Oriented Client-Server System for Interactive Segmentation of Medical Images using the Generalised Active Contours Model

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Abstract

In this paper we describe the first prototype of a distributed medical imaging system suitable for the visualisation and processing of medical images. The prototype is an object-oriented client-server system that provides a complete framework for the interactive segmentation of blood vessel contours from X-Ray Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) scans, using the Generalised Active Contours Model. The system has been implemented exploiting the benefits of recent software developments, such as the Java programming language and the CORBA distributed object technology, which simplify the building, the maintenance and the portability of this kind of distributed applications.

21.3

A Lossless Compression Algorithm for Medical Images using Variable Block Size Segmentation

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Abstract

This paper presents a hybrid approach for image compression based on vector quantization (VQ) and fractal approximation. The low frequency components of an input image are approximated by VQ and its residual is coded by fractal mapping. Instead of using indirectly the gray patterns of an original image with contraction mapping for a domain pool like in the conventional fractal coding algorithms, our fractal coding method employs first an image approximated by transform VQ (TVQ) and then decimated as a domain pool. With the proposed algorithm the constraint of contraction mapping is not required, fractal approximation that uses the self-similarity of gray patterns works on the approximated image. Also, in order to improve the encoding step, and the complexity reduction, we introduce the orthogonalization of the domain pool. For designing the codebook of the TVQ , the Lind Buzo and Gray (LBG) algorithm is used . Computer simulations with several test images show that the proposed method yields better performance than the conventional fractal coding methods for encoding still images.

21.4

Hybrid Approach for Still Image Compression Based on Fractal Approximation and Vector Quantification

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Abstract

The Redundancy in digital image representation can be classified into two categories :Local and global. Local redundancy corresponds to the coherence, smoothness or correlation in the image data that is due to the fact that the gray level values within a neighbourhood vary gradually rather than abruptly. Global redundancy could be attributed to the repetition of patterns within an image. The first kind of redundancy can be eliminated by representing the neighbourhood in a compact form, but the second one is eliminated by encoding the repeated patterns by using suitable coding methods. For example, Lempel - Ziv scheme searches for repeated patterns by suitable pointers to the previous occurrences[24].

In the first part of this paper, an analysis of local and global characteristics exhibited by image data is presented. In general, the performance of image compression scheme performs well on a given image if the scheme is based on exploiting specific type characteristic that is present within the image. Hence, in order to drive a compression scheme that performs well on most images, we need to find out the characteristics that are widely exhibited by images. Two common types of image characteristics generally used for lossless image compression are presented.The second part of the paper presents an algorithm for lossless compression. The proposed scheme exploits both type of redundancy in order to get maximum compression for most types of images.The algorithm proposed in this paper is based on these two characteristics. In this image compression scheme, the image is segmented into variable size blocks coded by three different coding schemes depending on the characteristics exhibited by the pixels within the block.The three coding schemes used in this algorithm are the base-offset and run length encoding schemes to exploit the local redundancy and block matching scheme to exploit the simlarity within an image[18][[12].

21.5

A Hardware-Software System for Visualization and Imaging Human Electric Potential

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Abstract

This paper describes a pilot system that acquires images of the electric potentials within the human body and stores the results in a format accessible and visualizable through the WWW. The proposed system uses a system of external electrodes to acquire measurements of electric potentials at the level of the skin, followed by an algorithm that reconstructs the value of the electric potential in the interior of the human body, thus producing a three dimensional (3D) image. The main aspects of the reported work is the visualization of the results in such a way that the acquired information can be imaged through the WWW so that the diagnostically useful information can be maximized. For this reason, the voxels of the acquired electric image are labeled using a conventional CT image from the same patient whereas a triangulation algorithm (Marching Cubes - MC) is used to create the VRML output for information visualization.

21.6

A Three-Dimensional Correlation Method for Registration of Medical Images in Radiology

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Abstract

The availability of methods to register multi-modality images in order to "fuse" them and to correlate their information is increasingly becoming an important requirement for various diagnostic and therapeutic procedures. A variety of image registration methods have been developed but they remain limited to specific clinical applications. Assuming rigid body transformation, two images can be registered if their differences are calculated in terms of translation, rotation and scaling. This paper describes the development and testing of a new correlation based approach for three-dimensional image registration. First, the scaling factors introduced by the imaging devices are calculated and compensated for. Then, the two images become translation invariant by computing their three-dimensional Fourier magnitude spectra. Subsequently, spherical coordinate transformation is performed and then the three-dimensional rotation is computed using a novice approach referred to as "polar shells". The method of polar shells maps the three angles of rotation into one rotation and two translations of a two-dimensional function and then proceeds to calculate them using appropriate transformations based on the Fourier invariance properties. A basic assumption in the method is that the three-dimensional rotation is constrained to one large and two relatively small angles. This assumption is generally satisfied in normal clinical settings.

The new three-dimensional image registration method was tested with simulations using computer generated phantom data as well as actual clinical data. Performance analysis and accuracy evaluation of the method using computer simulations yielded errors in the sub-pixel range.

21.7

Restricted Surface Matching: A New Registration Method for Medical Images

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Abstract

None.

Session 22
Nerve & Muscle 2

22.1

Classifying Arm Movements in Tetraplegics with Artificial Neural Networks

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Abstract

Using relatively simple instrumentation and software running at the PC compatible computer we can objectively determine reaching abilities in humans with paralysed arm muscles. In this paper we present a new approach to determine and classify reaching abilities of spinal cord injured (SCI) patients by artificial neural networks (ANN). Proposed hybrid method consists from two parts: (1) approximating arbitrary non-linear functions such as joint angles recorded during arm movement by wavelet network (WN); and (2) automatic classification of reaching abilities based on feedforward neural network (NN). This methodology was designed to be as objective as possible as well as convenient both for actual use and for subsequent data processing.

22.2

Recurrence Quantification Analysis of Surface Electromyograms

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Abstract

In this paper we describe one of the possible application of recurrence plot strategy to the analysis of surface elctromyograms (sEMG). Recurrence quantification analysis (RQA) is an efficient time-series analysis tool pertaining to the class of non-linear dynamics time-domain processing. We analysed sEMG recorded during isometric contractions at constant and linearly varying force. In order to have a comparison with better known techniques, sEMG was also processed by standard FFT algorithms in order to compute the median frequency of sEMG power spectrum over time. From our results, we may conclude that RQA is almost equivalent to frequency domain analysis when considering costant force isometric contraction. At the contrary, it appears that RQA is most effective in detecting sEMG changes determined by brisk transients of force output.

22.3

Bispectrum Analysis of Surface EMG

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Abstract
In this pilot study, bispectral analysis a particular form of higher-order spectra (HOS), is introduced as a new method for analyzing the surface electromyographic signal (SEMG). The motivation behind the use of HOS in SEMG signal processing is to: detect and characterize existing non linearities in the SEMG signal; estimate the phase; and extract informtion due to deviations from normality [1]. Bispectral analysis findings, suggest that the SEMG signal is highly non Gaussian at low levels of force (FL) of maximum voluntary contracion (MVC), with the value of the bicoherence index (test statistic of Gaussianity) slightly decreasing with increasing force up to 50% of MVC. These findings are compared with power spectrum and turns analysis. Further work is currently in progress to evaluate the usefullness of HOS in normal subjects and subjects suffering from neuromuscular disorders.

22.4

A Fully Integrated, Intelligent and Quantitative Working Environment for the EMG Evaluation

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Abstract
The evaluation of the EMG signal is a difficult and time consuming task. A great effort has been done during the last decade to offer quantitative and reliable algorithms to support clinicians in this evaluation. This paper describes the new approaches that we have adopted to solve this difficult task. An Expert System (ES) has been developed to guide the eletromyographist in the planning and evaluation of the EMG and Nerve Conduction Studies (NCS). The expert system owns the knowledge to interpret the Results of the Neurological Objective Exam, to indicate the right sequence of NCS and EMG tests to perform and to achieve the most suitable diagnosis of the site of lesion on the basis of the results of the evaluation of EMG under the three different conditions of registration with needle electrode, i.e., at rest, under weak contraction, by individuation of the Motor Unit Action Potentials (MUAPs) and under maximum contraction, studying interference pattern. The MUAPs individuation and classification is based on neural networks, while the elaboration of the interference pattern is performed in the frequency domain estimating the quantitative features that are known as discriminating between different myogenic and neurogenic pathologies. These quantitative algorithms and knowledge bases, are integrated into a hybrid system called Hynex, which offers a fully integrated and coherent information environment, to individuate and classify the site of lesion. The Hynex system is constituted by other supporting tools, such as explanation modules, neuromuscular atlases and relational databases, in order to offer a complete intelligent working environment to users. The porting of the system under an Internet/Intranet solution is under evaluation in order to realise intelligent remote supporting systems.

22.5

A Multi-feature / Multi Classifier System in EMG Diagnosis

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Abstract

In the case of difficult pattern recognition problems, the combination of the outputs of multiple classifiers using for input multiple feature sets extracted from the raw data, can improve the overall classification performance. In this work a modular neural network system in EMG diagnosis is presented where multiple features extracted from the motor unit action potential (MUAP) waveforms recorded during routine electromyographic (EMG) examination were fed into multiple classifiers, and the classification results were combined in order to improve the diagnostic yield. The feature sets computed, were: (i) the time domain parameters, (ii) the frequency domain parameters, (iii) the autoregressive coefficients, (iv) the cepstral coefficients and (v) the wavelet transform coefficients for four different wavelets (Daubechies with 4 and 20 coefficients, Chui, and Battle-Lemarie). The classifiers implemented were: (i) the back-propagation (BP), (ii) the radial basis function (RBF) network and (iii) the self-organising feature map (SOFM). The proposed system was developed for the assessment of normal subjects and subjects suffering with myopathy and motor neuron disease. It was shown that the modular neural network system enhanced the diagnostic performance of the individual classifiers making the whole system more robust and reliable.

22.6

A Computer Aided Scanning EMG System

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Abstract

The objective of this study is to develop an intelligent system for automatic needle positioning in electromyography (EMG). The system will allow the physician to visualise the electrical activity of the muscle territory examined.

The system consists of the following modules:

1. *Controller and stepper motor actuators:* This is a software programmable board designed to control up to two stepper motors via appropriate stepper motor driver boards. It is connected directly to a PC computer for programming and control and can also be used as a stand-alone system. The motors may, also, be controlled by hand using a mouse or a digital potentiometer, a feature that is essential for initial positioning. The linear steps per electrical impulse generated by the controller are 0.025mm and 0.0125mm for the two motors, respectively.
2. *Data acquisition:* The concentric or a monopolar needle electrode used, is driven at a steady speed into the muscle to a predetermined depth at a given angle. As the needle is retrieved, the EMG signal is recorded and processed at distinct needle positions. The EMG signal is sampled at each point for 1 second at 20kHz and bandpass filtered at 2 to 10 kHz.
3. *Intelligent signal analysis and decision making*:
   - 3.1. *Motor unit action potential (MUAP) neural network pattern recognition:* The acquired electromyographic (EMG) signal is analysed for the recognition of similar MUAPs. The recognition process is based on the Kohonen's self organising feature maps unsupervised learning algorithm.
   - 3.2. *Positioning controller:* The outcome of the pattern recognition sub-module instructs the system to drive the needle electrode at electrically active areas for further investigation.
4. *Display of results:* This module allows the visualisation of the electrical activity of the muscle along the electrophysiological section under investigation.
5. *Database:* A user friendly module that handles the efficient storing and retrieval of examination data and signals.

The system software was developed using the Borland Delphi II Visual Programming environment running on a PC.

The system is currently at the experimental stage and is evaluated for safety and reliability before its introduction in the neurophysiology laboratory. It will be applied at both normal subjects, as well as on subjects suffering with neuromuscular disorders.

It is envisioned that the proposed system will assist the physician in reaching a diagnosis by providing useful information about the electrophysiological activity of the muscle.

22.7

Model Based Decomposition of MUAPS into their Constituent SFEAPS

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Abstract

The motor unit action potential (MUAP) represents the spatial and temporal summation of single fibre extracellular action potential (SFEAPs) generated from the same motor unit. MUAP morphology is affected by structural reorganization of the motor unit that takes place due to disorders affecting peripheral nerve and muscle. MUAP features extacted in the time domain like duration, amplitude and phases are extensively used by the neurophysiologist for the assesment of neuromuscular disorders. In this study, a model based decomposition of MUAPs into their constituent SFEAPs is investigated. The objective is to give the neurophysiologist a visualization of an "estimated" structural organization of the motor unit which includes information about number of fibres, fibre distribution and positioning and fibre diameter.

The model developed by Dimitrov and coworkers was used to generate SFEAPs. Typical MUAPs recorded from normal muscle were simulated. The non-linear least squares optimization procedure procedure based on the Levenberg-Marquardt algorithm was used to obtain a solution to the MUAP decomposition problem i.e. fibre distribution and positioning and fibre diameter. It is shown that a satisfactory solution to the decomposition problem was obtained for a small recording radius (1.2 mm) and a limited number of fibres (10).

Further work is required both in the directions of simulating muscle pathology and pathophysiology and in evaluating other optimization algorithms and more specifically generic algorithms.

22.8

What Does 'Belly-Tendon' Recording of Single Fibre Action Potential Reflect?

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Abstract

The potentials produced at a large distance (typical for surface recordings) by a relatively short skeletal muscle fibre above the end-plate and tendon as well as the formation of the 'belly-tendon' potential were analyzed on the basis of a mathematical model. The 'belly-tendon' recordings give a chance to obtain as great as possible potentials. Their properties resemble those of the monopolar recorded 'belly' potential, although the 'belly-tendon' potentials are bipolarly recorded. They mainly reflect the processes of the excitation origin and extinction in contrast to conventional bipolar recordings that can cancel these effects to a great extent. Their power spectra can be represented as the product of power spectra of the first derivative of the intracellular action potential (IAP) and of the impulse response that takes into account the bipolar recording of the potentials. The spectral characteristic frequencies (Fmax, Fmed, Fmean) depend not only on propagation velocity of the excitation along the fibre, but on the IAP duration and magnitude of the negative after-potential.

22.9

Calculation of the Potentials Produced by Inclined Muscle Fibres at a Rectangular Electrode

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Abstract
A fast and precise way of calculation of extracellular potentials produced in an infinite volume conductor at a point or rectangular plate electrode by a single muscle fibre of finite length inclined to the skin surface, was suggested. The way is based on consideration of muscle fibre as a linear timeshift invariant system of potential generation. The extracellular potential is the output signal of the system, whose input signal is the first temporal derivative of the intracellular action potential and impulse response is the sum of potentials produced by two dipoles propagating from the end-plate to the fibre endings. The way needs no simplification of the intracellular action potential shape. The integration of potentials produced by inclined fibre and detected by a rectangular electrode of any size is performed analytically. This gives us a chance to study the effect of actual anatomy of muscles on the potentials detected by electrodes of actual size and location in relation to the fibres' direction. We thus can simulate and analyse actual experimental and clinical recordings.

22.10

On Two Approaches in Describing Biological Signals for their Classification Based on Shape

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Abstract
To classify signals, numerical parameters to characterise them and some procedure of performing the task, are needed. In order to provide a convenient description of the biological signals, useful to their classification based on shape, two approaches were compared: the coefficients of the FFT, and the Fourier Descriptors (FD). The paper deals with these topics, pointing in the same time to an effective application, where spontaneous EMG multiplets were to be classified. As a conclusion, the FD constitute an appealing approach, looking more appropriate, as they actually convey information on the shape of the signals.

Session 23
Cardiovascular Systems: Experimental and Applied

23.1

Effect of Ejection Velocity on Pressure Generation in the Heart. In Situ Canine Studies.

A. Landesberg, P. Liu, O. Lichtenstein, R. Shofti, R. Beyarand, S. Sideman

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We examined the hypothesis that the effect of the ejection velocity on the in situ canine left ventricle pressure (LVP) is determined by the intracellular negative mechanical feedback, whereby the sarcomere shortening velocity determines the biochemical rate of crossbridge (Xb) turnover from force to non-force generating conformations. The LVs (n=6) were exposed by mid-line sternotomy. An occluder was positioned around the ascending aorta, a tube was inserted into the LV through the apex and three sets of orthogonal sonomicrometers were implanted in the LV wall. Forced ejections through the apical tube were imposed randomly, and the ejected volume, velocity and timing, were controlled by the computer-programmed step motor. The pressure deficit (PD), i.e. the difference between the isovolumic pressure (Piso) and the pressure during ejection, was measured at the same instant of the twitch. Consistent with our prediction, PD, normalized by Piso, was found to be independent of the onset of ejection for the same ejection velocity (V) and hence is independent of the changes in the activation level during the systole. Also, PD is linearly dependent on the duration of ejection (Dt) for constant ejection velocity, and increases linearly with the ejection velocity: PD=g1.V. Dt. Piso, where g1 is the mechanical feedback coefficient, g 1 00224 0002 = ± .. [1/ml]. Thus, LV work is determined by the effect of ejection velocity on pressure. The mechanical feedback coefficient g1 provides a measurable index for the power generation capability of the LV.

23.2

Multipolar Transesophageal Pacing Leads Sensitivity and Selectivity

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Abstract

Standard esophageal pacing leads produce a symmetrical electric field and stimulate not only the heart but the surrounding tissue ass well. We introduced a new type of esophageal lead and called it "a selective esophageal pacing lead". This lead is suitable for recording of esophageal ECG and pacing of either cardiac chamber. In this paper, electrical parameters of the selective esophageal lead are defined and used for comparing of leads with different angular electrodes. These parameters describe the sensitivity and the selectivity of the lead. The selective lead consists of the mechanical part which is implanted into the esophagus and of electronic circuits that enable its proper function, i.e. producing of an electric field directed into the wanted direction, towards the heart.

23.3

Autonomic Response to Transcranial Magnetic Stimulation: Adaptive Filtering of the Heart Rate Variability

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Abstract
The aim of our study was to analyse short term responses on the heart rate to external stimuli which can not be assessed by traditional spectral analysis techniques. A new method for the separation of the heart rate variability (HRV) signal is proposed that can provide a quantitative estimate of the respiratory sinus arrhythmia (RSA) as well as true HR responses without respiratory disturbances. ECG and respiration of 5 normal subjects were recorded during repetitive transcranial magnetic stimulation (TMS) over the motor cortex. For the analysis of the HRV an adaptive filter was applied, using the R-R interval series as the input and the simultaneously sampled respiration signal as reference. As a result, the part of the R-R interval series, which is predictable by respiration, i.e. the RSA contribution, is estimated by the filter-algorithm. Furthermore, a beat-to-beat estimation/cancellation of the respiratory component is obtained by the adaptive filter, which might be helpful in studies examining dynamic cardiorespiratory responsiveness to various external stimuli.

23.4

Using Computerized System for Measurement of Intima-Media Complex

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Abstract
In the paper we describe a computerised analysing system for evaluation of the vascular wall, especially the system can be utilised for the measurement of the wall thickness and plaque area on the carotid and femoral arteries. 7he system is based on a Duplex ultrasonography system and IBM PC computer with frame grabber board. Evaluation is performed off-line on the frozen images recorded on videotape. The paper deals With the description of the, different Image transformations, which improves quality of the uitresonographyImages images during computerised evaluation.

23.5

Whole Blood Viscosity at Low Shear Stresses in Hypertension

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Abstract
In order to investigate the role of whole blood viscosity in the microcirculation for the case of essential hypertension, we carried out measurements at different shear stresses. To obtain viscosimetry data at a low level of stresses, a new system was developed. The same setup was used for plasma viscosity measurements. It was found that in the case of hypertensive subjects, whole blood viscosity was significantly increased. However, this increment cannot be attributed to plasma's viscosity changes. It seems that the elevation of whole blood viscosity in hypertension, at low shear stresses, is caused by alterations of its cellular elements. Thus, the etiological factors of microcirculation disorders associated with essential hypertension, may be revealed by erythrocytes rheology investigation, since they are the major cellular component of blood. Therefore, in hypertensive patients, whole blood viscosity at low shear stresses, could give us useful information for the management of microcirculation system malfunctions, associated with erythrocytes' abnormal behavior.

23.6

Comparison Between Numerical Flow Simulations and MR Measures on Glass Anastomosis Models

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Abstract
In this work we analyse the results of numerical ow simulations on 3D anastomosis models reproducing exactly the glass models used in MR velocity measurements per- formed at MR Research Centre, Skejby Sygehus, Aarhus University Hospital, Denmark.
This allowed us to compare the simulation results with the measured data. The aim of the work is to check the accuracy of the measurements and to validate the data obtained from the Navier-Stokes solvers simulating the blood ow at the anastomosis [2], in order to use the simulation results to overcome problems in data acquisition and measurement errors, to compute e_ciently derived quantities like the Wall Shear Stress and to study the e_ect of changes in vessel geometry on the ow for surgical planning. Preliminary results obtained on these anastomosis geometries show that simulations can be used to extrapolate more information from noisy measures and to analyse ow patterns.

Session 24
Intelligent Systems 1

24.1

Feature Selection for Multiple Binary Classification Problems in Biomedical Data Analysis

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Abstract
The present study proposes a method for selection of feature subsets, which retain sufficient information necessary to obtain the same binary classification as that of the whole set of features (coherent features). The method is based on a novel approach to data representation, in which the axes are the data, points instead of the features (a transpose projection). Under this representation, coherent features are located in the vicinity of each other, and hence can be clustered, while noisy features are pointed out and eliminated.

24.2

Knowledge Discovery in Electrocardiographic Data Based on Neural Clustering Algorithms

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Abstract
This study describes a knowledge discovery experiment in the area of coronary heart disease risk (CHD) assessment. Adaptive resonance theory networks serve as basis for performing clustering on a data base which is composed of heart rate variability measurements (HRV) from individuals at varying risk of CHD. The HRV measurements are represented on Poincaré plots. Poincaré plots provide a method to visualise information related to the instantaneous beat-to-beat behaviour of the heart, showing the degree of heart rate (HR) as a pattern of points. Based on the unsupervised classification of these plots, the corresponding symbolically described medical records of the subjects are compared in order to discover relationships between the electrocardiogram-based subject groups and risk factors such as age, cholesterol, etc. Also the degrees of HR and HRV are used to describe semantically the relation between the clusters and coronary risk. Furthermore, the results of these experiments indicate that by building appropriated unsupervised neural networks to process Poincaré plots further insight into the relationships between HR, HRV and autonomic dysfunction in asymptomatic subjects can be achieved. This paper suggests that such a discovery process can be used to generate meaningful results despite the relatively small size of the database and the complexity of the underlying physiological phenomena. The main contribution of this work is in showing the potential value of neural clustering algorithms to the task of finding significant knowledge in coronary heart disease databases.

24.3

Fuzzy Rule Based Ranking of Parameters influencing on Magnitude and Prognosis of Acute Myocardial Infarction Patients

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Abstract
The procedure for risk's factors identification and ranking, concerning some problems of acute myocardial infarction, is proposed in this paper. Medical experts evaluations (5 of them) are exploited. These experts' opinions are averaged by the proposed procedure. Fuzzy numbers determination based on experimental data from patients' files (as for both numerical and binary) is carried out. Defuzzification is done by fuzzy "AND" operator and risk factors ranking by sum or the squared differences.

24.4

A Decision Support Software Package for Medical Treatment of I.C.U Patients

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Abstract
The complexity of the cases submitted to an ICU, the variety of the underline disease, the severity, as well as the large number of substances administered to each patient constitute obvious the need of a decision support system. This system will assure the safety of the administered treatment, will help to adjust the dose according to the situation of each patient and it will screen for possible interactions and incompatibilities between the administered drugs. The system under study is organised around a relational database management system (RDBMS) that consist of: a) all available substances, b) all generic names of medications available in Greece for each substance, c) incompatibilities (2,300 cases), d) interactions (50,000 cases), and e) cost information for each drug. It is a powerful and useful tool for ICU staff without additional work to the routine of daily practice.

24.5

Fuzzy Neural Network Based Characterization of Diffused Liver Diseases using Image Texture Analysis Techniques on Ultrasonic Images

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Abstract

In this study the classification of B-scan ultrasonic liver images using a novel fuzzy neural network classifier is investigated. Image texture analysis techniques were used to extract classification features. The techniques used are the Fractal Dimension Texture Analysis (FDTA), the Spatial Gray Level Dependence Matrices (SGLDM), the Gray Level Difference Statistics (GLDS), the Gray Level Run Length Statistics (RUNL), and First Order gray level Parameters (FOP). All four techniques were applied on three sets of ultrasonic liver images: normal, fatty, cirrhosis. A total of 150 cases were investigated (50 each class). with all abnormal cases being histollogically proven . In each image , a 32x32 rectangular region of - interest was selected by an expert physician. Extracted features are fed to a neural network classifier based on geometrical fuzzy sets. Starting from the construction of the Voronoi diagram of the training patterns, an aggregation of Voronoi regions is performed leading to the identification of larger regions belonging exclusively to one of the pattern classes. The resulting scheme is a constructive algorithm that defines fuzzy clusters of patterns. Based on observations concerning the grade of membership of the training patterns to the created regions, decision probabilities are computed through which the final classification is performed. Classification accuracy achieved with the proposed neural network classifier was found to be higher than that reported for physicians performing visual interpretation of ultrasound images and superior to that obtained using Nearest Neighbor classifiers.

24.6

Classification of Asthmatic Lung Sound Spectra

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Abstract
Spectral information of asthmatic lung sounds was analyzed in relation to the measured lung function. This work forms an onset to the development of an intelligent system for monitoring asthmatic patients. Fourier spectra of the recorded lung sounds were used to classify the sounds into different categories of lung function. For the classification process, the 1-nearest neighbour classification technique was used. The use of Fourier spectra was optimized by applying a power raising transformation (involution). The considered spectral range was divided into spectral bins of variable width. Best results were found for small values of the power, near zero, and this observation applies for all spectral bin widths. The optimal bin width appeared to be in the order of several tens of Hz. The mean or the median frequency appeared to be too rough a parameter for optimal classification.
Without transformation, the median frequency did not change with lung function. The involution resulted in a significant correlation between median frequency and lung function, being largest for intermediate values of the power. The spectral change resulting from the involution is illustrated by pseudocolour plots.

24.7

Determination of Suitable Markers by the GUHA Method for the Prediction of Bleeding at Patients with Chronic Lymphoblastic Leukemia

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Abstract
Thrombocytopenia and bleeding are a dangerous complications in the treatment of hematologic malignancies. Therapy and prophylaxis of bleeding are based only on administration of platelet transfusion. The main adverse effect of this therapy is refractoriness and lowered effect of the subsequent transfusion. Physician's decision whether to administer platelet transfusion or not is based on two facts: · an estimation of bleeding risks (about 80 % of decision importancy) an estimation of refractoriness development risk (about 20 % of decision importancy). New decision support system based on the neural networks paradigm is constructed (under support of Grants IGA MZ No.3773-3 and GA AS CR No. A2030801) to improve the probability of correct estimation of bleeding risk (item 1). According to our experiences [2] and after some tests we have decided to use multilayer neural network. The first step to the determination of optimal neural network topology is to find suitable and significant factors, so called „markers" influencing bleeding. The method GUHA (General Unary Hypotheses Automaton) have been used for this reason [1]. The first succesfull results are described in this paper.

24.8

Establishing Criteria for Automated Evaluation of Non-Stress Test in Antepartum Cardiotocography

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Abstract

The main principle of present-day perinatology is to ensure successful childbirth. Antepartum biophysical monitoring is usually performed by means of cardiotocography (CTG). In an attempt to minimize subjectivity and poor reproducibility of visual evaluation of CTG traces, computerized systems for automated analysis of cardiotocographic signals are commonly used. They perform several tasks where the most important are real-time acquisition and analysis of cardiotocografic signals from sev-eral fetal monitors. Further extension of computerized cardiotocography is a qualitative analysis of antepartum cardiotocograms which is carried out within non-stress test (NST). The NST idea based on fetal heart rate acceleration associated with fetal movement is a good prognostic sign with high predic-tive value of fetal well-being. This paper presents the procedure of establishing criteria for automated evaluation of non-stress test in computer-aided cardiotocography.

Session 25
Instrumentation 1

25.1

Image Gating in MR Scanners using a Fiber Optic Respiration Monitor

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Abstract

The authors have previously developed a fiber optic based device for respiration measurement.

We report here on the development of this device to act as a gating tool to allow for respiratory compensation in MR scanners. The principle of operation of the device is based on bending losses induced in coiled optical fibers which are located in an elasticated bandage that can be placed over the thoracic or abdominal regions. The system features a graphical interface written in Visual Basic for Windows. The system provides an optical feedback channel that permits the MR subject to inhale, exhale or hold their breath as required, in order to maintain the chest wall in the appropriate position. Results presented here indicate the utility of the technique in assisting a test subject to reproduce accurate breath holds.

25.2

Optical Self-Mixing in a Diode Laser as a Method for No Touch Pulse Measurement

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Abstract

An arterial pulsatility was measured using an optical self-mixing in a diode laser. This system was able to detect pulsation profiles of major arteries with potentially useful information including pulse wave velocity and profile of pulse pressure. The basis of the measurement was the self-mixing that occurred in the diode laser cavity when the radiation scattered back by the skin into the laser interfered with the field inside it and caused a changes of a laser pump current.

The self-mixing signal was extracted by two different ways simultaneously: with using a photodiode accommodated in the rear facet of the diode laser package and normally used for monitoring of the laser power and with a help of small resistance resistor from the laser pump current.

A special low-noise two-channel amplifier was designed and built. The pigtail diode laser technology was used to send light through an optical fiber to a skin from which the optical backscattered light was detected and fed back into the same laser.

Described self-mixing method has the same sensitivity but the significant advantages of simplicity, compactness, and robustness as well as the self-aligning and self-detecting abilities when compared with the use of conventional interference methods.

25.3

Investigation of Photoplethysmographic Signals in the Human Oesophagus

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Abstract
The continuous monitoring of blood oxygen saturation in patients with compromised peripheral perfusion is often difficult or impossible, since conventional non-invasive techniques such as pulse oximetry fail. Measurements of oxygen saturation are unreliable when patients are peripherally cool with low cardiac output and poor peripheral circulation. These clinical situations commonly occur after major surgery including cardiopulmonary bypass. We suggest that the above difficulties might be overcome if the sensor were to monitor a more central part of the body. It is proposed to use the oesophagus as measurement site and reflection techniques on the hypothesis that this site should be better perfused. A new probe was constructed utilising miniaturised opto-electronic devices designed to fit into a transparent oesophageal stomach tube. One infrared wavelength was used in this study at 880 nm and a circuit to analyse the photoplethysmograph (PPG) signal was developed. The output PPG signals were sampled and recorded by a data acquisition system and a laptop personal computer. Initial measurements were carried out to investigate the amplitude of the pulsatile signal in the oesophagus and preliminary results are presented.

25.4

Device for Air in Line Detection (AILD)

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Abstract
Our research goal is to develop and validate an ultrasonic air-in-line detection system for use in detecting air bubbles in the fluid line of an infusion device. It comprises a transmitter and a receiver, which are positioned to pinchingly engage a portion of the fluid line therebetween. Both the transmitter and the receiver have convex-shaped lenses which contact and cause a slight indentation of the tube for enhanced coupling therebetween. The device also includes self-testing electronic componentry which compares the transmitter-off output with the transmitter-on output to determine whether operation is normal or should be stopped because either there is air in the line or the electronic circuitry is faulty.

25.5

Medical Devices Directives and their Implementation in the United Kingdom

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Abstract

The implementation of the European Union's directives is a challenge for each European Union Member state, especially the implementation of the Medical Devices Directives, where the health and safety of the patient and the users of Medical Devices are of the utmost importance. This paper describes briefly the European Union's Medical Devices Directives and the role of the Medical Devices Agency which is the responsible body in the United Kingdom for their implementation.

Session 26
Cardiovascular Systems: Heart Rate - Signal Analysis

26.1

Autonomic Nervous Function in Rabbit Myocardium After Atropine Administration: Evaluation by Spectral Analysis of R-R Interval Variability

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Abstract
The fluctuations that underlie the spontaneous variability of heart rate (HR) were investigated in rabbits using power spectral analysis. The experiments were performed using 14 young adult rabbits, anesthetized i.p. with urethane. The first group (A) was injected with atropine sulphate 2 mg/kg bw i.v., the second group (B) was injected with the muscarinic blocker 0.5 mg/kg bw i.v., whereas the third group (C), used as control, was given saline. The surface electrocardiogram (ECG) was recorded at rest and after atropine or saline treatment. The computer program calculated a series of consecutive intervals as a function of beat numbers. From the tachogram power spectral density (PSD) was computed. Every spectral component was identified by the center frequency and quantified by its power. The results suggested a dose-dependent atropine effect on time and frequency domain of HR variability.

26.2

Individualisation of Model for Reconstruction of Heart Rate

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Abstract
The aim of this study is to develop the universal model for reconstruction of HR based on electrically measured physiological parameters or their combinations. The simultaneous non-invasive measurements of ECG, transthoracic impedance and physical activity for two groups of healthy persons during different predetermined exercise and normal daily activities have been carried out. A special multichannel recording instrument has been developed for non-invasive registration of signals.
Linear models based on QT-interval, ventilation volume and physical activity have been calculated and compared as well as their combinations. Linear combination of QT and activity models have been chosen for generalising to get the universal model. This model gives a relatively simple, but satisfactory bases for heart rate reconstruction for rate adaptive cardiac pacing purposes, but additional individualisation of the generalised model using preliminary clinical knowledge about person under examination is useful for better reconstruction of the heart rate.

26.3

Assessment of Heart Failure by Means of Beat-To-Beat Series of Left Ventricular Volume: A Preliminary Study

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Abstract
In this preliminary study we analyse in time and frequency domains the beat-to-beat variability of left ventricular volume and its first derivative, to verify if the applied method is able to discriminate between normal subjects and patients affected with dilatative cardiomiopathy of different level (NYHA II-III class).
The ventricular volume signal is obtained by ultrasonographic technique using acoustic quantification.
Left ventricular volume signal and its derivative appear to be able to distinguish, in spite of the sources of error coupled to the measurement, the existing differences among the different classes of patients mentioned above. These properties may be resumed and visualised through a phase diagram in the plane (volume Vs volume derivative).
The respiratory rhythm in the beat-to-beat power spectrum of the extracted parameters, as well as its absolute power, may provide useful information for the classification of severity in patients with cardiac disease.

26.4

A New Neural Network System for Arrhythmias Classification

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Abstract
A new neural network system for classification of the cardiac rhythm is presented in this paper.
The system is composed of two neural network classifiers : a morphological classifier cascaded to a timing classifier. While the morphological classifier classify the P and QRS complexes into normal and/or abnormal beats, the timing classifier takes as inputs the information of the morphological classifier and the duration of the PP, PR and RR intervals and output the following arrhythmias:
sinus tachycardia, sinus bradycardia, sinus arrhythmia, atrial extrasystoles, atrial tachycardia, atrial fibrillation, atrial flutter, ventricular tachycardia, ventricular extrasystoles, ventricular flutter and supraventricular tachycardia in addition to the normal sinus rhythm.

26.5

Application of Recurrence Plots on Cardiovascular Pressure and Flow Signals

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Abstract
Objective: Recurrence plots have been used with several nonlinear biological systems to identify state changes under different physiologic or pathologic conditions. The aim of this study was to quantify such changes from the time series of cardiovascular flow and pressure signals, by extracting the informational content from a cardiovascular state space representation. Methods: Left ventricular pressure (LVP), representing the left ventricular regulatory system, aortic pressure (AOP), representing the baroreceptor controlled peripheral arterial system and aortic flow, representing the informational content of the „Windkessel" function, were defined to construct the ventriculoarterial state space orbit VAO = [LVP(t), AOP(t+Δt), AOF(t+Δt)]. The recurrence map of the VAO and the nonlinear parameters percent recurrence, percent determinism and the entropy were calculated. Signals from a totally occluded aorta, as a disturbance of cardiovascular interaction, are compared to a control condition. Results: The recurrent diagonals become more rigid under total occlusion. Entropy (2,3% rise) and determinism (24% rise) are significantly ($p<0,003$) increased. Conclusions: This marks a more complex dynamic system coming up with the sudden increase of ventricular afterload, which may activate several mechanisms of local and systemic regulation. These mechanisms can cause a higher degree of determinism and complexity than those working during normal physiologic circumstances.

26.6

Correlation Between the Invasive and Non-Invasive Parameters of Cardiac Ventricular Repolarization Prolongation and Inhomogeneity

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Abstract
The correlation between the ventricular repolarization inhomogeneity reflecting parameters and the results of programmed ventricular stimulation was assessed in 136 post-myocardial infarction patients. Registration of increased QTc interval duration and QT, QTa and QU intervall dispersion in patients with and without high risk of sudden death according to programmed ventricular stimulation demonstrate the efficacy of this non-invasive method to identify the high-risk subgroup of post-myocardial infarction patients.

26.7

Whole-Heart Modelling: From Anatomical Models to PDEs

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An anatomical model of the diastolic dog ventricle is coupled with excitable maps to construct a coupled map lattice (CML) model of electrical activity propagation. This model of ventricular propagation is then used to drive local, ordinary differential equation models of cell excitability to simulate the effects of disturbances in ventricular propagation on cell behaviour.

Session 27
Telemedicine/Intelligent Systems 2

27.1

Design and Development of an Intranet Hospital Information System

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Abstract

Medical institutions have felt the need for a well structured Computer-based Patient Record (CPR) for at least 20 years now. Hospital Information Systems (HIS) were conceived to serve that purpose. Along with controlling and managing the Hospital's administrative data, many systems have incorporated CPRs. A pilot application is being developed to serve the needs of management of Inpatient and Outpatient Medical Record, the mechanism of patients' visits and bed reservation from the GP's (General Practitioners) as well as the management of the drug store. Having these needs in mind we elaborated an Intranet Web Client-Server application. The developed system provides a user-friendly, secure graphical interface and adds exciting features such as Internet access, access to complete electronic patient records (including medical images), remote access, email etc. The whole application was developed as an Active X Document meaning that it can be downloaded from a Web Server and run from within a Web Browser. The scope of this Intranet based Hospital Information System is to improve the quality of health care provision, to minimise the Institution's costs, to ameliorate time management, to increase training capabilities and to improve remote patient record access. This system will increase patient satisfaction by reducing waiting times and staff morale through high quality information systems and infrastructure.

27.2

Health Promotion Programme in Nutrition Through Telemedicine

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Abstract

In this paper we present the attempt of providing services of preventive medicine and health promotion through the telemedicine system of Sismanoglion hospital. Telemedicine is a worthwhile effective way of supporting remote population involving the smallest possible number of specialists.

27.3

Distance Information, Support and Communication for European Carers

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Abstract

We present the Greek pilot of the DISCUS project. The rationale for the project stems from the observation that cost-effective professional health and care services are becoming increasingly important due to changing demographics, and increased demands on limited care resources. There is the opportunity for telematics to directly increase the efficiency and quality of care by making knowledge, skills and experience more accessible to care providers. This is particularly relevant in rural communities where they may have little or no opportunities to share nowledge and experiences with peers, as is the case in the Greek site located in the island of Samos.The primary objective of DISCUS therefore to provide an Internet based information/training, support and communication system especially for carers in more remote areas, which will allow them to exchange ideas and benefit from the knowledge base of other professional carers across Europe. Extensive dissemination opportunities are also foreseen amongst educational/training centres in that the system will provide an easy to use, time-saving and qualified learning resource.DISCUS will follow user centred design principles to develop an Internet based service. The project will test the feasibility of producing a generic service, and will identify the ease with which this can be tailored to meet local conditions.

27.4

User Friendly Data Base for Automation in a Virological Laboratory

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Abstract

A data base system for the automation of virological laboratory set up at the Molecular Virology Unit in the Advanced Biotechnology Center of Genova is presented. This database also includes a facility to easily share information between the virological laboratory and the clinical department where the patients are treated.

27.5

Automatic Wheezes Detection using Wavelet Packets

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Abstract

Currently, the automatic wheezes detection methods are based on the identification of a particular shape of peaks in the respiratory power spectrum. These techniques present a high false detection rate, caused by the presence of peaks in normal sounds similar to those characterising wheezes.

In this paper, a new method for automatic wheezes detection based on the wavelet packets was developed. This method operates in the time-frequency domain including two stages : The first one detects all suspicious peaks in the frequency domain which could characterising wheezes, the second one validates, in the time domain, the true wheezes and rejects the false ones.

27.6

Automatic Babbling Identification by Means of a Fractal Dimension Based Technique

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Abstract

The analysis of babbling is a valid instrument in the study of children prelinguistic maturation. When the recordings of sound pronounced by a child have to be examined a problem arises related to the long time necessary to identify the very short tracts of babbling present in these recordings. On the other hand, the babbling can be analysed both from phonetic and acoustic points of view and it is possible to identify it by using suitable criteria. In this paper we propose a method able to automatically identify the consonant-vowel segments, which constitute the babbling, thus allowing a faster examination of the recordings. The technique, based on the fractal dimension parameter calculated on segments of recording, is able to distinguish in a reliable, easy and fast way the vocalic tracts, permitting a successive automatic evaluation of the acoustic parameters.

27.7

Survival Data Analysis Using Neural Networks

Elena Ellioti

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Abstract

The goal in cancer prognosis determination is to access life expectancy of a patient on the basis of measured parameters known as prognostic factors. In this paper is shown how neural networks can be used instead to augmented standard statistical techniques for survival data analysis. We assess the performance of the data from clinical trial involving patients suffering from brain metastases.

27.8

Vis Et Pressus in Coxa Simulator

Vlado Stankovski[1], Aleš Igliè[2], Veronika Kralj-Igliè[3], Dragica Smrke[1], Boštjan Kersniè[1]

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Abstract

The programming language Java™ (Sun Microsystems, Inc.) is used to produce a set of objects that comprise the hip-joint geometry (points, axes, profiles, distances, angles), objects that describe the forces and the stress distribution in the hip-joint articular surface (forces, stress), as well as objects that can be manipulated by using Drag and Drop operations in order to simulate changes in the hip-joint geometry (femoral head, femoral neck, greater trochanter and upper part of the femur). Any change in the objects that can be manipulated influences the remaining objects that are currently displayed. Particularly, any change can influence the hip-joint reaction force and the corresponding contact stress distribution. The changes are estimated automatically by using methods that are attached to the specific objects.

Digitised profiles of standard antero-posterior radiographs of the hip-joint are used as input to this computer-aided system. A non-homogeneous scaling method that is based on a reference model of the hip musculature, is used to prepare data for each human subject. These data serve as input to a three-dimensional mathematical model of the hip-joint in one-legged stance, which is used to estimate the value of the hip-joint reaction force. Afterwards, the stress distribution in the hip-joint articular surface is calculated by using another three-dimensional model, which takes into account the previously determined hip-joint reaction force, the femoral head radius and the center-edge angle of Wiberg.

Session 28
Instrumentation 2

28.1

2.45 GHz Telecommand for Ambulatory Patient Monitoring Applications

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Abstract

This paper discusses the design of a minimum-power 2.45 GHz pulse receiver and companion transmitter for use in a semi-active, duplex RF transponder. A 50 W microstrip stub-matched zero-bias diode detector forms the heart of the body-worn receiver, achieving a tangential sensitivity of -56 dBm.

Three-pole bandpass filtering provides rejection of out-of-band signals, typically 28 dB in the 900 MHz cellular band. Base-to-transponder interrogation reliability averaged 95 % within an operational hospital ward of floor area of 82 m^2.

28.2

Reliability of Compartmental Syndrome Assessment using Bioimpedance Measurement

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Abstract

A compartmental syndrome may potentially occur wherever a limiting envelope surrounds neuromuscular tissue. Increased tissue pressure, due to the changes in quantity and substance of intra- and extracellular fluids, is the primary pathophysiological factor related with emergence of compartmental syndrome. Usually, it is a consequence of chronic or acute ischaemia, appearing most frequently in lower extremities i.e. lower legs. Unfortunately, it requires an immediate diagnostics finding and surgical treatment, due to an important danger of limb survival. The standard clinical diagnostic procedures are either painful for patients, (intracompartmental pressure measurement) or are inadequate, showing only circulation and/or vessels state. We made certain that early and non-invasive diagnostics of compartmental syndrome is possible, especially on the patients with "one-extremity" syndrome, i.e. only one leg seriously ill, using multiple frequency bioimpedance measurement and analysis, measuring impedance magnitude and phase angle in the frequency range from 100 Hz to 1 MHz. One of the main problems in compartmental syndrome diagnostics is determination of "normality criterion" due to differences among subjects, patients and normal population. An attempt to achieve these criteria and discuss reliability of result's analysis is described.

28.3

An Integrated Instrumentation Approach for the Study of Venous Leg Ulcers

David Wertheim[1], John Melhuish[2], Andreas Hoppe[1], Robert Williams[1] and Keith Harding[2]

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Abstract

The mechanism of action of compression therapy is poorly understood. The aim of this research study is to develop and apply non-invasive instrumentation based investigations to form an integrated approach to improve the understanding of compression therapy. We have developed a system for continuous monitoring of compression therapy forces, expressed as pressure. The system was applied to investigate forces and combined with investigation of skin surface temperature under the four layer bandage system in five healthy volunteers. At a position about 8 cm above the medial malleolus we observed a median pressure of 40 mmHg (range 27 to 40 mmHg), in the sitting position, following application of the bandage system. Twelve minutes after bandage application there was an increase in temperature on the bandaged legs, median = + 1.9 °C (range + 1.5 to + 4.3 °C) and a decrease on the unbandaged legs, median = - 0.7 °C (range - 0.2 to – 1.4 °C). The range in applied pressure suggests that the mode of action of compression therapy may not be solely the result of the Compression applied. The increase in skin surface temperature may suggest a temperature related increase in skin blood flow. This study illustrates the benefits of integrating results of the different investigations of pressure and skin surface temperature.

28.4

Measurement of Functional Parameters of Defibrillators

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[1]Department of Electronics, Technical University, Sofia, Bulgaria
[2]Laboratory of Medical Physics, University of Patras, Greece

Abstract

The defibrillation efficiency depends on the possibility of the instrument to deliver the exact predetermined energy to the thorax and the heart, respectively. In cases of cardioversion treatment, the pulse shoud be properly synchronised with the patient's own cardiac electrical potentials. The objective of this work is to examine the possibilities and implement methods for measurement of the main instrument parameters, namely delivered energy, maximal voltage, pulse duration, current intensity trough the patient thorax (by an indirect way, with known load resistance), synchronisation with the QRS-complex

28.5

IBM PC Based Real-Time TV Tracking & Electrical Activity Recording System

Yu. Kaminsky, J. Bures, I. Krekule

Inst. of Physiology, Acad. of Sci. of the Czech Rep., Prague,
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Abstract
Developed enhanced system for real-time imaging, tracking and simultaneous recording of bio-electrical activities of animals under behavioral experiments is described. The system, based on a PC, TV camera and custom-made interface/preprocessing plug-in IBM PC board was already successfully applied to a number of experiments.

Session 29
Quantitative Analysis of Ultrasonic Imaging of Atherosclerotic Plaques

29.1

Ultrasonic Image Standardisation

A.N. Nicolaides

Irvine laboratory for Cardiovascular Investigation and Research, Academic Surgical Unit, Imperial College School of Medicine at St Mary's, London, U.K.

Abstract

None.

29.2

Restenosis after Percutaneous Transluminal Angioplasty; A Human Model.

Maura Griffin[1], Ganesh Ramaswami[1], Andrew N. Nicolaides[1], Surinder Dhanjil[1], Aghiad Al-Kotoubi[2], Thomas Tegos[1], Gerard Stansby[1], Robert Wilkins[3], John Lewis[4], Mitra Boolell[1], Michael Davies[1]

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Abstract

Background : Animal work in the area of restenosis cannot be easily extrapolated to man, it is essential that a method is developed for human studies. Our aim was to determine the feasibility of studying the natural history of the atherosclerotic plaque following percutaneous transluminal angioplasty (PTA), using duplex scanning.

Methods: Twenty three patients with fourty stenoses (>70% and < 5cms in length) in the iliac and femoro-popliteal segments were studied with duplex scanning before PTA, on day 1, weekly for 8 weeks , 3 months, six months and at 1 year. Various ultrasonic measurements were made.

Results: 30 stenoses were used for analysis. Mean reduction in plaque thickness immediately after PTA was greater in echolucent plaques than echogenic plaques.

All stenoses showed plaque growth after PTA and their division into 2 arbitrary groups helped identify two different patterns. It was also shown that plaque growth was not synonoymous with restenosis.

Conclusion: Unlike angiography, duplex scanning provides valuble information on both luminal diameter and plaque thickness and may be used to study the natural history of plaques following angioplasty.

29.3

Correlation of Microemboli Detected in the Middle Cerebral Artery on Transcranial Doppler with the Echomorphology of the Carotid Atherosclerotic Plaque

T.J. Tegos, E Kalodiki, A.N. Nicolaides, M. Sabetai, S. Dhanjil, T.S. El Atrozy, G. Ramaswami, M. Daskalopoulos, P. Robless, G. Pare, S. Byrd, K. Kalomiris

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Abstract

It has been shown that the prevalence of cerebral microembolism (CME) on transcranial Doppler (TCD) is high in the presence of: 1. Cerebrovascular symptoms due to carotid disease where the prevalence of CME is in the range of 25-89% of symptomatic patients in different series, depending on the duration of monitoring and the time proximity to the cerebrovascular event (Sielber 1993-1, Grosset 1994-2, Valton 1995-3, Sitzer 1995-4, Babikian 1997-5, Georgiadis 1997-6, Sliwka 1997-7) 2. Severe carotid stenosis (Babikian 1994-8) and 3. Cerebral computerised tomography infarction (CT infarction) (Daffershofer 1996-9).It has also been shown, in cross-sectional studies, that the ultrasonic tissue characteristics of carotid atheroma can separate the unstable from the stable plaques. More specifically, carotid plaques associated with a significant stenosis (more than 70% on duplex scanning) and having dark morphologic characteristics on ultrasound (echolucent plaques) are associated with a higher prevalence of cerebrovascular symptoms and CT infarctions in comparison to plaques characterised with moderate degree of stenosis (50-70%) and having bright morphologic characteristics on ultrasound (echogenic plaques) (Geroulakos 1993-10, Cave 1995-11, El-Barghouty 1995-12, 1996-13, 1996b-14).

The aim of this cross sectional study was to determine the relationship between the embolic count (EC) in the middle cerebral artery (MCA) on TCD with the ipsilateral carotid plaque echomorphologic characteristics.

29.4

Texture Analysis for the Classification of Carotid Plaques

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Abstract

The objective of this work is to develop a computer aided system which will facilitate the automated characterization of carotid plaques recorded from high resolution ultrasound images for the identification of individuals with asymptomatic carotid stenosis at risk of stroke. The system consists of the following four modules: (i) image standardization, (ii) image segmentation, (iii) feature extraction and selection, (iv) plaque classification. The images are standardised using blood and adventitia as reference, and the plaque is identified and manually outlined. In the feature extraction module, nine different texture feature sets and shape parameters (a total of 61 features) are extracted from the segmented plaque image in order to be used for the plaque classification. The plaques should be classified into one of the following types: (i) symptomatic because of ipsilateral hemispheric symptoms, or (ii) asymptomatic because they were not connected with ipsilateral hemispheric events. For the classification the unsupervised learning neural network algorithm self-organising feature map (SOFM) is used. A total of 37 (24 symptomatic + 13 asymptomatic) ultrasound images of carotid plaques were examined and their features were extracted. The statistics of all features extracted for the two groups indicate a high degree of overlap, making the separation of the two groups a difficult task. The SOFM classifier was trained and evaluated with the ten different feature sets. Best feature set was found to be the fractals set with a classification success rate of 65%. Due to the complexity of the problem and the high degree of overlap of the texture features it is necessary that the results be verified with more data.

29.5

Shape and Texture Analysis of the Carotid Plaque, and its Correlation with Cerebral Infarctions on CT, and Cerebrovascular Symptoms

Konstantinos Kalomiris, Thomas J Tegos, Michael Sabetai, Andrew N Nicolaides

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Abstract

This work has studied the relationship between ultrasonic texture characteristics, ultrasonic shape characteristics, cerebral infarctions on CT, and cerebrovascular symptoms, in an attempt to identify the unstable carotid plaque, i.e. the plaque associated with high prevalence of ipsilateral cerebral infarctions on CT, and cerebrovascular symptoms. The morphological features used were: the grey scale median (GSM) for the texture, and the bending energy (BE) for the shape. It has been shown that echolucent plaques (plaques with low GSM) with irregular shape (high BE) are associated with high prevalence of ipsilateral cerebral infarctions on CT and cerebrovascular symptoms, whereas echogenic plaques (high GSM) with smooth shape (low BE) are associated with low prevalence of ipsilateral cerebral infarctions on CT and cerebrovascular symptoms. Previous work has demonstrated the significance of the GSM in identifying the unstable carotid plaque [1], but no attempt, to our knowledge, has been made to establish the clinical significance of the ultrasonic shape characteristics of the carotid plaque. The importance of the ultrasonic texture and shape characteristics will be established in prospective studies of patients with asymptomatic carotid plaques, aiming at the identification of patients with a high risk for stroke, and therefore for a better selection of asymptomatic patients who might benefit more from a carotid endarterectomy.

Computer Simulation of Blood Flow Dynamics After Carotid Endarterectomy

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Abstract

During follow-up evaluations of patients operated of Carotid EndArterectomy (CEA) a lift of the proximal step of CEA can be observed, and some cases of restenosis may be imputable to this. The authors in this study have investigated such a phenomenon by means of a computer simulation of blood flow after CEA with a direct numerical solution of the complete fluid dynamics problem. The mathematical results well compare with Echocolor-Doppler measurements of references cases, providing the necessary link between real condition and simulated flow. Wall shear stress analysis indicates the presence of a negative friction in correspondence of the proximal CEA step, in contrast with the common belief, and gives a rationale explanation of its lift. The authors conclude their study by showing that the plaque end is always characterised by a negative shear stress, but that, nevertheless, the friction is significantly reduced if the proximal end is prolonged proximally along the common carotid artery for least 1 cm. down from the step of CEA, letting it to terminate after the patch expansion.

29.7

LDA and Ultrasonic Velocity Measurements in Models of Stenosed Carotid Bifurcation with Irregular Lesion Surface - Measurement Stand and Methodology

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[2]Laboratory for Fluid Mechanics, Fachhochschule Muenchen, Lothstrasse 34, 80335 Munich, Germany

Abstract

The presence of high-grade (80% to 99% reduction of diameter) asymptomatic stenoses of internal carotid artery is often connected with an increased rate of cerebral symptoms. However, many stenoses are free of the associated events. Lesion surface irregularity, caused by e.g. ulceration or thrombosis in carotid artery stenoses, is thought to be a factor increasing the risk of neurological events.

The paper deals with LDA and ultrasonic Doppler velocity measurement in elastic replicas of stenosed carotid bifurcation with an irregular plaque surface. Two sets of models with different grades of the lumen cross-section reduction (one with stenoses of 80% in both branches of carotid artery and second with stenosis of 90% in internal carotid artery) and 3 kinds of severity of plaque surface irregularity, as well as respective models with smooth lesion surface, were used. The experiments were done under pulsatile flow condition with mean Reynolds number Re=200, Womersley parameter a=3.5, and entire volume flow QCCA=305 ml/min. DMSO-water-Separan mixture showing non- Newtonian properties similar to blood was applied as a blood analogue. Obtained results prove the appropriation of the applied measurement setup and methodology.

AUTHOR INDEX

NOTES

VIII MEDITERRANEAN CONFERENCE ON MEDICAL AND BIOLOGICAL ENGINEERING AND COMPUTING

Medicon '98

June 14-17, 1998 , Lemesos, Cyprus

Medicon '98 is the VIII in the series of regional meetings in the Mediterranean of the International Federation for Medical and Biological Engineering (IFMBE). The goal of Medicon '98 is to provide updated information on the state of the art on Medical and Biological Engineering and Computing. The programme consists of a 190, invited and submitted papers on new developments in these fields.

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