Final Program and Abstract Book

9th INTERNATIONAL CONFERENCE ON
Information Technology
&
Applications in Biomedicine

Theme

"Citizen Centered e-Health Systems in a Global Healthcare Environment"

4-7 November, 2009

Larnaca, Cyprus

Under the auspices of
H.E. the Minister of Health, Dr Christos Patsalides

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Welcome Address

Dear colleagues and students,

On behalf of the Organizing Committee, we would like to cordially invite you to the 9th International Conference on Information Technology and Applications in Biomedicine (ITAB 2009).

The overall objective of ITAB 2009 is to cover the state of the art of Information Technology Applications in Biomedicine targeting in the offering of a better service to the citizen. The theme of the conference is: *Citizen Centered e-Health Systems in a Global* Healthcare Environment.

The event is organized and sponsored by the University of Cyprus, the Cyprus University of Technology, and the University of Ioannina, Greece, co-organized and co-sponsored by the Cyprus Institute, Cyprus, and the Frederick University, Cyprus, and the University of Wisconsin, Milwaukee, USA. ITAB 2009 is technically co-sponsored by the IEEE Engineering in Medicine and Biology Society (IEEE EMBS), the International Federation for Medical and Biological Engineering (IFMBE), the European Federation of Medical Informatics (EFMI), and the European Society for Engineering and Medicine (ESEM). Additional support was also given by the IEEE EMBS Cyprus Chapter, the IEEE Cyprus Section, the Cyprus Society of Medical Informatics, and the Cyprus Association of Medical Physics and Biomedical Engineering.

ITAB 2009 marks the continuation of the previous 8 successful conferences held in Prague in 1997, in Washington DC in 1998, in Amsterdam in 1999, in Virginia in 2000, in Birmingham in 2003, in Ioannina in 2006, in Tokyo in 2007, and in Shenzhen in 2008.

A total of 147 papers are presented, with 37 papers on e-Health Systems, m-Health Systems, and Telemedicine Systems, 52 papers in Biomedical Signal Processing and Analysis, 28 papers in Biomedical Image Processing and Analysis, 12 papers in Bioinformatics and Computational Biology, 6 papers in Systems Biology and Modeling Methodologies, and 12 papers in Diagnostic and Therapeutic Systems. These papers come from 39 different countries. Also, 42 papers will be presented by students and a student paper competition will take place (the award will be given during the Gala Dinner). Selected papers will be published in the IEEE Transactions of Information Technology and Biomedicine, and the Journal of Biomedical Signal Processing and Control. We would like to thank all the track chairs and reviewers who put a great deal of time and effort, under very tight deadlines during summer time, in order to help us review all the papers and put the program together.

Furthermore, five special sessions are organized with 35 papers to be presented on the following topics: LinkSCEEM HPC Life Sciences Meeting, 2nd International Workshop on Computational Intelligence in Medical Imaging (CIMI 2009), 1st International Workshop on Information Technology for Patient Safety (ITPS 2009), 1st International Workshop on Multi-type Content Repurposing and Sharing in Medical Education, 1st International Workshop on Computational Methods in Orthopedic Biomechanics and Rehabilitation (COMOR 2009).

The program features seven keynote presentations from distinguished colleagues. The first keynote will be given by Prof. Luis Kun, Senior Research Professor of Homeland Security National Defense University / IRMC, USA, on "Global Health Transformation through true Interoperability". The second keynote will be given by Prof. Yuan-Ting Zhang, Chinese University of Hong Kong, Hong Kong, on "Cardiovascular Health Informatics: Sensing and Imaging Plagues in Arteries". The third keynote will be given by Mr. Kyriacos Kokkinos, General Manager of IBM Cyprus, Cyprus, on "Paving the path towards eHealth for Cyprus Public Healthcare Ecosystem". The fourth keynote, will be given by Prof. Metin Akay, Arizona State University, USA, on "A Low Cost and Effective Electronic Medical Record System for Developing Countries". The fifth keynote will be given by Prof. Niilo Saranummi, VTT Technical Research Centre of Finland, Finland, on "Personal Health Record and Value-Based Healthcare". The sixth keynote will be given by Prof. Robert Allen, University of Southampton, UK, on "Signal processing in patient assessment and care: from hospital to home", and the seventh keynote will be given by Prof. Gunther Eysenbach, University of Toronto, Canada, on "Medicine 2.0 - new opportunities and challenges in the provision of health information and elearning".

This year's ITAB is held in the sunny island of Cyprus, an island with a huge recorded history and cultural heritage. We hope that you will find time to explore the island.

On behalf of the Organising Committee, we would like to wish you all a very stimulating and exciting Conference.

Regards,

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Past ITAB Conferences

ITAB 2009 marks the continuation of the previous 8 successful conferences:

1st ITAB 1997, Prague, Czech Republic, 7-9, September, 1997.
2nd ITAB 1998, Washington, DC, USA, 16-17, May, 1998.
3rd ITIS-ITAB 1999, Amsterdam, Netherlands, 12-13, April, 1999.
4th ITAB 2000, Arlington, Virginia – USA, November 9-10, 2000.
5th ITAB 2003, Birmingham, UK, 24-26, April, 2003.
6th ITAB 2006, Ioannina, Greece, 26-28, October, 2006.
7th ITAB 2007, Tokyo, Japan, 8-11, November, 2007.
8th ITAB 2008/IS3BHE, Shenzhen, China, 30-31, May, 2008.

Past ITAB papers (except for ITAB 2006) can be found under IEEE Explore at:
http://ieeexplore.ieee.org/xpl/RecentCon.jsp?punumber=5530#

Keynote Speakers

Global Health Transformation through true Interoperability, Luis Kun, Senior Research Professor of Homeland Security National Defense University / IRMC, USA

Cardiovascular Health Informatics: Sensing and Imaging Plagues in Arteries, Yuan-Ting Zhang, Head of the Division of Biomedical, Engineering at the Chinese University of Hong Kong, Director of the Key Lab for Biomedical Informatics and Health Engineering of the Chinese Academy of Sciences, Hong Kong

Paving the path towards eHealth for Cyprus Public Healthcare Ecosystem, Kyriacos Kokkinos, Gen. Mgr., IBM Cyprus, Cyprus

A Low Cost and Effective Electronic Medical Record System for Developing Countries, Metin Akay, Professor of Bioengineering, Arizona State University, USA

Personal Health Record and Value-Based Healthcare, Niilo Saranummi, Research Professor, VTT Technical Research Centre of Finland, Finland

Signal processing in patient assessment and care: from hospital to home, Robert Allen, Professor of Biodynamics and Control Institute of Sound and Vibration Research University of Southampton

Medicine 2.0 - new opportunities and challenges in the provision of health information and elearning, Gunther Eysenbach, Associate Professor at the Department of Health Policy Management and Evaluation at the University of Toronto

Global Health Transformation through true Interoperability

Luis Kun

Senior Research Professor of Homeland Security – IRM College, National Defense University, USA

Abstract

In this XXI Century and as the Health Care and Public Health infrastructure intersect deeper into the many Information Technology (IT) subfields, abundant and formidable changes can occur that will allow society to shift current systems into some where wellness and disease prevention will be the focus. Many changes can affect positively medical and cost effective outcomes as well as the elimination of medical errors and patient safety for example. In these arenas, with the convergence of science, technology and with Information Technology acting as a catalyst for change, health care systems around the world are slowly shifting from "hospital based" ones into distributed systems that include: hospitals, clinics, homecare systems with treatment and management of chronic diseases for the elderly via Internet, etc. In order to achieve such visions, multiple efforts have been tried for creating electronic health record as well as the information highway for their use. In the US the health system is very scattered and most hospital systems do not contain for example mental health, dental health and or vaccine registry information. On one hand through major medical research the emergence of clinical and health data repositories or "Intelligent Data Warehouses" that not only include traditional clinical data, but also advanced imaging, molecular medicine, tissue micro-array analysis and other bioinformatics information is available. These increasingly multi-modality data warehouses are constantly updated, continuously expanded and populated with millions of records. Although these repositories of electronic information can be leveraged not only to improve point of care clinical decision-making for individual patients, they can also support population health chronic and infectious disease analytics (i.e., epidemiology and surveillance), cost efficient multi-center (e.g., and multi-country) clinical trials, and comprehensive post-market pharmacovigilance.. On the other hand the integration of healthcare and public health is a major concern as well. Globalization (i.e., the interdependencies that each country has with many others) for example has raised the sense of awareness through "the information highway". During and since 2007 the US public has learnt through successive media stories related to: the death of pets due to food-import contamination, children's toys imports containing lead paint, food contamination, drug contamination, drug ingredients contaminated, etc. During 2008 we heard about: People getting very sick from fish containing the ciguatera toxin and Tab / drinking water containing about 36 different medications, e.g., antibiotics, antidepressants, etc. As the northern hemisphere prepares currently for the second wave of the 2009 H1N1 Flu Pandemic (which will probably start around October 2009) all nations could have benefited by having epidemiology and surveillance data from all southern hemisphere nations available for the production of more "accurate" vaccines. Still the perfect opportunity to transform our health care systems to a strategy of disease prevention and wellness is in the horizon. Using information technology as an enabler, we can encompass a wide range of opportunities that can start at the cellular, molecular and genetics levels and go as far as population health. Initial immunization studies show the level of antibody titers against viral diseases depends on the circadian time of inoculation. The concepts of

chronobiology and chronotherapeutics can be used to generate disease prevention strategies based on these circadian-rhythm dependencies. The public will also be better protected against environmental threats and food borne diseases through the use of remote sensing data and a worldwide food enterprise architecture.

BIOGRAPHICAL SKETCH

Dr. Kun is a Professor of Systems Management at the IRMC of the National Defense University, where he is the Course Manager for Homeland Security. He graduated from the Merchant Marine Academy in Uruguay; and has a BSEE, MSEE and Ph.D. in Biomedical Engineering all 3 degrees from UCLA. His extensive background on Information Technology, Medical and Public Health Informatics, includes 14 years with IBM where he: developed the first six clinical applications for the IBM PC; was one of the pioneers on bedside terminals for Intensive Care and developer of a semi-expert, real-time, clinical decision support system; was the technical manager of the Nursing Point of Care System; the biomedical engineer in the team of 4 that developed the first Teleradiology system and the first Picture Archival and Communications Systems, to run on an IBM platform. He was Director of Medical Systems Technology and Strategic Planning at Cedars-Sinai Medical Center in LA. As Senior IT Advisor for the Agency for Health Care Policy and Research (1996-98) he formulated the IT vision and was the lead staff for HPCC program and Telehealth. Co-author of the Reports to the Congress on Telemedicine (1997) and on HIPAA Security. He was an invited speaker to the White House, highly responsible for the Telemedicine portion of the Balanced Budget Act of 1997. Kun represented the DHHS Secretary at a Pan American Forum of Health Care Ministers on Telecommunications and the Health Care Industry in Mexico in 1997. He was a Distinguished Fellow at the CDC (1999-2001) Senior Computer Scientist for the Health Alert Network for Bioterrorism and as the Acting Chief Information Technology Officer he formulated the IT vision for the National Immunization Program (NIP) (10/2000). Since 1980, Dr. Kun had academic adjunct appointments at: UCLA, UT (Arlington, Dallas and Galveston), at Rutgers University and at Emory University. In the past 30 years he has written and edited a large number of editorials, articles, book chapters / sections, and books and has lectured on medical and public health informatics, information technology and biomedical engineering in over 75 countries. He is in the IEEE Distinguished Visitor Program for the Computer Science (for both the US and Latin America) as well as the Engineering Medicine and Biology Society and is/was in the advisory board of many magazines, professional journals and board of directors of several organizations including AAES, AIMBE, ICMCC, IFMBE, IEEE-SSIT, etc. He has served as an invited: Conference, track or session chair, tutorial, special symposia, and/or publications, invited speaker / keynote speaker and in conference scientific committees, etc. over 300 times. He was conference chairman of the Health Care Information Infrastructure (HCII) conference in 1995 and the Interoperability Summit on Health Care Transformation of 2009 at the National Academy of Sciences. He is the founding Chair of the IEEE-USA Critical Infrastructure Protection Committee (2007); the Bioterrorism & Homeland Security WG and the Electronic Medical Record and High Performance Computers and Communications Subcommittee (1991). He chairs the IFMBE's Global Citizen Safety and Security WG. Dr. Kun received many awards and recognition including the 2009 first ever AIMBE Fellow Advocate Award, the "2002 - IEEE-USA Citation of Honor Award": "For exemplary contributions in the inception and implementation of a health care information technology vision in the United States." In 1999 he was inducted as a Fellow of the American Institute for Medical and Biological Engineering: "For outstanding leadership and contributions in the creation, development, and implementation of the health care information infrastructure and related policies." He is a Fellow of AIMBE and the IEEE.

Cardiovascular Health Informatics: Sensing and Imaging Plagues in Arteries

Yuan-Ting Zhang

Head of the Division of Biomedical, Engineering at the Chinese University of Hong Kong, Director of the Key Lab for Biomedical Informatics and Health Engineering of the Chinese Academy of Sciences, Hong Kong

Abstract

Abstract - This keynote will address a spectrum of health informatics topics, ranging from physiological and biomedical information acquisition processing, to transmission and data fusion for the non-invasive monitoring of cardiovascular diseases. It will closely examine important issues on the topic of body sensor networks with applications, and will define the concepts of the Cardiovascular Health Informatics (CHI) area. Topics will include core technologies highlighting wearable medical device design as well as the importance of standards for achieving optimized system performance.

BIOGRAPHICAL SKETCH

Yuan-Ting Zhang is currently the Head of the Division of Biomedical Engineering at the Chinese University of Hong Kong, the Director of the Key Lab for Biomedical Informatics and Health Engineering of the Chinese Academy of Sciences, and the Founding Director of the SIAT-Institute of Biomedical and Health Engineering of Chinese Academy of Science. Dr. Zhang was a Research Associate and Adjunct Assistant Professor at the University of Calgary, Canada from 1989 to 1994. He chaired the Biomedical Division of Hong Kong Institution of Engineers in 1996/97 and 2000/01. Dr. Zhang was the Technical Program Chair of the 20th IEEE-EMBS Annual Int'l Conference in 1998 and the General Conference Chair of the 27th IEEE-EMBS Annual Int'l Conference in 2005. He was elected as an AdCom member in 1999 and served as Vice-President (Conferences) of IEEE-EMBS in 2000. He was a Co-Chair of IEEE-EMBS Summer School on Medical Devices and Biosensors. Dr. Zhang serves currently as a member of IEEE-EMBS Technical Committee of Wearable Systems and Sensors, and the Editor-in-Chief for IEEE Trans. On Information Technology in Biomedicine.

Dr. Zhang's research interests include cardiovascular health informatics, neural engineering, wearable medical devices, and body sensor networks particularly for mobile health. He has published more than 300 scientific articles in the area of biomedical engineering and filed over 20 patent applications. Dr. Zhang and his team received more than 30 awards and recognitions which include the Fellow of International Academy of Medical and Biological Engineering, IEEE Fellow, the Fellow of American Institute of Medical and Biological Engineering, and the recipient of 2006 Distinguished Service Award of IEEE-EMBS.

Paving the path towards eHealth for Cyprus Public Healthcare Ecosystem

Kyriacos Kokkinos

General Manager, IBM Italia SpA, Cyprus Branch

Abstract

The presentation elaborates on the introduction of Integrated HealthCare Information System IHCIS project for Nicosia and Famagusta Hospitals, its implementation considerations and critical success factors. Project attributes that go beyond IT systems, such as people, structure, culture etc, are described and lessons learned the way forward are discussed with emphasis on the expected benefits, productivity gains and improvement in healthcare services. The topic covers the following: i. Overview of Health Information System (HIS): HIS Status Overview, Next steps; ii. Business Functionality: Business areas addressed, and 'Early Wins' through IHCS; and iii. Organizational Readiness: Systems, Hospital Processes, and Culture.

BIOGRAPHICAL SKETCH

Mr Kokkinos, General Manager of IBM Cyprus is managing the business operations of IBM in Cyprus since 1998. Throughout his career in IBM, he held a number of managerial positions at local and international levels. IBM Cyprus operates as a branch office of IBM Corporation since 1963, and is the leading Information Technology organization in the country.

His academic qualifications include a *Masters and Bachelors Degree in Electronics Engineering* with specializations in Communications and Computer Engineering, (*MScEE and BScEE from New Jersey Institute of Technology, NJ, USA*), as well as IBM's *Corporate Executive MBA* from Henley Management College (UK), with specialization on Strategic Management.

As a technologist and senior business leader, he is a strong believer of the already occurring socio-economic revolution fueled by the web capabilities. Being an IT professional as well as an active member of the Cyprus business society, he is passionate in articulating his strong belief that Technology can and should act as an essential enabler for a "new" European Cyprus, able to compete and excel in a global economy. As a professional manager, he acts as an agent of change for an e-Cyprus, bringing a new breeze of innovative and creative ideas for cultural and technological fitness to e-Europe.

He serves on the Board of Directors of a number of Professional, Business and semi-government organizations. As a professional, he is a corporate worker with strong commitment to knowledge and innovation management, with a passion in winning, executing and teaming.

A Low Cost and Effective Electronic Medical Record System for Developing Countries

Metin Akay

Professor, School of Biological and Health System Engineering, Ira Fulton School of Engineering–ASU, Tempe, Arizona, USA

Abstract

Developing countries face a slew of health problems that threaten the lives of millions of people each day. However, without a proper system of organization, these problems are amplified by the fact that the doctors must waste their time and resources finding and organizing patient information in often chaotic paper based systems. This paper focuses on the proof of concept of creating an electronic medical records or EMRs that could be used in one of these nations. In this paper, we define what an EMR is, discuss some current electronic medical records used in developed as well as developing countries, and introduce the Alzheimer's Institute Database (AID). This database is currently being used at Banner Alzheimer's Institute (BAI). It is created in the FileMaker® program and is originally designed as an Alzheimer's database. However, it serves as a proof of concept for a low cost and effective implementation of a fully customizable EMR for developing countries due to the flexibility and customizability afforded by using this program.

BIOGRAPHICAL SKETCH

Prof. Akay, who is currently a professor of Bioengineering at ASU, received his B.S. and M.S. in Electrical Engineering from Bogazici University, Istanbul Turkey in 1981 and 1984, respectively and a Ph.D. degree from Rutgers University in 1990. He has played a key role in promoting the biomedical education in the world by writing several prestigious books and editing the Biomedical Engineering Book Series published by the Wiley and IEEE press. Prof. Akay is a recipient of the IEE EMBS Service Award, a IEEE Third Millennium Medal and the IEEE Engineering in Medicine and Biology Society Early Career Achievement Award in 1997, the Young Investigator Award of Sigma Xi Society, Northeast Region in 1998 and 2000, is a fellow of Institute of Physics and IEEE and serves on numerous editorial and advisory boards of several international journals.

Personal Health Record and Value-Based Healthcare

Niilo Saranummi

Research Professor, VTT Technical Research Centre of Finland
Finland

Abstract

PHR's and PHR based services will be an important tool in reforming healthcare. What we are aiming at is to contribute towards the creation of a health service environment where citizens have the possibility and means to take charge of managing their own health and care in partnership with healthcare professionals. In this environment citizens are genuinely active and equal partners in managing their health and care. In this equal partnership it is understood and accepted that whereas healthcare professionals are experts in healthcare related issues citizens are experts in how they lead their lives, what life styles they adopt and what choices they make. The presentation structure is the following: First a look at what is driving health reform concluding with the need to make "value" the first priority. Then the role of citizens and patients in the value drive: They must be empowered to act as co-producers in cooperation with healthcare professionals. Lastly, the role of the PHR and services based on the PHR will be elaborated.

BIOGRAPHICAL SKETCH

Niilo Saranummi received his D.Tech. degree in biomedical engineering at Tampere University of Technology in 1976. He is currently research professor in health technology at VTT Technical Research Centre of Finland. His research interests include personal health systems and eHealth, and innovation, technology transfer and technology policy setting in health technologies. He has participated in various roles into appr. 40 EU-funded projects in the area of ICT and health. He is co-founder and chair of HL7 Finland since 1996. He was Editor-in-Chief of IEEE Transactions of Information Technology in Biomedicine (2002-2007). He chairs the International Academy of Medical and Biological Engineering (IAMBE) 2009 – 2012. He chairs IEEE / EMBS's TC on Information Technology for Health. He has served as President of the International Federation for Medical and Biological Engineering (IFMBE), International Union for Physical and Engineering Sciences in Medicine (IUPESM) and European Alliance for Medical and Biological Engineering and Science (EAMBES). He is a Fellow of Finnish Academies of Technology, International Academy of Medical and Biological Engineering (IAMBE), American Institute of Medical and Biological Engineering (AIMBE) and IEEE. He was the recipient of the Otto Schmitt award of IFMBE in 2006.

Signal processing in patient assessment and care: from hospital to home

Robert Allen

Professor of Biodynamics and Control Institute of Sound and Vibration Research University of Southampton, UK

Abstract

Biomedical signal processing and control is a rapidly growing area of research This is not really surprising, however, given the increasing interest in general, with the availability of low-cost, reliable computing power, the wealth of algorithms already developed and the potential to communicate the results of processing using efficient graphical interfaces. Despite these developments, however, the nursing staff measure body temperature with a thermometer placed under the tongue, plot the reading as a point on a graph and then, with little justification, join up the dots to produce a graph of the time series. What happened to the temperature between readings? How was the sampling frequency selected? Despite these considerations, such charts still form the bedrock of patient management at the bedside, perhaps rightly so, and are part of the nurse-patient relationship. After all, the nurse is the primary monitor of the patient's condition.

This is, of course, supplemented now by monitors and the results of diagnostic tests where the results are produced using signal or image processing. In the operating theatre or intensive care unit, monitoring systems abound to display vital signs in real time. Biomedical signals have their own characteristics and analysis techniques require appropriate development for clinical application. Many algorithms for noise reduction, feature extraction or manipulation have already been developed and, although perhaps many have not yet been used in regular clinical practice, the potential has been clearly demonstrated. Medical imaging is one area where many developments are very much down to the processing and many diagnostic tests depend upon the extraction or manipulation of signal features at some stage. Indeed, it is probably fair to say that signal processing, in some form or another, underpins much of clinical decision-making and patient management. Control of management delivery is also on the increase through regulation of drug infusion, electrical stimulation of muscle, and so on.

This paper with present an overview of biomedical signal processing applications in patient management and will also indicate trends in the delivery of patient care that is increasingly available to the patient in their own home. Novel, bio-inspired approaches to signal processing will be described that are currently under development that may lead to advances in areas such as medical ultrasound imaging.

BIOGRAPHICAL SKETCH

Professor Robert Allen, BSc(Hons), PhD, CEng, FIEE, FIMechE, FIPEM
Honorary Editor of the journal Medical Engineering and Physics (http://www.elsevier.co.uk)

Founding Editor-in-Chief of the journal Biomedical Signal Processing & Control (http://www.elsevier.co.uk)
Founding Editor-in-Chief of the journal Bioinspiration & Biomimetics: Learning from Nature (http://www.iop.org/EJ/bioinsp)
Member of the Mechatronics, Informatics & Control Group Board, (Institution of Mechanical Engineers)

He is a Fellow of the Institution of Electrical Engineers, the Institution of Mechanical Engineers and the Institute of Physics and Engineering in Medicine.

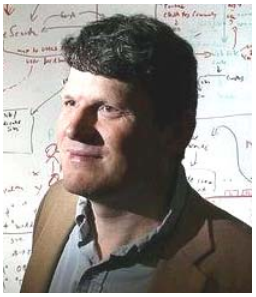
Research interests are currently focused on the development and application of signal processing techniques for biomedical systems analysis and on the bio-inspired control of unmanned, underwater vehicles. Particular interests include: efficient estimation of auditory evoked potentials for assessment of hearing and of depth of anaesthesia, cerebral hydrodynamic modelling and non-invasive assessment of intracranial compliance, processing of fluoroscopic images for measurement of spine kinematics and understanding and development of bio-inspired acoustic systems.

Robert Allen holds a Personal Chair in Biodynamics and Control at the Institute of Sound and Vibration Research (ISVR), University of Southampton, UK. Following training in the machine tool industry and a period as numerical control programme engineer (Dean, Smith & Grace Ltd., in collaboration with IBM UK) he studied at the University of Leeds and graduated with BSc (Hons) in Control Engineering and was awarded a PhD for research on modelling the dynamic characteristics of neural receptors. This was followed by Postdoctoral positions at the University of Leeds (Dept. Anaesthesia) on monitoring intracranial pressure of severely head-injured patients to prevent secondary brain damage, and at the Welsh National School of Medicine, Cardiff (Dept. Anaesthetics) on a parameter estimation approach to non-invasive measurement of cardiac output.

He moved to the University of Southampton (Faculty of Medicine) in 1984 to a newly-created position as Lecturer in Biocomputation, and from there to the Department of Mechanical Engineering in 1985 as Lecturer and Senior Lecturer in Control Engineering and to the ISVR in 1997.

The Institute of Sound and Vibration Research (ISVR) is an internationally recognized centre of excellence in teaching, research and consulting. In the 2001 Research Assessment Exercise it received the top 5* rating (the University of Southampton is one of only two in the UK, where the entire Faculty of Engineering received 5*), and it achieved 23/24 for its teaching quality. The interface between technology and humans has been at the centre of its activities, with active research and teaching programs in audiology (with a highly respected MSc course), human vibration interactions, medical imaging, patient monitoring and physiological modelling. Clinics at ISVR (including the South of England Cochlear Implant Centre) and collaborations with hospitals are the core of these projects. Signal processing is a fundamental tool in all these activities, and the ISVR is internationally recognized for its expertise in this field.

Medicine 2.0 - new opportunities and challenges in the provision of health information and elearning



Gunther Eysenbach

Associate Professor at the Department of Health Policy Management and Evaluation at the University of Toronto, Canada

Abstract

In this keynote, Dr Eysenbach will reflect on the impact of "Medicine 2.0" approaches on learning. “Medicine 2.0” applications, services, and tools have been defined as Web-based services for health, medicine, and biomedical research, that use Web 2.0 technologies and/or semantic web and virtual reality approaches, featuring 1) social networking, 2) participation, 3) apomediation, 4) openness, and 5) collaboration. Examples are given, and opportunities and challenges are discussed.

BIOGRAPHICAL SKETCH

Gunther Eysenbach MD MPH (a graduate of the University of Freiburg, Germany, and Harvard University, USA) is Editor-in-Chief and publisher of the Journal of Medical Internet Research, the #1 ranked ehealth journal, and producer of the Medicine 2.0 congress series, as well as a podcast producer. He is an Associate Professor at the Department of Health Policy, Management and Evaluation at the University of Toronto, where he teaches and supervises PhD and Master's students in the area of eHealth and Medical Informatics, and a Senior Scientist at the Centre for Global eHealth Innovation in Toronto, where his research focuses on consumer health informatics and public health informatics. He is recognized by many as a leading scholar in health informatics.

Opening Ceremony

6.30 **Conference General Chairs Welcome**
Prof. Constantinos S. Pattichis

6.35 **Conference Programme Chairs Welcome**
Assoc. Prof. Efthyvoulos Kyriacou

6.40 **Welcome by IEEE – EMBS**
Prof. Metin Akay

6.45 **Welcome by the University of Cyprus**

6.50 **Historical Overview of eHealth in Cyprus and Awards Presentation**
Prof. Christos N. Schizas

7.10 **Welcome and Conference Opening**
Dr Christos Patsalides, Minister of Health of Cyprus

7.15 **Keynote Speech**
Global Health Transformation Through True Interoperability
Prof. Luis Kun

8.00 **Reception**

Awards

Medical users for Pioneering the Deployment of eHealth in Cyprus:

1.	Professor Lefkos T. Middleton	Diagnostic Systems
2.	Dr Costas Antoniades	Emergency Telemedicine
3.	Mr Andreas Kouppis	Ambulance Emergency Telematics
4.	Dr Agathoklis N. Schizas	Tele-Orthopaedics
5.	Dr Mary Vassiliou	Tele-Pathology
6.	Dr Kyriacos Kyriacou	Tele-Pathology
7.	Dr Chrysa Tziakouri-Shiakkalli	Tele-Radiology
8.	Dr Fylaktis Constantinides	Health Information Systems
9.	Dr Theodoros Kyprianou	Intensive Care Telematics
10.	Dr Antonis P. Jossif	eHealth Record
11.	Ms Barbara Pitsillides	Home Monitoring
12.	Dr Minas Kyriakides	eHealth Strategy

General Conference Information

Poster Presentation Guidelines

Poster sessions are a valuable method for authors to present papers and meet with interested attendees for in-depth technical discussions. Therefore, it is important that you display your results clearly to attract people who have an interest in your work and your paper.

Maximum poster size (width x height) are: 841mm x 1189mm (A0).

Your poster should cover the KEY POINTS of your work. The ideal poster is designed to: (1) Attract attention, (2) Provide a brief overview of your work, (3) Initiate discussion and questions. The title of your poster should appear at the top in CAPITAL letters about 25 mm (1") high. The author(s) name(s) and affiliation(s) are put below the title. Use color to highlight and make your poster more attractive, by using pictures, diagrams, cartoons, figures, etc., rather than only text wherever possible. The smallest text on your poster should be at least 9 mm (3/8") high, and the important points should be in a larger font. Make your poster as self-explanatory as possible. Push pins or Velcro will be provided to attach your paper.

The poster exhibition opens at 08:30 Thursday November 5th. Posters should be placed on the walls between 07:30 and 08:30. The poster exhibition will be open through the whole conference, until 11.00 Saturday November 7th. The posters must be removed before 11.30.

Slide Presentation Guidelines

For oral presentations, a laptop PC, video projector, microphone, and laser pointer will be provided. The laptop PC will have Windows XP, Adobe Acrobat, Media Player, and MS PowerPoint. The presenters can bring their presentations on CD/memory stick. It is strongly recommended that presenters bring their presentations on CD/memory stick (flash drive) to store on the laptop PC at least 15 min prior to your session. This will avoid switching time-delay between the presentations. The regular oral presentations are scheduled for 15-minute slots. Your presentation should be 12 minutes long, followed by a 3 minute question-answer period.

Social Program

Nicosia excursion **Thursday, 5th November, 13:15hrs**

Please note that on Thursday, we have organized a beautiful excursion to Nicosia, the Capital of Cyprus and one of its most beautiful towns. This will be free to all participants. This excursion will start at 13.15hrs and will be completed at night. Our tour will take us to the Cyprus Archaeological museum, the medieval city of Nicosia within the walls, the dividing line, and the Byzantine Museum. In an effort to see as much as possible, participants will be served sandwiches on board the buses for lunch, but on our way back we will stop for dinner in a beautiful traditional village restaurant.

Nicosia is the capital of Cyprus and a must for every visitor on the island. Our tour will first take us to the Cyprus Archaeological Museum where a huge collection of important archaeological findings are housed, and through which the cultural heritage of the island can be traced.

Driving along the green line and the old city of Nicosia, we will see one most unfortunate distinction; the fact that this is Europe's only militarily divided city since 1974. Situated within the Venetian walls, in the heart of old Nicosia, is Laiki Yitonia is a beautifully restored eighteenth century neighborhood within the Walls. We will walk to see all sites mentioned above and at the end we will allocate for some time for some quick shopping.

We will then proceed to the Archbishopric area which is also located within the walls. Within the Archbishopric grounds one can find the Byzantine Museum, which is one of the finest of its kind in the world. St. John's Cathedral are located within its grounds. On our way out of Nicosia we will also make a short stop at the nearby Liberty Statue.

Gala dinner **Friday, 6th November, 20:00hrs**

We have organized a beautiful event at the Golden Bay next to the beach. The meal will comprise of a sumptuous buffet and we will be entertained with live music and Cypriot dancers. The student's awards ceremony will also take place. Dress informal.

Students Paper Competition Finalists

Students were encouraged to submit their papers for the ITAB 2009 student paper competition, following the regular paper submission procedure. Submissions were evaluated based on their originality, scientific merits, structure, and clarity of composition. All submissions were peer-reviewed and finalists were selected based on the merits of submissions. First, Second, and Third place winners will be selected n the course of the conference based on the technical merits of the work, professionalism of the presentation, and verbal communication skills. The three overall winners of the SPC will receive an engraved plaque and an honorarium of 500 Euro for the first placed winner, 300 Euro for the second placed winner, and 200 Euro for the third placed winner. The winners will be announced in the Gala Dinner. All Finalists will receive Certificates of Merit. The finalists will be invited to submit their work in journal special issues.

Th.3.1.6 9:45-10:00

Whole Body Vibration training: analysis and characterization

Antonio Fratini, Antonio La Gatta, Mario Cesarelli and Paolo Bifulco
Department of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy

Th.3.3.1 11:15-11:30

A Complex Discrete Wavelet Transform for Processing Quadrature Doppler Ultrasound Signals

Gorkem Serbes[1] and Nizamettin Aydin[2]
[1]*Mechatronics Engineering Department, Bahcesehir University, Istanbul, Turkey*
[2]*Computer Engineering Department, Yildiz Technical University, Istanbul, Turkey*

Th 1.3.2 11:30-11:45

INTENSA: Heart Failure Patient's Follow-up System Using the ISO/IEEE11073 Standard

Miguel Martínez de Espronceda Cámara[1], Ignacio Martínez Ruiz[2], Santiago Led Ramos[1], Jesús Daniel Trigo Vilaseca[2], Iñigo Oses Galé, Javier Escayola Calvo[2], Luis Javier Serrano Arriezu[1], José García Moros[2] and Antonio García Quintana[3]
[1]*Electrical andElectronics Engineering Dep., Public University of Navarre, Spain*
[2]*Communications Technologies Group (GTC), Aragon Institute for Engineering Research (I3A), University of Zaragoza, Spain*
[3]*Cardiology Service of Hospital Dr. Negrín, Canary Islands*

Th.2.3.6 12:30-12:45

Automated Vessel Tree Segmentation: Challenges in Computer Aided Quantification of Diffuse Parenchyma Lung Diseases

Panayiotis Korfiatis, Anna Karahaliou and Lena Costaridou
Department of Medical Physics, School of Medicine, University of Patras, Greece

Th.3.3.6 12:30-12:45

A Novel Hybrid and Automatic Method for EOG Artifact Rejection

Manousos A. Klados[1], Christos L. Papadelis[2] and Panagiotis D. Bamidis[1]

[1]*Group of Applied Neuroscience, Lab of MedicalInformatics, Medical School, Aristotle University of Thessaloniki, Thessaloniki, Greece*

[2]*Center for Brain/Mind Sciences (CIMEC), University of Trento, Mattarello, Trentino*

Fr.1.4.2 9:45-10:00

A web-accessible mammographic image database dedicated to combined training and evaluation of radiologists and machines

Zinon Antoniou[1], Georgia Giannakopoulou[2], Ioannis Andreadis[1], Konstantina Nikita[1], Panos Ligomenides[3] and George Spyrou[3]

[1]*National Technical University of Athens, Greece*

[2]*School of Medicine, University of Athens, Greece*

[3]*Academy of Athens Biomedical Research Foundation, Athens, Greece*

Fr. 4.2.2 11:45-12:00

Spectral Analysis for Scatterer Estimation in Optical Coherence Tomography Images

Evgenia Bousi, Andreas Kartakoullis and Costas Pitris

Department of Electrical and Computer Engineering, University of Cyprus, Cyprus

Fr.2.5.2 15:45-16:00

Evolutionary Conformal Prediction for Breast Cancer Diagnosis

Antonis Lambrou[1], Harris Papadopoulos[2] and Alexander Gammerman[1]

[1]*Computer Learning Research Centre, Royal Holloway, University of London, London, UK*

[2]*Computer Science and Engineering Department, Frederick University, Cyprus*

Fr.2.5.3 16:00-16:15

Combined Texture Features for Improved Classification of Suspicious Areas in Autofluorescence Bronchoscopy

Panagiotis Bountris[1], Afroditi Apostolou[1], Maria Haritou[1], Elisavet Passalidou[3] and Dimitris Koutsouris[1]

[1]*Biomedical Engineering Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece*

[2]*Fluorescence Bronchoscopy and Laser Treatment Unit, Sismanoglio General Hospital of Attica, Athens, Greece*

Fr.6.1.4 16:15-16:30

ANN-based simulation of transcriptional networks in Yeast

Maria Manioudaki[1,2] and Panayiota Poirazi[2]

[1]*Department of Chemistry, University of Crete, Heraklion, Crete, Greece*

[2]*Institute of Molecular Biology and Biotechnology (IMBB), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Crete, Greece*

Fr.3.7.1 17:30-17:45

Classification of Raman Spectra using Support Vector Machines

Alexandros Kyriakides[1], Costas Pitris[1] and Evdokia Kastanos[2]

[1]*Department of Electrical and Computer Engineering, University of Cyprus, Cyprus*

[2]*Dept. of Life and Health Sciences, University of Nicosia, Cyprus*

Program at a Glance

	Wednesday, 4th Nov. 2009			
18:30-19:15	**Opening Ceremony**			
19:15-20:00	**Keynote We.1**			
20:00-22:00	**Welcome Cocktail**			
	Thursday, 5th Nov. 2009			
8:15-9:00	**Keynote Th.1**			
9:00-10:30	**Session Th.1.1 eHealth I:** Telemedicine Systems	**Session Th.2.1 Medical Imaging I:** Visualisation	**Session Th.3.1 Biosignals I:** Monitoring	**Special Session Th.SS.1.1 LinkSCEEM Meeting:** High Performance Computing Applications in Life Sciences
10:30-10:45	***Coffee Break***			
10:45-11:15	**Poster Session Th.1.2 eHealth II**	**Poster Session Th.2.2 Medical Imaging II**	**Poster Session Th.3.2 Biosignals II**	**Special Session Th.SS.1.2 LinkSCEEM Meeting cnt'd:**
11:15-12:45	**Session Th.1.3 eHealth III:** e&m Health Systems Devices	**Session Th.2.3 Medical Imaging III:** Segmentation I	**Session Th.3.3 Biosignals III**	**Special Session Th.SS.1.3 LinkSCEEM Meeting cnt'd**
13:00	***Light Lunch***			
13:15	**Bus leaves for Nicosia**			
19:30	**Traditional village dining**			
	Friday, 6th Nov. 2009			
8:15-9:30	**Keynote Fr. 1 & 2**			
9:30-11:00	**Session Fr.1.4 eHealth III:** e&m Health Systems on the Web	**Special Session Fr.SS.2.1** 2nd International Workshop on Computational Intelligence in Medical Imaging (CIMI 2009)CIMI	**Session Fr.3.4 Biosignals IV:** Fetus and Newborn	**Session Fr.4.1 Diagnostic & Therapeutic Systems I**
11:00-11:30	***Coffee Break***			
11:30-13:00	**Session Fr.1.5 eHealth IV:** e&m Health Systems	**Session Fr.2.4 Medical Imaging IV:** Segmentation II	**Session Fr.3.5 Biosignals V:** ECG	**Session Fr.4.2 Diagnostic & Therapeutic Systems II**
13:00-14:15	***Lunch Break***			
14:15-15:30	**Keynote Fr. 3 & 4**			
15:30-17:00	**Session Fr.5.1 Systems Biology and Modeling Methodologies**	**Session Fr.2.5 Medical Imaging V:** Analysis	**Session Fr.3.6 Biosignals VI:** CAD Systems I	**Session Fr.6.1 Biological Data Analysis and Integration**
17:00-17:30	***Coffee Break***			

17:30-19:00	**Session Fr.7.1 Meet the Editors**	**Special Session Fr.SS.3.1 1st International Workshop on Computational Methods in Orthopedic** Biomechanics and Rehabilitation (COMOR 2009)	**Session Fr.3.7 Biosignals VII:** CAD Systems II	**Session Fr.6.2 Sequence and Structure Analysis of Biological Macromolecules**
20:00	***Gala Dinner***			

Saturday, 7th Nov. 2009

8:45-9:30	**Keynote Sa.1**			
9:30-11:00	**Special Session Sa.SS.4.1 1st International Workshop on Information Technology for Patient Safety (ITPS 2009)**	**Special Session Sa.SS.3.2 COMOR 2009 cont'd.**	**Special Session Sa.SS.5.1 1st International Workshop on Multi-type Content Repurposing and Sharing in Medical Education**	
11:00-11:30	***Coffee Break***			

Technical Program

Thursday Morning, Nov. 5

Session: **Keynote Th.1**
Time & Place: **8:15-9:00, Les Etoiles**
Chairperson: **D. I. Fotiadis**
University of Ioannina, Greece

Th.1 **8:15-9:00**
Cardiovascular Health Informatics: Sensing and Imaging Plagues in Arteries
Yuan-Ting Zhang
Head of the Division of Biomedical, Engineering at the Chinese University of Hong Kong, Director of the Key Lab for Biomedical Informatics and Health Engineering of the Chinese Academy of Sciences, Hong Kong

Thursday Morning, Nov. 5

Session: **Th.1.1 eHealth I: Telemedicine Systems**
Time & Place: **9:00-10:30, Les Etoiles**
Chairperson: **Toshiyo Tamura**
Department of Biomedical Engineering, Graduate School of Engineering, Chiba University, Chiba, Japan

Th.1.1.1 **9:00-9:15**
Optimizing Resource Management in Emergency Management & Response
Panos Constantinides[1], Michael Barrett[2] and Angelina Kouroubali[3]
[1]*Frederick University, Nicosia, Cyprus*
[2]*Cambridge University, Cambridge, UK*
[3]*Institute of Computer Science at the Foundation for Research Technology Hellas (ICS-FORTH), Crete GR*

Th.1.1.2 **9:15-9:30**
Question Answering for Biology and Medicine
Julien Gobeill[1], Emilie Pasche[2], Douglas Teodoro[2], Christian Lovis[3], Anne-Lise Veuthey[4], and Patrick Ruch[1]
[1]*BiTeM group at the University of Applied Sciences, Information Studies Department, Geneva, Switzerland*
[2]*BiTeM group at the University and Hospitals of Geneva, Geneva, Switzerland*
[3]*University and Hospitals of Geneva, Geneva, Switzerland*
[4]*Swiss Institute of Bioinformatics, Geneva, Switzerland*

Th.1.1.3 9:30-9:45

Evaluation of e-learning teaching activities in Mediterranean countries

Claudia Brancaleone[1], Riccardo Tranfaglia[1], Mario Sansone[1], Luciano Mirarchi[2] and Marcello Bracale[1]

[1]Department of Biomedical, Electronic and Telecommunication Engineering, University Federico II, Naples, Italy

[2]Service Marketing, Siemens Medical Solution S.p.a., Milano, Italy

Th.1.1.4 9:45-10:00

Comparative Computational Methods for Identification of Inherent or Acquired Mechanisms of Resistance to Prednisolone in Acute Lymphoblastic Leukemia Cells

George Lambrou[1], E.G. Sifakis[2], Andriana Prentza[3], Aristotelis Chatziioannou[4], Dimitris Koutsouris[2], Eleftheria Koultouki[1] and Fotini Tzortzatou-Stathopoulou[1]

[1]Hematology/Oncology Unit, University of Athens, "Aghia Sophia" Children's Hospital, Athens, Greece

[2]Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece

[3]Department of Digital Systems, University of Piraeus, Piraeus Greece

[4]Institute of Biological Research & Biotechnology, National Hellenic Research Foundation, Athens, Greece

Th.1.1.5 10:00-10:15

Realtime Physiological Condition and Location Monitoring of Street Orienteering Participants

Ibrahim Khalil, Mahathir Almashor and Fahim Sufi

RMIT University, Melbourne, Australia

Th.1.1.6 10:15-10:30

Is the home health care monitoring effective?

Toshiyo Tamura[1], Isao Mizukura[1], Haruyuki Tatsumi[2] and Yutaka Kimura[3]

[1]Department of Biomedical Engineering, Graduate School of Engineering, Chiba University, Chiba, Japan

[2]Department of Biological Structure & Signal Transduction, Sapporo Medical University, Sapporo, Japan

[3]Health Science Center, Kansai Medical University, Osaka, Japan

Coffee Break 10:30-10:45

Thursday Morning, Nov. 5

Session: **Th.2.1 Medical Imaging I: Visualization**
Time & Place: **9:00-10:30, Venus**
Chairperson: **Ioannis Seimenis**
Medical Diagnostic Center "Ayios Therissos", Cyprus

Th.2.1.1 09:00-09:15

Quantitative Analysis of Brain White Matter Lesions in Multiple Sclerosis Subjects

Christos Loizou[1], Constantinos Pattichis[2], Ioannis Seimenis[3] and Marios Pantziaris[4]

[1]Department of Computer Science, Intercollege, Limassol, Cyprus

[2]*Department of Computer Science, University of Cyprus, Cyprus*
[3]*Medical Diagnostic Center "Ayios Therissos", Cyprus*
[4]*Cyprus Institute of Neurology and Genetics, Cyprus*

Th.2.1.2 09:15-09:30
Visualizing the 3D Structure of Medical Objects Based on 2D Data
Andreas Lanitis[1] and Georgios Stylianou[2]
[1]*Dept. of Multimedia and Graphic Arts, Cyprus University of Technology, Cyprus*
[2]*Dept. of Computer Science, European University Cyprus, Cyprus*

Th.2.1.3 09:30-09:45
Human Anatomy Visualization and Navigation System for Image-Guided Surgery Quantitative
Lucio Tommaso De Paolis[1], Marco Pulimeno[2], Luca Ramundo[3] and Giovanni Aloisio[1]
[1]*Dept. of Innovation Engineering, Salento University, Lecce, Italy*
[2]*Marco Pulimeno is with the ISUFI, Salento University, Lecce, Italy*
[3]*Engineering Faculty, Salento University, Lecce, Italy*

Th.2.1.4 09:45-10:00
Evaluation of synchronicity in heart motion by elucidating intersection index from successive echocardiograms
Kohji Masuda, Rui Takahashi, Takashi Yoshinaga and Shun Uchibori
Graduate School of Bio-Applications and Systems Engineering, Tokyo University of Agriculture and Technology, Koganei, Tokyo, Japan

Th.2.1.5 10:00-10:15
The mathematical path to develop a heterogeneous, anisotropic and 3-dimensional glioma model using finite differences
Alexandros Roniotis[2], Kostas Marias[1], Vangelis Sakkalis[1], Michalis Zervakis[2] and Ioannis Karatzanis[1]
[1]*Inst. of Computer Science, Foundation for Research and Technology (FORTH), Heraklion, Greece*
[2]*Dept. of Electronic & Computer Engineering, Technical University of Crete, Chania, Greece*

Th.2.1.6 10:15-10:30
Quantitative Examination of Soft Tissue Ultrasound Elastograms
Malgorzata Przytulska and Juliusz Kulikowski
IBBE PAS, Warsaw, Poland

Coffee Break 10:30-10:45

Thursday Morning, Nov. 5

Session: **Th.3.1 Biosignals I: Monitoring**
Time & Place: **9:00-10:30, Minerva**
Chairpersons: **C.D. Nugent**
Computer Science Research Institute, School of Computing and Mathematics, University of Ulster, N. Ireland

Nikolas Stylianides
Dept. Computer Science, University of Cyprus, Cyprus

Th.3.1.1 **9:00-9:15**
Noninvasive biological sensor system for detection of drunk driving
Shigeyuki Kojima[1], Shinitirou Maeda[1], Yumi Ogura[1], Etsunori Fujita[1], Kohji Murata[2], Tsutomu Kamei[1,3,4], Toshio Tsuji[5], Shigehiko Kaneko[6] and Masao Yoshizumi[7]
[1]Deltatooling Co., Hiroshima, Japan
[2]Shimane Institute of Health Science, Shimane, Japan and Kanazawa University Graduate School of Medical Science, 13-1 Takaramachi, Kanazawa-shi, 920-0934 Ishikawa, Japan
[3]European University Viadrina Frankfurt (Oder), Frankfurt (Oder), Germany,
[4]Kanazawa University Graduate School of Medical Science, Ishikawa, Japan
[5]Faculty of Engineering, Hiroshima University, Hiroshima, Japan
[6]School of Engineering, The University of Tokyo, Tokyo, Japan
[7]Hiroshima University Graduate School of Biomedical Sciences, Hiroshima, Japan

Th.3.1.2 **9:15-9:30**
Vehicle Driver's ECG and sitting posture monitoring system
Chang-Ming Yang, Chih-Chung Wu, Chun-Mei Chou and Tzu-Lin Yang
Ming Young Biomedical Corp., Jhunan, Miaoli, Taiwan

Th.3.1.3 **9:30-9:45**
INTREPID, a biosignal-based system for the monitoring of patients with anxiety disorders
Nikolaos S. Katertsidis[1], Christos D. Katsis[2] and Dimitrios I. Fotiadis[3]
[1]Unit of Medical Technology and Intelligent Information Systems, Dept. of Computer Science, University of Ioannina, Ioannina, Greece
[2]Department of Medical Physics, Medical School and the Unit of Medical Technology and Intelligent Information Systems, Dept of Computer Science, University of Ioannina, Ioannina, Greece
[3]Department of Materials Science and Engineering, University of Ioannina, Ioannina, Greece

Th.3.1.4 **9:45-10:00**
Evidence fusion for activity recognition using Dempster-Shafer theory of evidence
Jing Liao, Yaxin Bi and C.D Nugent
Computer Science Research Institute, School of Computing and Mathematics, University of Ulster, N. Ireland

Th.3.1.5 10:00-10:15
Tremor Analysis by Decomposition of Acceleration into Gravity and Inertial Acceleration using Inertial Measurement Unit
Otakar Šprdlík[1,2], Zdeněk Hurák[2], Martina Hoskovcová[3] and Evžen Růžička[3]
[1]*Institute of Information Theory and Automation of the ASCR, Czech Republic*
[2]*Czech Technical University in Prague, Faculty of Electrical Engineering, Dept. of Control Eng., Czech Republic*
[3]*Charles University in Prague, 1st Faculty of Medicine, Dept. of Neurology, Czech Republic*

Th.3.1.6 9:45-10:00
Whole Body Vibration training: analysis and characterization
Antonio Fratini, Antonio La Gatta, Mario Cesarelli and Paolo Bifulco
Department of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy

Coffee Break 10:30-10:45

Thursday Morning, Nov. 5

Special Session: **Th.SS.1.1 LinkSCEEM Meeting: High Performance Computing Applications in Life Sciences I**
Time & Place: **9:00-10:30, Diana**
Chairperson: **K. Schilling**
The Cyprus Institute, Cyprus

Th.SS.1.1.1 9:00-09:30
High performance computing (HPC) in translational research
Arthur Thomas
University College, London, UK

Th.SS.1.1.2 9:30-10:00
High Performance Computing in Biomedical Informatics
D. I. Fotiadis
University of Ioannina, Greece

Th.SS.1.1.3 10:00-10:30
Real-Time Finite Element Modeling for High Fidelity Surgical Simulation
George Turkiyyah[1&2]
[1]*American University of Beirut, Lebanon*
[2]*University of Washington, USA*

Coffee Break 10:30-10:45

Thursday Morning, Nov. 5

Poster Session: **Th.1.2 eHealth II**
Time & Place: **10:45-11:15, Mezzanine**
Chairperson: **Panos Constantinides**
Frederick University, Nicosia, Cyprus

Th.1.2.1 10:45-11:15
A holistic environment for the design and execution of self-adaptive clinical pathways
Dimitrios Alexandrou[1], Ioannis Skitsas[2] and Gregoris Mentzas[3]
[1]*Information Management Unit of National Technical University of Athens, Greece*
[2]*Software Engineer of the R&D Department of UBITECH Research Ltd., Athens, Greece*
[3]*School of Electrical and Computer Engineering of National Technical University of Athens, Greece*

Th.1.2.2 10:45-11:15
Optimization Procedure for the Impact Detection Thresholds in an Accelerometer Smart Sensor
David Naranjo-Hernández[1,2], Laura María Roa-Romero[1,2], Luis Javier Reina-Tosina[2,3] and Miguel Ángel Estudillo-Valderrama[1,2]
[1]*Biomedical Engineering Group, University of Seville, Spain*
[2]*CIBER-BBN, Spain*
[3]*Dept. of Signal Theory and Communications, University of Seville, Spain*

Th.1.2.3 10:45-11:15
C2i: A tool to gather medical indexed information
Laurent Lecornu[1], Clara Le Guillou[2], Gregoire Thillay[1], Pierre-Jean Garreau[2], Helene Jantzem[2] and Jean-Michel Cauvin[3]
[1]*INSTITUT Telecom, Telecom Bretagne UEB; ITI Dpt, Brest, France*
[2]*CHU Brest, Medical Information Departement, Brest, France*
[3]*Inserm, Brest, France*

Th.1.2.4 10:45-11:15
Heart Rate Variability in healthy people compared with patients with Congestive Heart Failure
Leandro Pecchia, Paolo Melillo, Mario Sansone and Marcello Bracale
Department of Biomedical, Electronic and Telecommunication Engineering, University of Naples "Federico II", Naples, Italy

Th.1.2.5 10:45-11:15
PERFORM: First steps in the assessment of patient motion status and support to treatment changes
George A Rigas[2], Alexandros T. Tzallas[2], Dina A Baga[2], Themis P Exarchos[2], Christos D Katsis[2], Dimitra A Chaloglou[3], Spiros Th Konitsiotis[4] and Dimitrios I Fotiadis[2]
[1]*Department of Computer Science, University of Ioannina, Greece*

[2]*Unit of Medical Technology and Intelligent Information Systems, Dept. of Material Sciences and Engineering, University of Ioannina, Greece*
[3]*ANCO S.A, Athens, Greece*
[4]*Department of Neurology, Medical School, University of Ioannina, Ioannina, Greece*

Th.1.2.6 10:45-11:15

Diagnosis of cardiovascular abnormalities from Compressed ECG: A Data Mining based Approach

Ibrahim Khalil
School of CS and IT, University, Melbourne, Australia

Th.1.2.7 10:45-11:15

A user-centered mobile health device to manage life-threatening anaphylactic allergies and provide support in allergic reactions

Luis Hernandez-Munoz and Sandra Woolley
Electronic, Electrical and Computer Engineering Department, University of Birmingham, Edgbaston, UK

Th.1.2.8 10:45-11:15

Network Based Clinical Decision Support System

Darius Jegelevicius[1], Algimantas Krisciukaitis[2], Arunas Lukosevicius[1], Vaidotas Marozas[1], Alvydas Paunksnis[2], Valerijus Barzdziukas[2], Martynas Patasius[1], Dovile Buteikiene[2], Alfonsas Vainoras[2] and Liudas Gargasas[2]
[1]*Biomedical Engineering Institute of Kaunas, University of Technology, Lithuania*
[2]*Institute for Biomedical Research of Kaunas, University of Medicine, Lithuania*

Th.1.2.9 10:45-11:15

Robotic Wheelchairs

Giorgos Demetriou
Frederick University Cyprus, Lemesos, Cyprus

Th.1.2.10 10:45-11:15

Integrated Web Services Platform for the facilitation of fraud detection in health care e-government services

Anastassios Tagaris[1], George Konnis[1], Xanthi Benetou[1], Thomas Dimakopoulos[2], Kyriakos Kassis[2], Nikolas Athanasiadis[3], Stefan Rueping[4], Henrik Grosskreutz[4] and Dimitris Koutsouris[1]
[1]Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece
[2]AGILIS Informatics and Statistics SA, Athens, Greece
[3]Intrasoft International SA, Brussels, Belgium
[4]Fraunhofer IAIS, St. Augustin, Germany

Th.1.2.11 10:45-11:15

A Hydrostatic Pressure Approach to Assess Accuracy of Finger Blood Pressure Measurement

Rein Raamat, Kersti Jagomägi, Jaak Talts and Jana Kivastik
Department of Physiology, University of Tartu, Estonia

Th 1.2.12 10:45-11:15

Patient specific computer automated dosimetry calculations during therapy with 111In Octreotide

Ioannis Vamvakas, Nefeli Logopati, Maria Andreou, Marios Sotiropoulos, Athanasios Gatzis, George Limouris, Christos Antypas, Maria Lyra

Department of Medical Physics, Aretaieion Hospital, University of Athens, Athens, Greece

Thursday Morning, Nov. 5

Poster Session: **Th.2.2 Medical Imaging II**
Time & Place: **10:45-11:15, Mezzanine**
Chairperson: **Christos Loizou**
Department of Computer Science, Intercollege, Limassol, Cyprus

Th.2.2.1 10:45-11:15

On Enhancing Cardiac Pulse Measurements Through Thermal Imaging

Thirimachos Bourlai[1], Pradeep Buddharaju[1], Ioannis Pavlidis[1] and Barbara Bass[2]

[1]University of Houston, Houston, TX, U.S.A.

[2]Methodist Hospital (Department of Surgery), Houston, TX, U.S.A.

Th.2.2.2 10:45-11:15

Brain MR Image Normalization in Texture Analysis of Multiple Sclerosis

Christos Loizou[1], Marios Pantzaris[2], Ioannis Seimenis[3] and Constantinos Pattichis[4]

[1]Department of Computer Science, School of Sciences, Intercollege, Cyprus

[2]Cyprus Institute of Neurology and Genetics, Cyprus

[3]Medical Diagnostic Center "Ayios Therissos", Cyprus

[4]Department of Computer Science, University of Cyprus, Cyprus

Th.2.2.3 10:45-11:15

Texture based evaluation of Osseo integration of oral implants in dental panoramic radiography

Ioannis Georgakopoulos[1], Stauros Tsantis[2], Panayiotis Korfiatis[2], Lena Costaridou[2], Theodoris Petsas[1] and George Panayiotakis[2]

[1]Department of Radiology, School of Medicine, University of Patras, Greece

[2]Department of Medical Physics, School of Medicine, University of Patras, Greece

Th.2.2.4 10:45-11:15

Image Segmentation of the Acetowhite region in Cervix Images Based on Chromaticity

Jun Xiong, Lei Wang and Jia Gu

Institute of Biomedical and Health Engineering, Shenzhen Institute of Advanced Technology Chinese Academy of Sciences, Shenzhe, 518055, China.

Thursday Morning, Nov. 5

Poster Session: **Th.3.2 Biosignals II**
Time & Place: **10:45-11:15, Mezzanine**
Chairperson: **Panagiotis D. Bamidis**
Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece

Th.3.2.1 10:45-11:15
Multiclassifiers with Competence Function Applied to the Recognition of EMG Signals for the Control of Bio-Prosthetic Hand
Marek Kurzynski, Tomasz Woloszynski and Andrzej Wolczowski
Wroclaw University of Technology, Department of Systems and Computer Networks, Wroclaw, Poland

Th.3.2.2 10:45-11:15
Identifying Fine Movement Difficulties in Parkinson's Disease Using a Computer Assessment Tool
Laura Cunningham[1], Chris Nugent[1], George Moore[1], Dewar Finlay[2] and David Craig[2]
[1]*Computer Science Research Institute and School of Computing and Mathematics, Faculty of Computing and Engineering, University of Ulster, Northern Ireland*
[2]*Belfast City Hospital/Queen's University, Belfast, Northern Ireland*

Th.3.2.3 10:45-11:15
A Simple Algorithm to Monitor HR for Real Time Treatment Applications
Konstantinos Banitsas[1], Panagiotis Pelegris[1], Tuvi Orbach[2], Dionysis Cavouras[2], Spiros Kostopoulos[2] and Konstantinos Sidiropoulos[1]
[1]*Electrical and Computer Engineering Department, Brunel University, West London, Uxbridge, Middlesex, UK*
[2]*Department of Medical Instruments Technology, Technological Educational Institute of Athens, Greece*

Th.3.2.4 10:45-11:15
ECG - precordial leads reconstruction
Michal Prauzek, Marek Penhaker, Ivan Bernabucci and Silvia Conforto

Th.3.2.5 10:45-11:15
Textile-based Monitoring System for Biker
Chang-Ming Yang, Chih-Chung Wu, Chun-Mei Chou and Ching-Wen Yang
Ming Young Biomedical Corp., Jhunan, Miaoli, Taiwan

Th.3.2.6 10:45-11:15
Partitioning Time Series Sensor Data for Activity Recognition
Xin Hong and Chris Nugent
School of Computing and Mathematics and Computer Science Research Institute, University of Ulster, Northern Ireland

Th.3.2.7 10:45-11:15

Control of Dexterous Hand – algorithm implementation issues

Jacek Góra[1,2], Przemysław M. Szecówka[3] and Andrzej R. Wołczowski[2]
[1]*Nokia Siemens Networks, RTP Wrocław, Poland*
[2]*Faculty of Electronics, Wrocław University of Technology, Wrocław, Poland*
[3]*Faculty of Microsystems Electronics and Photonics, Wrocław University of Technology, Wrocław, Poland*

Th.3.2.8 10:45-11:15

Classification of 3T MRS spectra using Support Vector Machines

Ioannis Dimou[1], Ioannis Tsougos[2], Evangelia Tsolaki[2], Kiki Theodorou[2] and Michalis Zervakis
[1]*Technical University of Crete, ECE Dept., Chania, Greece*
[2]*University of Thessaly Medical School, Medical Physics Department, Larissa, Greece*

Th.3.2.9 10:45-11:15

BioSigBrowser, biosignal processing interface

Juan Bolea[1], Rute Almeida[1], Pablo Laguna[2], Leif Sörnmo[3] and Juan Pablo Martínez[2]
[1]*Centro de Investigación Biomédica en Red (CIBERBBN), Instituto de Investigación en Ingeniería de Aragón (I3A), Departamento de ingeniería electrónica y comunicaciones, Universidad de Zaragoza, Spain*
[2]*Instituto de Investigación en Ingeniería de Aragón (I3A), Departamento de ingeniería electrónica y comunicaciones, Universidad de Zaragoza and with Centro de Investigación Biomédica en Red (CIBER-BBN), Spain*
[3]*Signal Processing Group Dept. of Electrical and Information Technology Lund University, Lund, Sweden*

Th.3.2.10 10:45-11:15

A comparison of text reading speed using square and rectangular arrays for visual prosthesis

Min Hye Chang[1], Hyun Seok Kim[1], Jae Hyuk Shin[1] and Kwang Suk Park[2]
[1]*Interdisciplinary Program of Bioengineering, Graduate School, Seoul National University, Republic of Korea*
[2]*Department of Biomedical Engineering, College of Medicine, Seoul National University, Republic of Korea*

Th.3.2.11 10:45-11:15

Portable Virtual Vestibular Stimulation

Jonathan Synnott[1], Paul McCullagh[1], Greg Kelly[2], Gerry McAllister[1] and Glen Houston[3]
[1]*School of Computing and Mathematics, University of Ulster, Northern Ireland*
[2]*School of Health Sciences, University of Ulster, Northern Ireland*
[3]*Principle Audiological Scientist with the Belfast Trust, Northern Ireland*

Th.3.2.12 10:45-11:15

Noise Removal from Electrocardiogram Signal Employing an Artificial Neural Network in Wavelet Domain

Eiman Farahabdi[1], Amin Farahabadi[1], Hossein Rabbani[1], M. Parsa Mahjoob[2] and Alireza Mehri Dehnavi[1]
[1]*Department of Biomedical Engineering, Isfahan University of Medical Sciences (IUMS), Isfahan, Iran*
[2]*School of Medicine, Jahrom University of Medical Sciences (JUMS), Jahrom, Iran*

Th.3.2.13 10:45-11:15

Accelerating Biomedical Signal Processing Algorithms with Parallel Programming on Graphic Processor Units

Evdokimos Konstantinidis, Christos Frantzidis, Lazaros Tzimkas, Costas Pappas and Panagiotis Bamidis

Lab of Medical Informatics, Medical School, Aristotle University of Thessaloniki, Thessaloniki, Greece

Th.3.2.14 10:45-11:15

Combined SHG Signal with AFM Imaging to Assess Conformational Changes in Collagen

Andreas Stylianou, Maria Kyriazi, Konstantinos Politopoulos and Dido Yova

Laboratory of Biomedical Optics and Applied Biophysics, School of Electrical and Computer Engineering, National Technical University of Athens, Greece

Th.3.2.15 10:45-11:15

Combined Functional Data from Multispectral Non-Ionizing and Non-Invasive Brain Imaging

Irene Karanasiou

National Technical University of Athens, Athens, Greece

Th.3.2.16 10:45-11:15

A Hydrostatic Pressure Approach to Assess Accuracy of Finger Blood Pressure Measurement

Rein Raamat, Kersti Jagomägi, Jaak Talts, and Jana Kivastik

Department of Physiology, University of Tartu, Estonia

Th.3.2.17 10:45-11:15

A Method of Monitoring Biological Effect of Radiation Exposure by Excretion of Endogenous Carbon Monoxide in Expired Gas

Alexander I. Dyachenko[1,2], Yurii A. Shulagin[1], Eugene V. Stepanov[2], Anna G. Zizina[1], Vladimir P. Krotov[1], Vladislav M. Petrov[1], Tamila E. Burkovskaya[1]

[1]*Institute of Biomedical Problems of RAS, Moscow, Russia*

[2]*Institute of General Physics named by A.M. Prokhorov of RAS Moscow, Russia*

Thursday Morning, Nov. 5

Special Session: **Th.SS.1.2 LinkSCEEM Meeting: High Performance Computing Applications in Life Sciences II**
Time & Place: **10:45-12:45, Diana**
Chairperson: **Vasilis Promponas**
Bioinformatics Research Laboratory, Department of Biological Sciences, University of Cyprus, Cyprus

Th.SS.1.2.1 10:45-11:10
Bioinformatics Applications on Windows and Linux Clusters
Mohamed Abouelhoda
Nile University, Egypt

Th.SS.1.2.2 11:10-11:35
Computing Some Secrets of Life: Computational Biology and Bioinformatics Research in the BRL@UCY.AC.CY
Vasilis Promponas
Bioinformatics Research Laboratory, Department of Biological Sciences, University of Cyprus, Cyprus

Th.SS.1.2.3 11:35-12:00
Applications of high performance computing to network extraction from real-time tomographic estimates of brain activity
Andreas A. Ioannides
Laboratory for Human Brain Dynamics, AAI-SCS Ltd, Nicosia, Cyprus

Th.SS.1.2.4 12:00-12:15
The HPC Project of the Cyprus Institute: Opportunities for Life Sciences Research
Christos Nicolaou
Computation-based Science and Technology Research Center, The Cyprus Institute, Nicosia, Cyprus

Th.SS.1.2.5 12:15-12:45
Panel Discussion: Promoting HPC use in computational science in the Eastern Mediterranean region: The case for Life Sciences Research
Panel members: Prof. K. Schilling (The Cyprus Institute), Prof. D. Fotiadis (University of Ioannina), Prof. G. Turkiyyah (American University of Beirut), Dr. V. Promponas (University of Cyprus) Mohamed Abouelhoda (Nile University, Egypt)

Light Lunch 13:00

Bus leaves for Nicosia 13:15

Thursday Morning, Nov. 5

Session: **Th.1.3 eHealth III: e&m Health Systems Devices**
Time & Place: **11:15-12:45, Les Etoiles**
Chairpersons: **Panayiotis Kyriacou**
School of Engineering and Mathematical Sciences, City University London, London, UK

Anastassios Tagaris
Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece

Th.1.3.1 11:15-11:30

My Camera, My Buddy - Legal and Sociological Assessment of the Potential of Video Surveillance in eHomeCare

Griet Verhenneman[1] and Annelies Veys[2]

[1]Interdisciplinary Centre for Law and ICT, Katholieke Universiteit Leuven, Belgium

[2]SMIT (Studies on Media, Information & Telecommunication), Department of Communication Studies, Free University of Brussels, Belgium

Th.1.3.2 11:30-11:45

INTENSA: Heart Failure Patient's Follow-up System Using the ISO/IEEE11073 Standard

Miguel Martínez de Espronceda Cámara[1], Ignacio Martínez Ruiz[2], Santiago Led Ramos[1], Jesús Daniel Trigo Vilaseca[2], Iñigo Oses Galé, Javier Escayola Calvo[2], Luis Javier Serrano Arriezu[1], José García Moros[2] and Antonio García Quintana[3]

[1]Electrical andElectronics Engineering Dep., Public University of Navarre, Spain

[2]Communications Technologies Group (GTC), Aragon Institute for Engineering Research (I3A), University of Zaragoza, Spain

[3]Cardiology Service of Hospital Dr. Negrín, Canary Islands

Th.1.3.3 11:45-12:00

Mobile Technology to Empower People with Diabetes Mellitus: Design and Development of a Mobile Application

Stavroula Mougiakakou[1,2], Ioannis Kouris[1], Dimitra Iliopoulou[1], Andriani Vazeou[3] and Dimitrios Koutsouris[1]

[1]Faculty of Electrical and Computer Engineering, National Technical University of Athens, Greece

[2]ARTORG Center for Biomedical Engineering Research, Faculty of Medicine, University of Bern, CH

[3]A' Department of Pediatrics, Diabetes Center, P&A Kyriakou Children's Hospital, Greece

Th.1.3.4 12:00-12:15

CHRONIOUS: A Wearable System for the Management of Chronic Disease Patients

Athanasios Papadopoulos[1], Dimitrios I. Fotiadis[1], Michael Lawo[2,3], Fabio Ciancitto[4], Christian Podolak[4], Raffaele L. Dellaca[5], Giulia Munaro[6], Roberto Rosso[6]

[1]FORTH BRI Foundation for Research and Technology - Hellas, Biomedical Research Institute, Ioannina, Greece

[2]*TZI, Germany*
[3]*Universität Bremen, Bremen, Germany*
[4]*Institute for Integrated Circuits IIS, Erlangen, Germany*
[5]*MIP and the Biomedical Engineering Dep., Politecnico di Milano University, Milano, Italy*
[5]*Telematic & Biomedical Services Vicenza Italy*
[6]*TESAN Telematic & Biomedical Services S.p.A., Vicenza Italy*

Th.1.3.5 12:15-12:30

The preservation of the CE mark for a medical device further to a maintenance process

Leandro Pecchia[1], Giorgio Carpino[2,3], Luciano Mirarchi[4] and Marcello Bracale[1]
[1]*Department of Biomedical, Electronic and Telecommunication Engineering University of Naples "Federico II", Naples, Italy*
[2]*DIBET, Università di Napoli Federico II, Naples*
[3]*Laboratory of Biomedical Robotics and Biomicrosystems, Università Campus Bio-Medico di Roma, Roma, Italy*
[4]*Siemens Healthcare Customer Services, Verona, Italy*

Th.1.3.6 12:30-12:45

MyCare Card development: the patient held electronic health record device

Victor Rybynok[1], Kyriacou Panayiotis[1], Jacqueline Binnersley[2], Andree Woodcock[2] and Louise Wallace[3]
[1]School of Engineering and Mathematical Sciences, City University London, London, UK
[2]School of Art and Design, Coventry University, Coventry, UK
[3]Faculty of Health and Life Sciences, Coventry University, Coventry, UK

Light Lunch 13:00

Bus Leaves for Nicosia 13:15

Thursday Morning, Nov. 5

Session: **Th.2.3 Medical Imaging III: Segmentation I**
Time & Place: **11:15-12:45, Venus**
Chairpersons: **Dimitris Maroulis**
Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens, Athens, Greece

Christos Loizou
Department of Computer Science, Intercollege, Limassol, Cyprus

Th.2.3.1 11:15-11:30

Microarray Image Segmentation using Spot Morphological Model

Dimitris Maroulis, Eleni Zacharia
Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens, Athens, Greece

Th.2.3.2 11:30-11:45

Segmentation of Two-Dimensional Gel Electrophoresis Images containing Overlapping Spots

Michalis Savelonas, Dimitris Maroulis and Eleutheria Mylona
Dept. of Informatics and Telecommunications, University of Athens, Greece

Th.2.3.3 11:45-12:00

Automatic vertebra tracking through dynamic fluoroscopic sequence by smooth derivative template matching

Tommaso Cerciello[1], Paolo Bifulco[1], Mario Cesarelli[1], Maria Romano[1] and Robert Allen[2]
[1]*Dept. of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy*
[2]*Institute of Sound and Vibration Research, University of Southampton, England*

Th.2.3.4 12:00-12:15

Intelligent Feature Selection for Model-Based Bone Segmentation in Digital Radiographs

André Gooßen[1], Dirk Peters[1], Thorsten Gernoth[1], Thomas Pralow[2] and Rolf-Rainer Grigat[1]
[1]*Vision Systems, Hamburg University of Technology, Germany*
[2]*General X-Ray, Philips Healthcare, Germany*

Th.2.3.5 12:15-12:30

Active Shape Model Aided by Selective Thresholding for Lung Field Segmentation in Chest Radiographs

Dimitris Iakovidis[1] and Michalis Savelonas[2]
[1]*Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece*
[2]*Dept. of Informatics and Telecommunications, University of Athens, Greece*

Th.2.3.6 12:30-12:45

Automated Vessel Tree Segmentation: Challenges in Computer Aided Quantification of Diffuse Parenchyma Lung Diseases

Panayiotis Korfiatis, Anna Karahaliou and Lena Costaridou
Department of Medical Physics, School of Medicine, University of Patras, Greece

Light Lunch 13:00

Bus Leaves for Nicosia 13:15

Thursday Morning, Nov. 5

Session: **Th.3.3 Biosignals III**
Time & Place: **11:15-12:45, Minerva**
Chairpersons: **Andreas Spanias**
School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, USA

Marios Neophytou
Department of Computer Science, University of Cyprus, Cyprus

Th.3.3.1 **11:15-11:30**
A Complex Discrete Wavelet Transform for Processing Quadrature Doppler Ultrasound Signals
Gorkem Serbes[1] and Nizamettin Aydin[2]
[1]Mechatronics Engineering Department, Bahcesehir University, Istanbul, Turkey
[2]Computer Engineering Department, Yildiz Technical University, Istanbul, Turkey

Th.3.3.2 **11:30-11:45**
Automatic Optic Disk Detection by the Use of Curvelet Transform
Mahdad Esmaeili[1], Hossein Rabbani[1], Alireza Mehri Dehnavi[1] and Alireza Dehghani[2]
[1]Department of Biomedical Engineering, Isfahan University of Medical Sciences, Isfahan, Iran
[2]Department of Ophthalmology, Isfahan University of Medical Sciences, Isfahan, Iran

Th.3.3.3 **11:45-12:00**
Noise Components Identification in Biomedical Signals based on Empirical Mode Decomposition
Alexandros Karagiannis and Philippos Constantinou
Mobile Radio Communications laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece

Th.3.3.4 **12:00-12:15**
Transform Domain Features for Ion-Channel Signal Classification Using Support Vector Machines
Karthikeyan Natesan Ramamurthy, Jayaraman J Thiagarajan, Prasanna Sattigeri, Bharatan Konnanath, Andreas Spanias, Trevor Thornton, Shalini Prasad, Michael Goryll, Stephen Phillips and Stephen Goodnick
School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, USA

Th.3.3.5 12:15-12:30

The concept of an intelligent, bio-inspired and brain controlled robotic system

Dobrea Dan Marius and Dobrea Monica Claudia
Department of Electronics, Telecommunications and Information Technology, "Gh. Asachi" Technical University, Iaşi, Romania

Th.3.3.6 12:30-12:45

REG-ICA: A New Hybrid Method for EOG Artifact Rejection

Manousos A. Klados[1], Christos L. Papadelis[2] and Panagiotis D. Bamidis[1]
[1]Group of Applied Neuroscience, Lab of MedicalInformatics, Medical School, Aristotle University of Thessaloniki,Thessaloniki, Greece
[2]Center for Brain/Mind Sciences (CIMEC), University of Trento, Mattarello, Trentino

Light Lunch 13:00

Bus Leaves for Nicosia 13:15

Friday Morning, Nov. 6

Session: **Keynote Fr. 1 & 2**
Time & Place: **8:15-9:30, Les Etoiles**
Chairperson: **Sotiris Pavlopoulos**
National Technical University of Athens, Greece

Fr.1 **8:15-8:45**
Paving the path towards eHealth for Cyprus Public Healthcare Ecosystem
Kyriacos Kokkinos
General Manager, IBM Italia SpA, Cyprus Branch

Fr.2 **8:45-9:15**
A Low Cost and Effective Electronic Medical Record System for Developing Countries
Metin Akay
Professor, School of Biological and Health System Engineering, Ira Fulton School of Engineering–ASU, Tempe, Arizona, USA

Friday Morning, Nov. 6

Session: **Fr.1.4 eHealth III: e&m Health Systems on the Web**
Time & Place: **09:30-11:00, Les Etoiles**
Chairpersons: **Lena Costaridou**
Department of Medical Physics, School of Medicine, University of Patras, Greece

Ilias Maglogiannis
University of Central Greece, Department of Computer Science and Biomedical Informatics, Greece

Fr.1.4.1 **9:30-9:45**
An Integrated Web-based Platform for the Provision of Personalized Advice in People at High Risk for CVD
Stavroula Mougiakakou[1,2], Ioannis Valavanis[1], George Karkalis[1], Stathis Marinos[1], Keith Grimaldi[1] and Konstantina Nikita[1]
[1]Faculty of Electrical and Computer Engineering, National Technical University of Athens, Greece
[2]ARTORG Center for Biomedical Engineering Research, Faculty of Medicine, University of Bern, CH

Fr.1.4.2 **9:45-10:00**
A web-accessible mammographic image database dedicated to combined training and evaluation of radiologists and machines
Zinon Antoniou[1], Georgia Giannakopoulou[2], Ioannis Andreadis[1], Konstantina Nikita[1], Panos Ligomenides[3] and George Spyrou[3]

[1]*National Technical University of Athens, Greece*
[2]*School of Medicine, University of Athens, Greece*
[3]*Academy of Athens Biomedical Research Foundation, Athens, Greece*

Fr.1.4.3 10:00-10:15

AMICA telemedicine platform: a design for management of elderly people with COPD

Luis Felipe Crespo Foix[1], Daniel Sanchez Morillo[1], Mario Crespo Miguel[1], Nicole Gross[2], Kostas Giokas[3], Jose Antonio Jimenez Millan[1] and Christophe Kunze[2]
[1]Biomedical Engineering and Telemedicine Lab, University of Cadiz, Cadiz, Spain
[2]Research Center for Information Technology, Kalrsruhe, Germany
[3]Institute of Communication and Computer Systems, National Technical University of Athens, Greece

Fr.1.4.4 10:15-10:30

Privilege Management Infrastructure for Virtual Organizations in Healthcare Grids

Isabel Román[1], Jorge Calvillo[1,2], Sergio Rivas[1,2] and Laura M. Roa[1,2]
[1]*Área de Ingeniería Telemática, Universidad de Sevilla, Seville, Spain*
[2]*ISCIII initiative CIBER of Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN) Seville, Spain*

Fr.1.4.5 10:30-10:45

Distributed Processing Methodology for Biomedical Sensor Networks: An Optimal Approach

Miguel Ángel Estudillo-Valderrama[1,2], Laura María Roa-Romero[1,2], Luis Javier Reina-Tosina[2,3] and David Naranjo-Hernández[1,2]
[1]*Biomedical Engineering Group, University of Seville, Spain*
[2]*CIBER-BBN, Spain*
[3]*Dept. of Signal Theory and Communications, University of Seville, Spain*

Fr.1.4.6 10:45-11:00

Home care phonocardiography: an Italian experience

Maria Romano[1], Mario Cesarelli[1], Mariano Ruffo[1], Paolo Bifulco[1], Mariano Iaccarino[2] and Stefania Iaccarino[2]
[1]*Department of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy*
[2]*"Iaccarino", Naples, Italy*

Coffee Break 11:00-11:30

Friday Morning, Nov. 6

Special Session: **Fr.SS.2.1 2nd International Workshop on Computational Intelligence in Medical Imaging (CIMI 2009)**
Time & Place: **09:30-11:00, Venus**
Chairperson: **Gerald Schaefer**
Department of Science, Loughborough University, Loughborough, U.K.

Fr.SS.2.1.1 9:30-9:45
A new method for the detection of microcalcifications in mammograms
Farhang Sahba[1] and Anastasios Venetsanopoulos[2]
[1]*Department of Electrical and Computer Engineering, Ryerson University, Toronto, Canada*
[2]*Vice President of Research and innovation at Ryerson University, Toronto, Canada, and Professor Emeritus, University of Toronto, Toronto, Canada*

Fr.SS.2.1.2 9:45-10:00
Filtering Normal Retinal Images for Diabetic Retinopathy Screening Using Multiple Classifiers
Jonathan Goh[1], Lilian Tang[1], George Saleh[2], Lutfiah Al turk[3],Yu Fu[1], Antony Browne[1]
[1]*Department of Computing, University of Surrey, Surrey, UK*
[2]*Moorfields Eye Hospital NHS Foundation Trust, London, UK*
[3]*Department of Statistics, King Abdulaziz University, Kingdom of Saudi Arabia*

Fr.SS.2.1.3 10:00-10:15
Skin lesion segmentation using cooperative neural network edge detection and colour normalisation
Gerald Schaefer[1], Maher Rajab[2], M. Emre Celebi[3] and Hitoshi Iyatomi[4]
[1]*Department of Science, Loughborough University, Loughborough, U.K.*
[2]*Department of Computer Engineering, Umm Al-Qura University, Makkah, Saudi Arabia*
[3]*Department of Computer Science, Louisiana State University, Shreveport, USA*
[4]*Department of Electrical Informatics, Hosei University, Tokyo, Japan*

Fr.SS.2.1.4 10:15-10:30
Multi-agent segmentation for 3D medical images
Richard Moussa, Pascal Desbarats and Marie Beurton-Aimar
Laboratory Labri, Talence cedex, France

Fr.SS.2.1.5 10:30-10:45
3D-2D Image registration for craniofacial superimposition in forensic medicine using covariance matrix adaptation evolution strategy
Jose Santamaria[1], Oscar Cordon[2], Sergio Damas[2] and Oscar Ibañez[2]
[1]*University of Ja´en, Ja´en, Spain*
[2]*European Centre for Soft Computing, Mieres, Spain*

Fr.SS.2.1.6 10:45-11:00

Perioperative cardiac risk prediction

Hitoshi Iyatomi[1], Tomotaka Kasamatsu[2], Jun Hashimoto[3], M.Emre Celebi[4], Gerald Schaefer[5] and Koichi Ogawa[1]

[1]*Department of Applied Informatics, Hosei University, Tokyo, Japan*

[2]*Department of Radiology, Keio University School of Medicine, Tokyo, Japan*

[3]*Department of Radiology, Tokai University School of Medicine, Isehara, Japan*

[4]*Department of Computer Science, Louisiana State University in Shreveport, USA*

[5]*Department of Computer Science, Loughborough University, UK*

Coffee Break 11:000-11:30

Friday Morning, Nov. 6

Session: **Fr.3.4 Biosignals IV: Fetus and Newborn**
Time & Place: **09:30-11:00, Minerva**
Chairperson: **Lenka Lhotská**
Dept. of Cybernetics FEE CTU in Prague, Prague, Czech Republic

Fr.3.4.1 9:30-9:45

PSD modifications of FHRV due to CTG storage rate

Mario Cesarelli, Maria Romano, Mariano Ruffo, Paolo Bifulco, Giulio Pasquariello and Antonio Fratini

Department of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy

Fr.3.4.2 9:45-10:00

Fetal heart rate data pre-processing and annotation

Václav Chudáček[1], Michal Huptych[1], Lenka Lhotska[1], Michal Koucký[2], Lukáš Bauer[1] and Jiří Spilka[1]

[1]*Cybernetics FEE CTU in Prague, Prague, Czech Republic*

[2]*Gyneacology and Obsterics unit of the Charles University Hospital, Prague, Czech Republic*

Fr.3.4.3 10:00-10:15

Assessment of non-linear features for intrapartal fetal heart rate classification

Jiří Spilka[1], Václav Chudáček[1], Michal Koucký[2] and Lenka Lhotská[1]

[1]*Dept. of Cybernetics FEE CTU in Prague, Prague, Czech Republic*

[2]*Gyneacology and Obsterics unit of the Charles University Hospital, Prague, Czech Republic*

Fr.3.4.4 10:15-10:30

Feature Extraction and Classification of EEG Sleep Recordings in Newborns

Vladana Djordjevic[1], Natasa Reljin[2], Vaclav Gerla[3], Lenka Lhotska[3] and Vladimir Krajca[4,5]

[1]*Gerstner Laboratory, Faculty of Electrical Engineering, Czech Technical University in Prague, Prague, Czech Republic*

[2]*Dept of Mathematical Sciences, Delaware State University, DE, USA*

[3]*Gerstner Laboratory, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic*

[4]*Department of Neurology, Faculty Hospital Na Bulovce, Prague, Czech Republic*
[5]*Faculty of Biomedical Engineering, Czech Technical University in Prague, Czech Republic*

Fr.3.4.5 10:30-10:45
Visualization Methods used for Evaluation of Neonatal Polysomnographic Data
Vaclav Gerla[1], Vladana Djordjevic[1], Lenka Lhotska[1] and Vladimir Krajca[2]
[1]*Czech Technical University in Prague, GerstnerLaboratory, Prague, Czech Republic*
[2]*Czech Technical University in Prague, Faculty of Biomedical Engineering, Czech Republic*

Coffee Break 11:00-11:30

Friday Morning, Nov. 6

Session: **Fr.4.1 Diagnostic & Therapeutic Systems I**
Time & Place: **09:30-11:00, Diana**
Chairperson: **George Spyrou**
Academy of Athens Biomedical Research Foundation, Athens, Greece

Fr.4.1.1 9:30-9:45
Prognosis of collapse of the osteonecrosis of the femoral head for patients treated with a tantalum rod by determining location and size of the lesion
Stelios Koumpoyiannis[1], Nikolaos Aravas[2], Socrates Varitimidis[3], Konstantinos Malizos[3] and Elias Houstis[3]
[1]Department of Computer and Communication Engineering University of Thessaly, Volos, Greece
[2]Department of Mechanical Engineering University of Thessaly, Volos, Greece
[3]Orthopaedic Department, University Hospital of Larissa, Larissa Greece

Fr.4.1.2 9:45-10:00
Feature Selection on Chronic Pain Self Reporting Data
Yan Huang[1], Huiru Zheng[1], Chris Nugent[1], Paul McCullagh[1], Norman Black[1], Kevin Vowles[2] and Lance McCracken[3]
[1]*University of Ulster, Jordanstown, UK*
[2]*Centre for Pain Research, University of Bath, UK & Haywood Hospital, Stoke-on-Trent, UK*
[3]*University of Bath, UK*

Fr.4.1.3 10:00-10:15
Clinical Massage Therapy with the Oral-Rehabilitation Robot in Patients with Temporomandibular Joint Disorders
Yuichi Obokawa[1], Jorge Solis[3], Hiroyuki Ishii[2], Hiroki Koga[1], Atsuo Takanishi[4] and Akitoshi Katsumata[5]
[1]*Department of Modern Mechanical Engineering, Waseda University, Japan*
[2]*Consolidated Research Institute for Advanced Science and Medical Care, Waseda University, Japan*
[3]*Department of Modern Mechanical Engineering, Waseda University; and at the Humanoid Robotics Institute (HRI), Waseda University, Japan*

[4]*Department of Modern Mechanical Engineering, Waseda University & Humanoid Robotics Institute (HRI), Waseda University, Japan*
[5]*Department of Dentistry, Asahi University, Gifu, Japan*

Fr.4.1.4 10:15-10:30

Design of MR-compatible robotic devices: magnetic and geometric compatibility aspects

Christoforos Keroglou[1], Nikolaos Tsekos[1], Ioannis Seimenis[2], Eleni Eracleous[2], Christodoulos Christodoulou[3], Constantinos Pitris[1] and Eftychios Christoforou[4]
[1]*Dept. of Electrical and Computer Engineering, University of Cyprus, Cyprus*
[2]*Medical Diagnostic Center "Ayios Therissos", Cyprus*
[3]*Dept. of Computer Science, University of Houston, USA*
[4]*Dept. of Mechanical and Manufacturing Engineering, University of Cyprus, Cyprus*

Fr.4.1.5 10:30-10:45

Liver ablation using a high intensity focused ultrasound system and MRI guidance

Christakis Damianou[1], Cleanthis Ioannides[2], Nicos Mylonas[1,3], Venediktos HadjiSavvas[1,3], Andreas Couppis[1,3] and Dimitris Iosif[1,3]
[1]*Frederick University Cyprus, Nicosia, Cyprus*
[2]*Polikliniki Igia, Limassol, Cyprus*
[3]*City University, London, UK*

Fr.4.1.6 10:45-11:00

Penetration of high intensity focused ultrasound ex vivo and in vivo rabbit brain using MR imaging

Venediktos Hadjisavvas[1,2], Christakis Damianou[1,3], Panayiotis Kyriacou[2], Cleanthis Ioannides[4], Nicos Mylonas[1,2], Andreas Couppis[1,2], Dimitris Iosif[1], Gavriella Parea[3] and Theodoros Chadjicharalambous[3]
[1]*Frederick University Cyprus, Nicosia, Cyprus*
[2]*City University, London, UK*
[3]*MEDSONIC LTD, Limassol, Cyprus*
[4]*Polikliniki Igia, Limassol, Cyprus*

Coffee Break 11:00-11:30

Friday Morning, Nov. 6

Session: **Fr.1.5 eHealth IV: e&m Health Systems**
Time & Place: **11:30-13:00, Les Etoiles**
Chairperson: **Efthyvoulos Kyriacou**
Department of Computer Science and Engeneering, Frederick University, Nicosia, Cyprus

Fr.1.5.1 11:30-11:45

An e-Health Solution for Ambulatory Facilities

Petar Rajkovic, Dragan Jankovic and Tatjana Stankovic
Faculty of Electronic Engineering, University of Nis, Nis, Serbia

Fr.1.5.2 11:45-12:00

Localisation of Forgotten Items using RFID Technology

Josef Halberg[1], Chris Nugent[2], Richard Davies[2] and Mark Donnelly[2]

[1]Computer Science and Electrical Engineering department at Luleå University of Technology, Sweden

[2]Computer Science Research Institute and School of Computing and Mathematics at University of Ulster, Northern Ireland

Fr.1.5.3 12:00-12:15

SCP-ECG in an ISO/IEEE 11073-PHD world: Store-and-Forward Transmission and Messaging Part

Jesús Trigo[1], Franco Chiarugi[3], Álvaro Alesanco[1], Miguel Martínez de Espronceda[2], Luis Serrano[2], Catherine Chronaki[3], Javier Escayola[1], Ignacio Martínez[1] and José García[1]

[1]Communications Technologies Group (GTC), Aragón Institute for Engineering Research (I3A), University of Zaragoza, Zaragoza, Spain

[2]Electrical and Electronics Engineering Dep., Public University of Navarre, Spain

[3]Biomedical Informatics Laboratory, Institute of Computer Science (ICS), Foundation for Research and Technology – Hellas (FORTH), Heraklion, Crete, Greece

Fr.1.5.4 12:15-12:30

Short-term relaxation responses to a voice-guided mobile phone relaxation application and self-guided relaxation

Juho Merilahti[1], Elina M. Mattila[1], Johan Plomp[1], Klaus Laine[2] and Ilkka Korhonen[1]

[1]VTT Technical Research Centre of Finland, Tampere, Finland

[2]Finnish Institute of Occupational Health, Finland

Fr.1.5.5 12:30-12:45

Implementation of a Prescription Fraud Detection Software Using RDBMS Tools and ATC Coding

Anastassios Tagaris, Panteleimon Mnimatidis and Dimitrios Koutsouris

Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece

Fr.1.5.6 12:45-13:00

Integrated platform for continuous monitoring of children with suspected cardiac arrhythmias

Efthyvoulos Kyriacou[1], Demetris Hoplaros[2], Constantinos Pattichis[2], Antonis Jossif[3], Kounoudes Anastasis[4], Milis Marios[4]

[1]Department of Computer Science and Engeneering, Frederick University, Nicosia, Cyprus

[2]Department of Computer Science, University of Cyprus, Nicosia, Cyprus

[3]Paedi Center for Specialized Pediatrics, Cyprus

[4]Signal Generix, Cyprus

Lunch Break 13:00-14:15

Friday Morning, Nov. 6

Session: **Fr.2.4 Medical Imaging IV: Segmentation II**
Time & Place: **11:30-13:00, Venus**
Chairperson: **Styliani Petroudi**
Department of Electrical and Computer Engineering,
University of Cyprus, Cyprus

Fr.2.4.1 **11:30-11:45**
Improving Medical Image Perception By Hierarchical Clustering Based Segmentation
Arul N. Selvan[1], Reza Saatchi[1] and Christine M. Ferris[2]
[1]Faculty of Arts Computing, Engineering and Sciences, Sheffield Hallam University, Sheffield, United Kingdom
[2]Faculty of Health and Wellbeing, Engineering and Sciences, Sheffield Hallam University, Sheffield, United Kingdom

Fr.2.4.2 **11:45-12:00**
Extended Vector Field Convolution Snake for Highly Non-convex Shapes Segmentation
Tiberiu Radulescu and Vasile Buzuloiu
Image Processing and Analysis Laboratory, Universitatea "Politehnica" din Bucuresti, Romania

Fr.2.4.3 **12:00-12:15**
Phase Based Level Set Segmentation of Ultrasound Images
Ahror Belaid[1], Djamal Boukerroui[1], Jean-Francois Lerallut[1] and Yves Maingourd[2]
[1]Université de Technologie de Compiègne, Centre de Recherches de Royallieu, France
[2]Pediatric Échocardiographic Center, CHU Amiens, France

Fr.2.4.4 **12:15-12:30**
Mammographic Segmentation Based on Mammographic Parenchymal Patterns and Spatial Moments
Wenda He[1], Erika Denton[2] and Reyer Zwiggelaar[1]
[1]Department of Computer Science, Aberystwyth University, Aberystwyth, UK
[2]Department of Radiology, Norfolk & Norwich University Hospital, Norwich, UK

Fr.2.4.5 **12:30-12:45**
Segmentation of Colorectal Pathology Images using Level Sets
Styliani Petroudi[1,2] and Michael Brady[2]
[1]Department of Electrical and Computer Engineering, University of Cyprus, Cyprus
[2]Wolfson Medical Vision Lab, Department of Engineering Science, University of Oxford, UK

Fr.2.4.6 **12:45-13:00**
Segmentation of MR Brain Images with Bias Artifact
Edoardo Ardizzone, Roberto Pirrone, Orazio Gambino and Francesco Alagna
DINFO – Dipartimento di Ingegneria Informatica viale delle Scienze, Universita' degli Studi di Palermo, Palermo, Italy

Lunch Break **13:00-14:15**

Friday Morning, Nov. 6

Session: **Fr.3.5 Biosignals V: ECG**
Time & Place: **11:30-13:00, Minerva**
Chairperson: **Christina Orphanidou**
Institute of Biomedical Engineering,
Dep. of Engineering Science, University of Oxford, Oxford, UK

Fr.3.5.1 **11:30-11:45**
Intensive Care Window: Real time monitoring and analysis in the Intensive Care environment
Nikolas Stylianides[1], Marios Dikaiakos[1], George Panayi[2] and Theodoros Kyprianou[2]
[1]Dept. Computer Science, University of Cyprus, Cyprus
[2]Intensive Care Unit, Nicosia General Hospital, Cyprus

Fr.3.5.2 **11:45-12:00**
Development of heart rate and respiration rate measurement system using body-sound
Hiroyasu Miwa[1] and Kensaku Sakai[2]
[1]Digital Human Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Tokyo, Japan
[2]Feel Fine Co. Ltd., Tokyo, Japan

Fr.3.5.3 **12:00-12:15**
Spectral fusion for estimating respiratory rate from the ECG
Christina Orphanidou[1], Oliver Brain[1], Shahab Khan[3], Jacques Feldmar[2], James Price[3] and Lionel Tarassenko[1]
[1]Institute of Biomedical Engineering, Dep. of Engineering Science, University of Oxford, Oxford, UK
[2]Oxford BioSignals, Brook House, Abingdon, UK
[3]John Radcliffe hospital, Oxford, UK

Fr.3.5.4 **12:15-12:30**
A new approach of unconstrained sleep monitoring and Pulse Transit Time extraction using PPG pillow and CC-ECG electrode system
Jeong Su Lee, Gih Sung Chung, Do Un Jeong, and kwang Suk Park
Interdisciplinary Program of Bioengineering, Graduate School, Seoul National University, Republic of Korea

Fr.3.5.5 **12:30-12:45**
CardioGrid: ECG Analysis on Demand to Detect Cardiovascular Abnormalities
Ibrahim Khalil, and Fahim Sufi
School of Computer Science and IT, RMIT University, Melbourne, Australia

Fr.3.5.6 **12:45-13:00**
Methods for Evaluation of Central Hemodynamics and Detection of Indicators of Risk of Sudden Cardiac Death for Network Based Clinical Decision Support System

Algimantas Krisciukaitis[1], Renata Simoliuniene[1], Andrius Macas[2], Giedre Baksyte[2] and Remigijus Zaliunas[1]
[1]*Kaunas University of Medicine, Lithuania*
[2]*Clinics of Kaunas University of Medicine, Lithuania*

Lunch Break **13:00-14:15**

Friday Morning, Nov. 6

Session: **Fr.4.2 Diagnostic & Therapeutic Systems II**
Time & Place: **11:30-13:00, Diana**
Chairpersons: **Costas Pitris**
Department of Electrical and Computer Engineering, University of Cyprus, Cyprus

Christodoulos Christodoulou
Department of Computer Science, University of Cyprus, Cyprus

Fr.4.2.1 **11:30-11:45**
Experimental Simulations of Ultrasonic Field Time-Development in 3D Ultrasonic Transmission Tomography
Dusan Hemzal[1], Igor Peterlík[2], Jiri Jan[3] and Jiri Rolecek[3]
[1]*Dept. of Condensed Matter Physics, Masaryk University, Brno, Czech Republic*
[2]*Faculty of Informatics, Masaryk University, Brno, Czech Republic*
[3]*Department of Biomedical Engineering, FEEC, Brno University of Technology, Brno, Czech Republic*

Fr.4.2.2 **11:45-12:00**
Spectral Analysis for Scatterer Estimation in Optical Coherence Tomography Images
Evgenia Bousi, Andreas Kartakoullis and Costas Pitris
Department of Electrical and Computer Engineering, University of Cyprus, Cyprus

Fr.4.2.3 **12:00-12:15**
Retinal Image Analysis Aimed at Support of Early Neural-layer Deterioration Diagnosis
Jiri Jan, Jan Odstrcilik, Jiri Gazarek and Radim Kolar
Department of Biomedical Engineering, University of Technology Brno, Czech Republic

Fr.4.2.4 **12:15-12:30**
Thick Film Transducers for High Frequency coded Ultrasonography
Andrzej Nowicki[1], Janusz Wojcik[1], Rasmus Lou-Moeller[2], Marcin Lewandowski[1], Ryszard Tymkiewicz[1], Wanda Wolny[2] and Tomasz Zawada[3]
[1]*Institute of Fundamental Technological Research, Ultrasonic Department, Warsaw, Poland*
[2]*InSensor A/S*
[3]*Ferroperm Piezoceramics A/S – Hejreskovvej, Kvistgaard, Denmark*

Fr.4.2.5 **12:30-12:45**

Akamas: Mining Association rules using a new algorithm for the Assessment of the Risk of Coronary Heart Events

[1]Minas Karaolis[1], J.A. Moutiris[2], L. Papaconstantinou[1], C.S. Pattichis[1]
[1]Department of Computer Science, University of Cyprus, Nicosia, Cyprus
[2]Department of Cardiology, Paphos General Hospital, Paphos, Cyprus

Fr.4.2.6 **12:45-13:00**

An Ontology and Rule Based Intelligent System to Detect and Predict Myocardial Diseases

Antonio J. Jara, Francisco J. Blaya, Miguel A. Zamora and Antonio F. G. Skarmeta
University of Murcia, Computer Science Faculty, Murcia, Spain

Lunch Break **13:00-14:15**

Friday Afternoon, Nov. 6

Session : **Keynote Fr. 3 & 4**
Time & Place: **14:15-15:30, Les Etoiles**
Chairperson: **Dimitris Koutsouris**
Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece

Fr.3 **14:15-14:45**

Personal Health Record and Value-Based Healthcare

Niilo Saranummi
Research Professor, VTT Technical Research Centre of Finland, Finland

Fr.4 **14:45-15:30**

Signal processing in patient assessment and care: from hospital to home

Robert Allen
Professor of Biodynamics and Control Institute of Sound and Vibration Research University of Southampton, UK

Friday Afternoon, Nov. 6

Session: **Fr.5.1 Systems Biology and Modeling Methodologies**
Time & Place: **15:30-17:00, Les Etoiles**
Chairperson: **Aristotelis Chatziioannou**
National Hellenic Research Foundation, Institute of Biological Research & Biotechnology, Athens, Greece

Fr.5.1.1 **15:30-15:45**
GRISSOM web based Grid portal: Exploiting the power of Grid infrastructure for the interpretation and storage of DNA microarray experiments
Aristotelis Chatziioannou[1], Ioannis Kanaris[2], Ilias Maglogiannis[3], Charalampos Doukas[2], Panagiotis Moulos[1], Eleftherios Pilalis[1] and Fragiskos Kolisis[1]
[1]National Hellenic Research Foundation, Institute of Biological Research & Biotechnology, Athens, Greece
[2]University of the Aegean, Department of Information and Communication Systems, Samos, Greece
[3]University of Central Greece, Department of Computer Science and Biomedical Informatics, Greece

Fr.5.1.2 **15:45-16:00**
Nonlinear, data-driven modeling of cerebrovascular and respiratory
Georgios Mitsis
University of Cyprus, Nicosia, Cyprus

Fr.5.1.3 **16:00-16:15**
Model of Cardiovascular Control During Valsalva Maneuver
Michel Kana[1] and Jiri Holcik[2]
[1]Czech Technical University in Prague, Chez Republic
[2]Masaryk University Brno, Chez Republic

Fr.5.1.4 **16:15-16:30**
Volume estimation of non-geometric shape cavity using an array of normal distributed distance sensors on a spherical mount, applicable in the right ventricle
Petros Toumpaniaris, Ilias Skalkidis, Aggeliki Giakoumaki and Dimitris Koutsouris
Biomedical Engineering Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, Greece

Fr.5.1.5 **16:30-16:45**
Quantitative Evaluation of a Mammographic Software Phantom Generator
Kristina Bliznakova and Nicolas Pallikarakis
Department of Medical Physics, University of Patras, Patras, Greece

Fr.5.1.6 **16:45-17:00**
An Open Web Services – based Framework for Data Mining of Biomedical Image Data
Charalampos Doukas[1], Ilias Maglogiannis[2] and Aristotle Chatziioannou[3]

[1]*University of the Aegean, Department of Information & Communication Systems Engineering, Samos, Greece*
[2]*University of Central Greece, Department of Computer Science and Biomedical Informatics, Samos, Greece*
[3]*Institute of Biological Research & Biotechnology, National Hellenic Research Foundation, Athens, Greece*

Coffee Break 17:00-17:30

Friday Afternoon, Nov. 6

Session: **Fr.2.5 Medical Imaging V: Analysis**
Time & Place: **15:30-17:00, Venus**
Chairpersons: **Marios S. Pattichis**
Dep. of Electrical and Computer Engineering, University of New Mexico, NM, USA

Andreas Anayiotos
Cyprus University of Technology, Limassol, Cyprus

Fr.2.5.1 15:30-15:45
AM-FM Analysis over Spatially Bounded Domains for Applications in Medical Imaging
Marios S. Pattichis and Victor Murray
Dep. of Electrical and Computer Engineering, University of New Mexico, NM, USA

Fr.2.5.2 15:45-16:00
Evolutionary Conformal Prediction for Breast Cancer Diagnosis
Antonis Lambrou[1], Harris Papadopoulos[2] and Alexander Gammerman[1]
[1]*Computer Learning Research Centre, Royal Holloway, University of London, London, UK*
[2]*Computer Science and Engineering Department, Frederick University, Cyprus*

Fr.2.5.3 16:00-16:15
Combined Texture Features for Improved Classification of Suspicious Areas in Autofluorescence Bronchoscopy
Panagiotis Bountris[1], Afroditi Apostolou[1], Maria Haritou[1], Elisavet Passalidou[3] and Dimitris Koutsouris[1]
[1]*Biomedical Engineering Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece*
[2]*Fluorescence Bronchoscopy and Laser Treatment Unit, Sismanoglio General Hospital of Attica, Athens, Greece*

Fr.2.5.4 16:15-16:30
Discrete Wavelet Transform vs. Wavelet Packets for Texture Analysis of Ultrasound Images of Carotid Atherosclerosis
Nikolaos Tsiaparas[1], Spyretta Golemati[2], John Stoitsis[1] and Konstantina Nikita[1]
[1]*Dep. of Electrical and Computer Engineering, National Technical University of Athens, Greece*
[2]*Medical School, National Kapodistrian University of Athens, Greece*

Fr.2.5.5 16:30-16:45

Effect Of Posture Change On The Geometric Features Of The Healthy Carotid Bifurcation

Andreas Anayiotos[1,5,] Nicolas Aristokleous[1], Ioannis Seimenis[2], Yiannis Papaharilaou[3], Georgios Georgiou[4] and Brigitta Brott[5]

[1]*Cyprus University of Technology, Limassol, Cyprus*

[2]*Medical Diagnostic Center Ayios Therissos, Nicosia, Cyprus*

[3]*IACM-FORTH (Institute of Applied and Computational Mathematics), Nicosia, Cyprus*

[4]*University of Cyprus, Nicosia, Cyprus*

[5]*Division of Cardiovascular Disease, University of Alabama, Birmingham, USA*

Fr.2.5.6 16:45-17:00

Automatic Standardisation of a Zebrafish Embryo Image Database

Fernando Boto[1], Céline Paloc[1], Alexis Verbeke[1], Carles Callol[2], Ainhoa Letamendia[2], Izaskun Ibarbia[2], Olaia Holgado[2] and J.M Virto[2]

[1]*Vicomtech, San Sebastian, Spain*

[2]*Biobide, San Sebastian, Spain*

Coffee Break 17:00-17:30

Friday Afternoon, Nov. 6

Session: **Fr.3.6 Biosignals VI: CAD Systems**
Time & Place: **15:30-17:00, Minerva**
Chairperson: **Christodoulos Christodoulou**
Department of Computer Science, University of Cyprus, Cyprus

Fr.3.6.1 15:30-15:45

Estimating the Depth of Anesthesia by Applying Sub Parameters to an Artificial Neural Network during General Anesthesia

Mehrab Ghanatbari[1], Hossein Rabbani[1], Alireza Mehri Dehnavi[1] and A. R. Mahoori[2]

[1]*Department of Biomedical Engineering, Isfahan University of Medical Sciences, Isfahan, Iran*

[2]*Department of Anesthesia, Urmia Medical University, Urmia, Iran*

Fr.3.6.2 15:45-16:00

Neural network application to the development of a novel diabetic neuropathy diagnosis tool using the Valsalva index and the SCR

Pedro V. Rivera Farina[1], Javier Perez Turiel[1], Lorena Gonzalez Sal[1], Enrique Gonzalez Sarmiento[1], Alberto Herreros[1] and Sara Higuero[2]

[1]*Biomedical Engineering Division, CARTIF, Foundation, Boecillo, Valladolid, Spain*

[2]*University Hospital of Valladolid, Valladolid, Spain*

Fr.3.6.3 16:00-16:15

Classification of Surface Electromyographic Signals using AM-FM Features

Christodoulos Christodoulou[1], Prodromos Kaplanis[1], Victor Murray[2], Marios Pattichis[2] and Constantinos S. Pattichis[1]

[1]*Department of Computer Science, University of Cyprus, Cyprus*

[2]*Department of Electrical and Computer Engineering, University of New Mexico, Albuquerque, NM, USA*

Fr.3.6.4 16:15-16:30

Classification of the emotional states based on the EEG signal processing

Martin Macas, Michal Vavrecka, Vaclav Gerla and Lenka Lhotska
Gerstner Laboratory, Czech Technical University in Prague, Prague, Czech Republic

Fr.3.6.5 16:30-16:45

On the Use of Cepstral Coefficients and Multilayer Perceptron Networks for Vocal Fold Edema Diagnosis

João Vilian, Joseana Fechine, Herman Gomes and Silvana Costa
[1]*Universidade Federal de Campina Grande, Campina Grande, Brazil*
[2]*Instituto Federal de Educação, Ciência e Tecnologia da Paraíba, João Pessoa, Brazil*

Fr.3.6.6 16:45-17:00

Identification of auditory cues utilized in human echolocation – Objective measurement results

Timos Papadopoulos, David S. Edwards, Daniel Rowan and Robert Allen
Institute of Sound and Vibration Research (ISVR), Southampton, UK

Coffee Break 17:00-17:30

Friday Afternoon, Nov. 6

Session: **Fr.6.1 Biological Data Analysis and Integration**
Time & Place: **15:30-17:00, Diana**
Chairpersons: **Vasilis Promponas**
Department of Biological Sciences, University of Cyprus, Nicosia, Cyprus

Manolis Christodoulakis
Department of Electrical and Computer Engineering
University of Cyprus, Cyprus

Fr.6.1.1 15:30-15:45

Multi-platform Data Integration in Microarray Analysis

Georgia Tsiliki[1], Michalis Zervakis[2], Marina Ioannou[1], Elias Sanidas[3], Evstathios Stathopoulos[3], Manolis Tsiknakis[4] and Dimitris Kafetzopoulos[1]
[1]*Institute of Molecular Biology and Biotechnology, FORTH, Crete, Greece*
[2]*Technical University of Crete, Crete, Greece*
[3]*Medical School, University of Crete, Crete, Greece*
[4]*Institute of Computer Science, FORTH, Crete, Greece*

Fr.6.1.2 15:45-16:00

Gene Expression Classifiers and Out-Of-Class Samples Detection

Alfredo Benso, Stefano Di Carlo and Gianfranco Politano
Department of Control and Computer Engineering, Torino, Italy

Fr.6.1.3 16:00-16:15

Investigating the minimum required number of genes for optimum classification of myopathy microarray data

Argiris Sakellariou[1], Despina Sanoudou[2] and George Spyrou[2]
[1]*National & Kapodistrian University of Athens, Greece*
[2]*Biomedical Research Foundation of the Academy of Athens, Greece*

Fr.6.1.4 16:15-16:30

ANN-based simulation of transcriptional networks in Yeast

Maria Manioudaki[1,2] and Panayiota Poirazi[2]
[1]*Department of Chemistry, University of Crete, Heraklion, Crete, Greece*
[2]*Institute of Molecular Biology and Biotechnology (IMBB), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Crete, Greece*

Fr.6.1.5 16:30-16:45

A Proposal for Gene Signature Integration

Michalis Blazadonakis[1], Michalis Zervakis[1] and Dimitrios Kafetzopoulos[2]
[1]*Technical University of Crete, Greece*
[2]*Institute of Molecular Biology and Biotechnology, Foundation for Research and Technology, Greece*

Fr.6.1.6 16:45-17:00

Optimal Graph Design Using A Knowledge-driven Multi-objective Evolutionary Graph Algorithm

Christos A. Nicolaou[1,2,3,] Christos Kannas[2,3,] and Constantinos S. Pattichis[3]
[1]*Cyprus Institute, Nicosia, Cyprus, University of Cyprus, Nicosia, Cyprus*
[2]*Noesis Chemoinformatics, Nicosia, Cyprus*
[3]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*

Coffee Break 17:00-17:30

Friday Afternoon, Nov. 6

Session: **Fr.7.1 Meet the Editors**
Time & Place: **17:30-19:00, Les Etoiles**
Chairperson: **Niilo Saranummi**
VTT Technical Research Centre of Finland, Finland

Biomedical Signal Processing & Control
Robert Allen

IEEE Transactions on Information Technology in Biomedicine
Yuan-Ting Zhang

IEEE EMBS Book Series
Metin Akay

Friday Afternoon, Nov. 6

Special Session: **Fr.SS.3.1 1st International Workshop on Computational Methods in Orthopedic Biomechanics and Rehabilitation (COMOR 2009) 1/2 (workshop to be continued on Saturday morning 09:30-11:00)**
Time & Place: **17:30-19:00, Venus**
Chairpersons: **George Papaioannou**
"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA

Nikos Pleros
Department of Informatics, Aristotle University of Thessaloniki, Thessaloniki, Greece

Adeeb Rahman
Dep. of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee

Fr.SS.3.1.1 17:30-17:50
Assessment of Vacuum-assisted trans-tibial amputee socket dynamics
George Papaioannou[1], Christos Mitrogiannis[1], George Nianios[1] and Goeran Fiedler[2]
[1]Dep. of Civil Engineering and Applied Sciences, University of Wisconsin, Milwaukee, USA
[2]Dep. of Human Movement, College of Health Sciences, University of Wisconsin, Milwaukee, USA

Fr.SS.3.1.2 17:50-18:10
Optical Fiber Sensors in Orthopedic Biomechanics and Rehabilitation
Nikos Pleros[1], George Kanellos[1,2] and George Papaioannou[2,3]
[1]*Department of Informatics, Aristotle University of Thessaloniki, Thessaloniki, Greece*
[2]*S.S.F. Safe Smart Fabric Adaptable Surface Ltd, Cyprus*
[3]*Department of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee, USA*

Fr.SS.3.1.3 18:10-18:30
On Modeling Electric Fields for Microscale Cell Manipulation
Ilya Avdeev and Michael Lovell
University of Wisconsin, Milwaukee, WI, USA

Fr.SS.3.1.4 18:30-18:50
Thin Film Overlaid Long Period Fibre Grating Sensors: Examples and Prospects for Advanced Health Monitoring Applications
Stavros Pissadakis[1], Nikolaos Vainos[2,3] and Maria Konstantaki[1]
[1]*Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, Heraklion, Greece*
[2]*National Hellenic Research Foundation, Theoretical and Physical Chemistry Institute, Athens, Greece*
[3]*Department of Materials Science, University of Patras, Patras, Greece*

Gala Dinner 20:00

Friday Afternoon, Nov. 6

Session: **Fr.3.7 Biosignals VII: CAD Systems II**
Time & Place: **17:30-19:00, Minerva**
Chairpersons: **Michalis Zervakis**
Technical University of Crete, Greece

Costas Neocleous
Department of Mechanical Engineering, Cyprus University of Technology, Cyprus

Fr.3.7.1 17:30-17:45
Classification of Raman Spectra using Support Vector Machines
Alexandros Kyriakides[1], Costas Pitris[1] and Evdokia Kastanos[2]
[1]*Department of Electrical and Computer Engineering, University of Cyprus, Cyprus*
[2]*Dept. of Life and Health Sciences, University of Nicosia, Cyprus*

Fr.3.7.2 17:45-18:00
Raman Spectroscopy for UTI Diagnosis and Antibiogram
Katerina Hadjigeorgiou[1], Evdokia Kastanos[2], Alexandros Kyriakides[1] and Costas Pitris[1]
[1]*Department of Electrical and Computer Engineering, University of Cyprus, Cyprus*
[2]*Dept. of Life and Health Sciences, University of Nicosia, Cyprus*

Fr.3.7.3 18:00-18:15

Raman Spectroscopy for Determining Nutritional Facts

Christos Moustakas and Costas Pitris
Department of Electrical and Computer Engineering, University of Cyprus, Cyprus

Fr.3.7.4 18:15-18:30

Pit Pattern Classification using Extended Local Binary Patterns

Michael Häfner[1], Alfred Gangl[1], Michael Liedlgruber[2], Andreas Uhl[2], Andreas Vécsei[3] and Friedrich Wrba[4]
[1]*Department of Gastroenterologyand Hepatology, Medical University of Vienna, Austria*
[2]*Department of Computer Sciences, Salzburg University, Austria*
[3]*St. Anna Children's Hospital, Vienna, Austria*
[4]*Department of Clinical Pathology, Medical University of Vienna, Austria*

Fr.3.7.5 18:30-18:45

An integrated CAD system for supporting diagnosis in gynaecological cancer of the endometrium

Ioannis Constantinou[1,2], C. A. Koumourou[1], M. S. Neofytou[1,2], V. Tanos[3], C. S. Pattichis[2], E.C. Kyriacou[4]
[1]*MedTechSol (Medical Technology Solutions) Ltd, Nicosia, Cyprus*
[2]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*
[3]*Aretaeio Hospital, Nicosia, Cyprus*
[4]*Department of Computer Science and Engeneering, Frederick University, Nicosia, Cyprus*

Fr.3.7.6 18:45-19:00

Neural networks to investigate the effects of smoking and alcohol abuse on the risk for preeclampsia

Costas Neocleous[1], Kypros Nikolaides[3], Kleanthis Neokleous[2] and Christos Schizas[2]
[1]*Department of Mechanical Engineering, Cyprus University of Technology, Cyprus*
[2]*Department of Computer Science, University of Cyprus, Cyprus*
[3]*Harris Birthright Research Centre for Fetal Medicine, King's College Hospital Medical School, London, UK*

Gala Dinner 20:00

Friday Afternoon, Nov. 6

Session: **Fr.6.2 Sequence and Structure Analysis of Biological Macromolecules**
Time & Place: **17:30-19:00, Diana**
Chairperson: **Vasilis Promponas**
Department of Biological Sciences, University of Cyprus, Nicosia, Cyprus

Pavlos Antoniou
Department of Computer Science, King's College, London, UK

Fr.6.2.1 **17:30-17:45**
Weighted Amino Acid Composition based on Amino Acid Indices for Prediction of Protein Structural Classes
Sundeep Singh Nanuwa, Andre Dziurla and Huseyin Seker
De Montfort University, Leicester, UK

Fr.6.2.2 **17:45-18:00**
Parallel Interacting Multiview Learning: An Application to Prediction of Protein Sub-nuclear Location
Cemal Okan Şakar[1], Olcay Kurşun[2], Hüseyin Şeker[3], Fikret Gürgen[1], Nizamettin Aydin[4] and Oleg Favorov[5]
[1]*Department of Computer Engineering, Bogazici University, Istanbul, Turkey*
[2]*Department of Computer Engineering, Istanbul University, Istanbul, Turkey*
[3]*Bio-Health Informatics Research Group at the Centre for Computational Intelligence, Department of Informatics, Faculty of Technology, De Montfort University, Leicester, UK*
[4]*Department of Computer Engineering, Yildiz Technical University, Istanbul, Turkey*
[5]*Department of Biomedical Engineering, University of North Carolina, Chapel Hill, USA*

Fr.6.2.3 **18:00-18:15**
A simple clustering approach for pathogenic strain identification based on local and global amino acid compositional signatures from genomic sequences: the *Escherichia* genus case
Vasilis Promponas
Department of Biological Sciences, University of Cyprus, Nicosia, Cyprus

Fr.6.2.4 **18:15-18:30**
A Parallel Implementation of a Multi-objective Evolutionary Algorithm
Christos Kannas[1,2,] Christos A. Nicolaou[1,2,3] and Constantinos S. Pattichis[3]
[1]*Noesis Chemoinformatics, Nicosia, Cyprus*
[2]*Cyprus Institute, Nicosia, Cyprus, University of Cyprus, Nicosia, Cyprus*
[3]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*

Fr.6.2.5 18:30-18:45

Mapping uniquely occuring short sequences derived from high throughput technologies to a reference genome

Pavlos Antoniou[1], Jackie Daykin[1], Costas Iliopoulos[1], Derrick Kourie[2], Laurent Mouchard[3] and Solon Pissis[1]

[1]*Department of Computer Science, King's College, London, UK*

[2]*Department of Computer Science, University of Pretoria, Pretoria, South Africa*

[3]*LITIS, University of Rouen, Saint-Etienne-du-Rouvray, France*

Gala Dinner 20:00

Saturday Morning, Nov. 7

Session: **Keynote Sa.1**
Time & Place: **8:45-9:30, Les Etoiles**
Chairperson: **Panagiotis D. Bamidis**
Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece

Sa.1 **8:45-9:30**
Medicine 2.0 - new opportunities and challenges in the provision of health information and elearning
Gunther Eysenbach
Associate Professor at the Department of Health Policy Management and Evaluation at the University of Toronto

Saturday Morning, Nov. 7

Special Session: **Sa.SS.4.1 1st International Workshop on Information Technology for Patient Safety (ITPS 2009)**
Time & Place: **09:30-11:00, Les Etoiles**
Chairperson: **Dimitris Iakovidis**
Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece

Sa.SS.4.1.1 **9:30-9:43**
Knowledge management activities in Patient Safety
Fujii Mai
Patient Safety Programme, A World Alliance for Safer Health Care Information, Evidence and Research (IER), World Health Organization, Geneva, Switzerland

Sa.SS.4.1.2 **9:43-9:56**
A Federated Data Collection Application for the Prediction of Adverse Hypotensive Events
Anthony Stell, Richard Sinnott and Jipu Jiang
National e-Science Centre, University of Glasgow, Glasgow, UK

Sa.SS.4.1.3 **9:56-10:09**
The RAPS Process Model: A framework for the identification and the management of risks against patient safety (RAPS)
Efstathia Kormari[1], Minas Pertselakis[1], Christos Pateritsas[1], Giorgos Siolas[1], Andreas Stafylopatis[1] and Fernando Gumma[2]
[1]*Institute of Communication and Computer Systems, National Technical University of Athens, Greece*
[2]*Aminio AB Stoccolma Lugano Branch, Switzerland*

Sa.SS.4.1.4 10:09-10:22

Automatic Evaluation of the Progress of Bacterial Pulmonary Infections in Temporal Radiographic Image Sequences

Spyros Tsevas[1,2] and Dimitris Iakovidis[2]

[1]*Dept. of Computer Science, University of Geneva, Switzerland*

[2]*Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece*

Sa.SS.4.1.5 10:22-10:35

An Ontology of Image Representations for Medical Image Mining

Dimitris Iakovidis[1], Daniel Schober[2], Martin Boeker[2] and Stefan Schulz[2]

[1]*Deptartment of Informatics and Computer Technology, Technological Educational Institute of Lamia, Lamia, Greece*

[2]*Department of Medical Biometry and Statistics, University of Freiburg, Germany*

Sa.SS.4.1.6 10:35-10:48

Management of uncomplicated urinary tract infections using fuzzy cognitive maps

Elpiniki Papageorgiou[1], Chris Papadimitriou[2] and Stavros Karkanis[1]

[1]*Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece*

[2]*Dept. of Informatics with Applications in Biomedicine, University of Central Greece, Lamia, Greece*

Sa.SS.4.1.7 10:48-11:00

Towards the Construction of Intuitionistic Fuzzy Cognitive Maps for Medical Decision Making

Elpiniki Papageorgiou and Dimitris Iakovidis

Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece

Coffee Break 11:00-11:30

Saturday Morning, Nov. 7

Special Session: **Sa.SS.3.1 1st International Workshop on Computational Methods in Orthopedic Biomechanics and Rehabilitation (COMOR 2009) 2/2**
Time & Place: **09:30-11:00, Venus**
Chairpersons: **George Papaioannou**
"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA

Nikos Pleros
Department of Informatics, Aristotle University of Thessaloniki, Thessaloniki, Greece

Adeeb Rahman
Dep. of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee

Sa.SS.3.2.1 9:30-9:50
Development of a new Bed System with Improved Decubitus Prophylaxis for Bed-Ridden Patients
Goeran Fiedler[1], George Papaioannou[1], Christos Mitrogiannis[1], George Nianios[1] and Theodoros Kyprianou[2]
[1]*"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA*
[2]*Nicosia General Hospital, Cyprus*

Sa.SS.3.2.2 9:50-10:10
Accuracy assessment of a photoimaging and scanner-based wound diagnostics method
George Nianios, Christos Mitrogiannis, Vasiliki Baradaki and George Papaioannou
"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA

Sa.SS.3.2.3 10:10-10:20
CT-Scan based FEA for the Assessment of the Effect of Bone Density on Femur's Fracture
Adeeb Rahman[1], Shirin Selmi[1], Chris Papadopoulos[1] and George Papaioannou[2]
[1]*Dep. of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee, WI, USA*
[2]*"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA*

Sa.SS.3.2.4 10:20-10:40
Validation of 3D Radiographical Image Distortion Correction and Calibration Algorithms
Christos Mitrogiannis, Goeran Fiedler, Chris Papadopoulos, George Nianios and George Papaioannou
Dep. of Civil Engineering and Applied Sciences, University of Wisconsin, Milwaukee, USA

Coffee Break 11:00-11:30

Saturday Morning, Nov. 7

Special Session: **Sa.SS.5.1 1st International Workshop on Multi-type Content Repurposing and Sharing in Medical Education**
Organised in the context of the EU FP7 eContentplus Programme Best Practice Network: Multi-type Content Repurposing and Sharing in Medical Education
Time & Place: **09:30-11:00, Minerva**
Chairpersons: **Panagiotis D. Bamidis,**
Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece

Eleni Kaldoudi
Medical School, Democritus University of Thrace, Alexandroupoli, Greece

Sa.SS.5.1.1 9:30-9:45
The Challenge of Standards for Cognitive Styles Adaptable Biomedicine Learning Object
Barry Eaglestone, Peter Holdridge, Nigel Ford
University of Sheffield, UK

Sa.SS.5.1.2 9:45-10:00
Re-use and exchange of an OpenSim platform based learning environment among different medical specialties for clinical scenarios
Eleni Dafli, Kostas Vegoudakis and Panagiotis Bamidis
Lab of Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Thessaloniki, Greece

Sa.SS.5.1.3 10:00-10:15
Graphics Cluster Based Visualization of 3D Medical Objects in Lesson Context
Dorian Gorgan, Adam Bartha, Andrei Truță and Teodor Ştefănuț
Technical University of Cluj-Napoca, Cluj-Napoca, Romania

Sa.SS.5.1.4 10:15-10:30
Depicting Educational Content Re-purposing Context and Inheritance
Nikolas Dovrolis[1], Stathis Konstantinidis[2], Panagiotis Bamidis[2] and Eleni Kaldoudi[3]
[1]*School of Medicine, Democritus University of Thrace, Greece*
[2]*Medical Informatics Laboratory, School of Medicine, Aristotle University of Thessaloniki, Greece*
[3]*Medical Physics Laboratory, School of Medicine, Democritus University of Thrace, Greece*

Sa.SS.5.1.5 10:30-10:45
Feeding back learning resources repurposing patterns into the "information loop": opportunities and challenges
D. Giordano, A. Faro, F. Maiorana, C. Pino, C. Spampinato
University of Catania, Dipartimento di Ingegneria Informatica e Telecomunicazioni, Catania, Italy

Sa.SS.5.1.6 10:45-11:00

From Taxonomies to Folksonomies: a roadmap from formal to informal modeling of medical concepts and objects

Panagiotis D. Bamidis[1], Eleni Kaldoudi[2], Costas Pattichis[3]

[1]*Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece*

[2]*Medical School, Democritus University of Thrace, Alexandroupoli, Greece*

[3]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*

Coffee Break 11:00-11:30

Abstracts

Thursday Morning, Nov. 5

Session: **Keynote Th.1**

Time & Place: **8:15-9:00, Les Etoiles**

Chairperson: **D. I. Fotiadis**
University of Ioannina, Greece

8:15
Cardiovascular Health Informatics: Sensing and Imaging Plagues in Arteries

Yuan-Ting Zhang

Head of the Division of Biomedical, Engineering at the Chinese University of Hong Kong, Director of the Key Lab for Biomedical Informatics and Health Engineering of the Chinese Academy of Sciences, Hong Kong

Abstract - This keynote will address a spectrum of health informatics topics, ranging from physiological and biomedical information acquisition processing, to transmission and data fusion for the non-invasive monitoring of cardiovascular diseases. It will closely examine important issues on the topic of body sensor networks with applications, and will define the concepts of the Cardiovascular Health Informatics (CHI) area. Topics will include core technologies highlighting wearable medical device design as well as the importance of standards for achieving optimized system performance.

Thursday Morning, Nov. 5

Session Th.1.1: **eHealth I: Telemedicine Systems**

Time & Place: **9:00-10:30, Les Etoiles**

Chairperson: **Toshiyo Tamura**
Department of Biomedical Engineering, Graduate School of Engineering, Chiba University, Chiba, Japan

Th.1.1.1 **9:00-9:15**
Optimizing Resource Management in Emergency Management & Response

Panos Constantinides[1], Michael Barrett[Error! Bookmark not defined.2] and Angelina Kouroubali[Error! Bookmark not defined.3]

[1]*Frederick University, Nicosia, Cyprus*
[2]*Cambridge University, Cambridge, UK*
[3]*Institute of Computer Science at the Foundation for Research Technology Hellas (ICS-FORTH), Crete GR*

Abstract—Dealing with life threatening situations demands efficiency and effectiveness of operations including optimizing the emergency response time, and utilizing resources and personnel as best appropriate for each incident. In this paper, we look at the efforts of the regional Emergency Medical Department (EMD) of Crete to introduce new technologies for optimizing emergency response, including the computerization of triage protocols and telemedicine.

Th.1.1.2 **9:15-9:30**
Question Answering for Biology and Medicine

Julien Gobeill[1], Emilie Pasche[2], Douglas Teodoro[2], Christian Lovis[3], Anne-Lise Veuthey[4], and Patrick Ruch[1]

[1]*BiTeM group at the University of Applied Sciences, Information Studies Department, Geneva, Switzerland*
[2]*BiTeM group at the University and Hospitals of Geneva, Geneva, Switzerland*
[3]*University and Hospitals of Geneva, Geneva, Switzerland*
[4]*Swiss Institute of Bioinformatics, Geneva, Switzerland*

Abstract— Biomedical professionals have at their disposal a huge amount of data, such as literature, i.e. textual contents, or databases, i.e. structured contents. But when they have a question, they often have to deal with too many documents in order to efficiently find the appropriate answer in a reasonable time. We have developed a Question Answering system which aims to analyze the user's question, to retrieve the most relevant documents from MEDLINE, and to extract from these retrieved documents a list of candidate answers, ranked

by confidence. These candidate answers are concepts issued from biomedical controlled vocabularies, such as the Medical Subject Headings (MeSH) for a first step, and are extracted from the most relevant documents with pattern matching strategies. For evaluation purposes, we apply the system on two biological databases, UniProt and DrugBank. From these resources, we generated two large benchmarks of 200 questions dealing respectively with diseases and proteins, and with diseases and drugs. For these 2 sets, the first candidate answer proposed by our system is respectively correct in 57% and in 68%, while respectively 70% and 75% of all answers to find are contained in the ten first proposed candidate answers. Despite the use of simple Information Extraction strategies, our system exploits the redundancy of information in literature in order to provide a powerful Question Answering system.

Th.1.1.3 **9:30-9:45**

Evaluation of e-learning teaching activities in Mediterranean countries

Claudia Brancaleone[1], Riccardo Tranfaglia[1], Mario Sansone[1], Luciano Mirarchi[2] and Marcello Bracale[1]

[1]*Department of Biomedical, Electronic and Telecommunication Engineering, University Federico II, Naples, Italy*
[2]*Service Marketing, Siemens Medical Solution S.p.a., Milano, Italy*

Abstract— In the IntraMEDnet project, financially supported by European Union in the program of Interreg III B Archimed, scientists, from different Institutions of Mediterranean Area (Greece, Cyprus and Italy), cooperated for developing related educational modules, which have been combined dynamically in a virtual classroom on the web, in order to create integrated educational units. The aim of this paper is to illustrate the methodology utilized in the development of this project and the validation and evaluation by the users. In order to identify educational needs and excellencies among the partners of the consortium, general thematic areas of common interest were identified and for each of them the partners developed learning objects, that have been taught in general curricula of involved institutions, for Medicine and Biomedical Engineering students. Moreover, such learning objects can be shaped to support self-directed (or expert instructed) problem-based learning, enhancing patient-oriented approach to medical education. The project also considered the improvement of this virtual connections between Universities, Hospitals and Research Centers of Mediterranean Area to grow into an integrated environment for sharing the learning process and to support research collaborations. A web questionnaire has been developed in order to evaluate by the users the e-learning platform and the learning objects, produced in the project. The data have been analyzed to assess technical aspects and the satisfactions of the users. The results of this study suggest a major utilization of this new methodology of education, in the classical curricula in Faculties of Medicine and Engineering, also for sharing experiences between geographically separated countries and Institutions.

Th.1.1.4 **9:45-10:00**

Comparative Computational Methods for Identification of Inherent or Acquired Mechanisms of Resistance to Prednisolone in Acute Lymphoblastic Leukemia Cells

George Lambrou[1], E.G. Sifakis[2], Andriana Prentza[3], Aristotelis Chatziioannou[4], Dimitris Koutsouris[2], Eleftheria Koultouki[1] and Fotini Tzortzatou-Stathopoulou[1]

[1]*Hematology/Oncology Unit, University of Athens, "Aghia Sophia" Children's Hospital, Athens, Greece*
[2]*Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece*
[3]*Department of Digital Systems, University of Piraeus, Piraeus Greece*
[4]*Institute of Biological Research & Biotechnology, National Hellenic Research Foundation, Athens, Greece*

Abstract— It has been shown previously that glucocorticoids exert a dual mechanism of action, meaning cytotoxic and mitogenic as well as mitogenic and anti-apoptotic, in a dosedependent manner on CCRF-CEM cells at 72h. Early gene expression response suggested also a dose-dependent dual mechanism of action of prednisolone which is apparently reflected on cell state upon 72 h of treatment. The present work applies different computational methods on microarray data in order to examine the hypothesis whether these cells have an intrinsic or acquired mechanism of resistance. Early onset gene expression at 4h was compared to 72h gene expression. Early gene expression allowed identification of genes initiating pivotal, early onset regulatory mechanisms activated by prednisolone. Late, 72h exposure, microarray analysis allowed the relative identification of feedback mechanisms. From these results, it appears that CCRF-CEM cells used in this study exhibited a combined pattern of intrinsic and acquired resistance to prednisolone.

Th.1.1.5 **10:00-10:15**

Realtime Physiological Condition and Location Monitoring of Street Orienteering Participants

Ibrahim Khalil, Mahathir Almashor and Fahim Sufi

RMIT University, Melbourne, Australia

Abstract—To make street orienteering sports attractive and interesting to global online viewers it is important to build a system that is capable of tracking mobile competitor positions in real-time using Global Positiioning systems (GPS) and wireless networking to collect information at a central server to be dislayed to the viewers. Another important aspect of such a realtime system is the ablity to monitor physiological condition of the participants. Existing systems used in orienteering sports events are unable to facilitate these features. They mostly perform offline analysis of navigation mistakes, race planning decisions and tactics only after the course is finieshed and digital contents of the RFID device are loaded into a PC. Therefore, in this paper, we describe the architecture and implementation of a realtime physiological condition and location monitoring system for street orienteering participants. This will allow spectators to view progress of participants and monitor changes in physiological conditions such as heart rates, blood oxygen level etc. from publicly viewable web.

Th.1.1.6 **10:15-10:30**

Is the home health care monitoring effective?

Toshiyo Tamura[1], Isao Mizukura[1], Haruyuki Tatsumi[2] and Yutaka Kimura[3]

[1]*Department of Biomedical Engineering, Graduate School of Engineering, Chiba University, Chiba, Japan*
[2]*Department of Biological Structure & Signal Transduction, Sapporo Medical University, Sapporo, Japan*
[3]*Health Science Center, Kansai Medical University, Osaka, Japan*

Abstract—The monitoring blood pressure at home is an important part of managing hypertension. We have developed a home healthcare system to monitor blood pressure. Our system has operated for about 1 year. In this study, we focused on blood pressure monitoring and discussed the motivation of subjects, and the importance of monitoring. We tested two different locations: one was a non-interventional location in Sapporo; the other was an interventional location in Osaka. Sixty-one out of 144 and 34 out of 61 subjects performed more than 100 measurements per year in Sapporo and Osaka, respectively. The results showed that the data obtained from subjects who monitored more than 100 times, twice a day, during the year are reproducible and reliable. Home blood pressure monitoring may be a good predictor of cerebrovascular and cardiovascular disease. However, the successful monitoring depended on the motivation and improvement of health condition of subjects.

Thursday Morning, Nov. 5

Session: **Th.2.1 Medical Imaging I: Visualization**

Time & Place: **9:00-10:30, Venus**

Chairperson: **Ioannis Seimenis**
Medical Diagnostic Center "Ayios Therissos", Cyprus

Th.2.1.1 **09:00-09:15**
Quantitative Analysis of Brain White Matter Lesions in Multiple Sclerosis Subjects

Christos Loizou[1], Constantinos Pattichis[2], Ioannis Seimenis[3] and Marios Pantziaris[4]

[1]*Department of Computer Science, Intercollege, Limassol, Cyprus*
[2]*Department of Computer Science, University of Cyprus, Cyprus*
[3]*Medical Diagnostic Center "Ayios Therissos", Cyprus*
[4]*Cyprus Institute of Neurology and Genetics, Cyprus*

Abstract- In this study the value of magnetic resonance image (MRI) shape and texture analysis was assessed in multiple sclerosis (MS) subjects, both in differentiating between normal or normal appearing and abnormal tissue and in assessing disease onset. Shape and texture analysis was carried out in normal appearing white matter and lesions detected in transverse sections of T2-weighted magnetic resonance (MR) images acquired from 22 symptomatic untreated subjects. All detected brain lesions were manually segmented by an experienced MS neurologist and confirmed by a radiologist. The results showed that there was no significant difference for most of the shape features and for all of the texture features between MS lesions at 0 and 6-12 months. For some texture features there was significant difference between normal or normal appearing tissue and MS lesions at 0 and 6-12 months. Further research with more subjects is required for computing shape and texture features that may provide information for better and earlier differentiation between normal tissue and MS lesions.

Th.2.1.2 **09:15-09:30**
Visualizing the 3D Structure of Medical Objects Based on 2D Data

Andreas Lanitis[1] and Georgios Stylianou[2]

[1]*Dept. of Multimedia and Graphic Arts, Cyprus University of Technology, Cyprus*
[2]*Dept. of Computer Science, European University Cyprus, Cyprus*

Abstract-3D imaging allows the detailed visualization of medical structures that can be very important in the process of treating patients. In this paper we describe a method for generating 3D models representing medical structures, using data derived from a single image showing a frontal view of an object. The proposed method utilizes a 3D deformable model that is allowed to deform in order to approximate the shape of a medical structure as

seen in the frontal view, allowing in this way the estimation of the complete 3D structure of the object. Experimental results using synthetic data prove the potential of this approach in generating 3D pelvis models.

Th.2.1.3 **09:30-09:45**

Human Anatomy Visualization and Navigation System for Image-Guided Surgery Quantitative

Lucio Tommaso De Paolis[1], Marco Pulimeno[2], Luca Ramundo[3] and Giovanni Aloisio[1]

[1]*Dept. of Innovation Engineering, Salento University, Lecce, Italy*
[2]*Marco Pulimeno is with the ISUFI, Salento University, Lecce, Italy*
[3]*Engineering Faculty, Salento University, Lecce, Italy*

Abstract-Minimally invasive surgery offers advantages that make it the best choice for many diseases. Modern technologies provide a great deal of support for this kind of surgical procedure, through medical image processing and visualization, 3D organ reconstruction and intra-operative surgical guidance. In this paper an advanced visualization and navigation system is presented where the surgeon is able to visualize the traditional patient information, such as the TC image set, together with a 3D model of the patient's anatomy built from this. Two different visualization modalities are available in real time and dynamically. Depending on the surgeon's needs, it is possible to obtain the automatic re-slicing of the orthogonal planes - in order to have an accurate visualization of the 3D model and slices exactly next to the actual position of the surgical instrument tip. In addition, the clipping modality can be activated, whereby the 3D model is cut in correspondence with a chosen visualization plane. This system can be used as support for the diagnosis, for surgical preoperative planning and also for image-guided surgery.

Th.2.1.4 **09:45-10:00**

Evaluation of synchronicity in heart motion by elucidating intersection index from successive echocardiograms

Kohji Masuda, Rui Takahashi, Takashi Yoshinaga and Shun Uchibori

Graduate School of Bio-Applications and Systems Engineering, Tokyo University of Agriculture and Technology, Koganei, Tokyo, Japan

Abstract-Considering the short-axis view of heart, a normal ventricular wall expands and contracts concentrically on echogram. To evaluate motion of heart, the tissue Doppler imaging (TDI) technique is available. However, it is not suitable for comprehensive evaluation of motion function because of anisotropy in motion direction. Therefore, we have developed software to recognize the synchronous motion of heart between the instantaneous velocities of ventricular wall. We calculated the intersection index and its trajectory of the gravity point during a heartbeat in 20 normal subjects and more than 100 heart disease patients. In the normal hearts the gravity points concentrate in a small region. The fluctuation of the gravity point in the heart disease patients is easily distinguished from the normal subjects.

Th.2.1.5 **10:00-10:15**

The mathematical path to develop a heterogeneous, anisotropic and 3-dimensional glioma model using finite differences

Alexandros Roniotis[2], Kostas Marias[1], Vangelis Sakkalis[1], Michalis Zervakis[2] and Ioannis Karatzanis[1]

[1]*Inst. of Computer Science, Foundation for Research and Technology (FORTH), Heraklion, Greece*
[2]*Dept. of Electronic & Computer Engineering, Technical University of Crete, Chania, Greece*

Abstract-Glioma is the most aggressive type of brain cancer. Several mathematical models have been developed to express tumor growth behavior. The most successful models have used the diffusion-reaction equation, with the most recent ones taking into account spatial heterogeneity and anisotropy. However, to the best of our knowledge, there hasn't been any work studying in detail the mathematical solution and implementation of the 3D diffusion model, addressing all related heterogeneity and anisotropy issues. This paper presents a complete mathematical framework on how to derive the solution of the equation using different numerical schemes of finite differences. Moreover, the derived mathematics can be customized to incorporate various cell proliferation schemes. Lastly, a comparative study of the numerical scheme helps us select the best of them and then apply it to real clinical data.

Th.2.1.6

10:15-10:30

Quantitative Examination of Soft Tissue Ultrasound Elastograms

Malgorzata Przytulska and Juliusz Kulikowski

IBBE PAS, Warsaw, Poland

Abstract- There are presented methods of computer-aided statistical analysis of ultrasound elastograms. It is described an approach consisting in initial segmentation of elastograms visualizing low-elasticity segments distribution in the tissue of an examined biological organ and in statistical analysis of this distribution. It was observed a good correlation between the values of some statistics and medical specialists' description of the elastograms. The ways of continuation of works aimed at improvement of the elastograms-based diagnosic methods are suggested.

Thursday Morning, Nov. 5

Session Th.3.1: **Biosignals I: Monitoring**

Time & Place: **9:00-10:30, Minerva**

Chairpersons: **C.D Nugent**
Computer Science Research Institute, School of Computing and Mathematics, University of Ulster, N. Ireland

Nikolas Stylianides
Dept. Computer Science, University of Cyprus, Cyprus

Th.3.1.1 **9:00-9:15**
Noninvasive biological sensor system for detection of drunk driving

Shigeyuki Kojima[1], Shinitirou Maeda[1], Yumi Ogura[1], Etsunori Fujita[1], Kohji Murata[2], Tsutomu Kamei[1,3,4], Toshio Tsuji[5], Shigehiko Kaneko[6] and Masao Yoshizumi[7]

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[2]*Shimane Institute of Health Science, Shimane, Japan and Kanazawa University Graduate School of Medical Science, 13-1 Takaramachi, Kanazawa-shi, 920-0934 Ishikawa, Japan*
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[4]*Kanazawa University Graduate School of Medical Science, Ishikawa, Japan*
[5]*Faculty of Engineering, Hiroshima University, Hiroshima, Japan*
[6]*School of Engineering, The University of Tokyo, Tokyo, Japan*
[7]*Hiroshima University Graduate School of Biomedical Sciences, Hiroshima, Japan*

Abstract— Systems capable of monitoring the biological condition of a driver and issuing warnings during instances of drowsiness have recently been studied. Moreover, many researchers have reported that biosignals, such as brain waves, pulsation waves, and heart beat are different between people who have and have not consumed alcohol. Currently, we are developing a noninvasive system to detect individuals driving under the influence of alcohol by measuring biosignals. In this paper, a new algorithm to distinguish between the normal and intoxicated state of a person is proposed as the basic theory of the sensing system.

Th.3.1.2 **9:15-9:30**
Vehicle Driver's ECG and sitting posture monitoring system

Chang-Ming Yang, Chih-Chung Wu, Chun-Mei Chou and Tzu-Lin Yang

Ming Young Biomedical Corp., Jhunan, Miaoli, Taiwan

Abstract— An ECG monitoring system comprised of six wearable textile-based electrodes is used to detect the ECG and sitting posture of vehicle drivers. The electrodes are washable,

comfortable, sewed into ordinary shirt, and not connected with extra wires; as a result, they not only detect drivers' ECG while they move, but also prevent hindering their driving. While drivers change the sitting postures, different electrodes are activated and change the morphology of ECG; this is how drivers' sitting postures are determined. A tri-axes accelerometer is also used to analyze ECG and detect the urban road condition. The monitoring system provides e-health services by transmitting signals to a PDA through Bluetooth. When it is necessary, the PDA is capable to transmit ECG and accelerometer signals to remote monitory center. The safety and health of drivers and pedestrians are the key issues of e-health for urban lives.

Th.3.1.3 **9:30-9:45**

INTREPID, a biosignal-based system for the monitoring of patients with anxiety disorders

Nikolaos S. Katertsidis[1], Christos D. Katsis[2] and Dimitrios I. Fotiadis[3]

[1]*Unit of Medical Technology and Intelligent Information Systems, Dept. of Computer Science, University of Ioannina, Ioannina, Greece*
[2]*Department of Medical Physics, Medical School and the Unit of Medical Technology and Intelligent Information Systems, Dept of Computer Science, University of Ioannina, Ioannina, Greece*
[3]*Department of Materials Science and Engineering, University of Ioannina, Ioannina, Greece*

Th.3.1.4 **9:45-10:00**

Evidence fusion for activity recognition using Dempster-Shafer theory of evidence

Jing Liao, Yaxin Bi and C.D Nugent

Computer Science Research Institute, School of Computing and Mathematics, University of Ulster, N. Ireland

Abstract— This paper explores a sensor fusion method within Smart Homes to be used to monitor human activities in addition to managing uncertainty in sensor based readings. A case study has shown that the Dempster-Shafer theory of evidence can incorporate the uncertainty derived from the sensor errors and the sensor context and infer the activity. The results from this work show that this method can detect a toileting activity within a Smart Home environment with an accuracy of 69.4%.

Th.3.1.5 **10:00-10:15**

Tremor Analysis by Decomposition of Acceleration into Gravity and Inertial Acceleration using Inertial Measurement Unit

Otakar Šprdlík[1,2], Zdeněk Hurák[2], Martina Hoskovcová[3] and Evžen Růžička[3]

[1]*Institute of Information Theory and Automation of the ASCR, Czech Republic*
[2]*Czech Technical University in Prague, Faculty of Electrical Engineering, Dept. of Control Eng., Czech Republic*
[3]*Charles University in Prague, 1st Faculty of Medicine, Dept. of Neurology, Czech Republic*

Abstract— Decomposition of acceleration was investigated as an alternative to commonly used direct spectral analysis of measured acceleration or angular velocity for tremor quantification. Orientation estimation algorithm was devised to decompose the measured acceleration into inertial acceleration caused by sensor movement in inertial reference frame and gravitational artifact. Resulting signals, beside measured acceleration and angular velocity, were used to assess tremor amplitude and frequency by spectral peak detection. The algorithm was tested on experimental data from a clinical study including patients with essential tremor. Influence of sensor calibration and connections of results to analytic approach are analyzed briefly.

Th.3.1.6 **9:45-10:00**

Whole Body Vibration training: analysis and characterization

Antonio Fratini, Antonio La Gatta, Mario Cesarelli and Paolo Bifulco

Department of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy

Abstract— The aim of this work is to contribute to the analysis and characterization of training with whole body vibration (WBV) and the resultant neuromuscular response. WBV aims to mechanically activate muscle by eliciting stretch reflexes. Generally, surface electromyography is utilized to assess muscular response elicited by vibrations. However, EMG analysis could potentially bring to erroneous conclusions if not accurately filtered. Tiny and lightweight MEMS accelerometers were found helpful in monitoring muscle motion. Displacements were estimated integrating twice the acceleration data after gravity and small postural subject adjustments contribution removal. Results showed the relevant presence of motion artifacts on EMG recordings, the high correlation between muscle motion and EMG activity and how resonance frequencies and dumping factors depended on subject and his positioning onto the vibrating platform. Stimulations at the resonant frequency maximize muscles lengthening and in turn, muscle spindle solicitation, which may produce more muscle activation. Local mechanical stimulus characterization (i.e. muscle motion analysis) could be meaningful in discovering proper muscle stimulation and may contribute to suggest appropriate and effective WBV exercise protocols.

Thursday Morning, Nov. 5

Special Session: **Th.SS.1.1 LinkSCEEM Meeting: High Performance Computing Applications in Life Sciences I**

Time & Place: **9:00-10:30, Diana**

Chairperson: **K. Schilling**
The Cyprus Institute, Cyprus

Th.SS.1.1.1 **9:00-09:30**
High performance computing (HPC) in translational research

Arthur Thomas

University College, London, UK

Abstract - Translational research seeks to move basic research results more expeditiously from "bench to bedside," and to allow feedback from clinical results to inform basic research. But many of the problems of translational research require substantial computing, for data analysis (e.g. of genome-wide association studies) or for modelling (e.g. to predict the outcomes of therapeutic interventions). This talk will discuss how HPC can be used to address some of the ever larger-scale computational problems which result from the use of high-throughput technologies to generate large volumes of research data, and to use those data to predict or explain phenotypic changes.

Th.SS.1.1.2 **9:30-10:00**
High Performance Computing in Biomedical Informatics

D. I. Fotiadis

University of Ioannina, Greece

Abstract - The evolution of CPU power with the latest advancements in bioinformatics, including all biological, biomedical and biochemical application domains, requires High Performance Computing methods and techniques. Nowadays, the majority of research efforts and applications in life sciences are delivered after processing huge amount of data produced by whole genome association studies, gene expression analysis, studies of thousands to millions number of proteins inside cells and large-scale computational fluid dynamics simulations in human tissues and organs. The demanding of high performance computing for delivering qualitative results is increasingly required as the availability of "bio-information" is extended daily. Computer clusters, computer grids and high-speed networks provide the hardware layer where the high performance computing is defined along with the generation of parallel/distributed algorithms and methods for the important biomedical application domain.

Th.SS.1.1.3 **10:00-10:30**

Real-Time Finite Element Modeling for High Fidelity Surgical Simulation

George Turkiyyah[1&2]

[1]*American University of Beirut, Lebanon*
[2]*University of Washington, USA*

Abstract - We present a haptic simulator that allows users to interact with a virtual model of a 3D anatomy to practice and rehearse surgical procedures. Multi-handed control allows the user to operate on the model, feel the forces involved in performing the procedure, and see 3D stereoscopic deformations superposed on the stresses induced by the operations. The simulator allows cutting through skin and tissue, undermining skin to separate it from the subcutaneous soft tissue, the addition of sutures to close wounds, and manipulation using multiple surgical instruments.

In order to support haptic interaction with 3D deformable models, an underlying physically-based model is needed that can generate, in real-time, the forces and deformations to be rendered as a result of user interaction. The physical model must support real-time topological modifications including the addition and removal of material, the embedding of new elements in the model, as well as the introduction of cuts in the geometry. We describe and demonstrate a physically-based framework for real-time interaction with 3D models discretized by finite elements and present a formulation that allows for progressive updates to be used in modeling the addition of new elements, dynamic changes in model connectivity, and arbitrary cutting through the model.

Thursday Morning, Nov. 5

Poster Session: **Th.1.2 eHealth II**

Time & Place: **10:45-11:15, Mezzanine**

Chairperson: **Panos Constantinides**
Frederick University, Nicosia, Cyprus

Th.1.2.1 **10:45-11:15**
A holistic environment for the design and execution of self-adaptive clinical pathways

Dimitrios Alexandrou[1], Ioannis Skitsas[2] and Gregoris Mentzas[3]

[1]Information Management Unit of National Technical University of Athens, Greece
[2]Software Engineer of the R&D Department of UBITECH Research Ltd., Athens, Greece
[3]School of Electrical and Computer Engineering of National Technical University of Athens, Greece

Abstract - As scientific achievements in the area of Healthcare have evolved during the last decade, inevitably there has been an increase of treatment quality. One of the challenges to be confronted is the personalization of treatment since each patient constitutes a unique case. The personalization requires the continuous reconfiguration of the treatment schemes since the clinical status of each patient and circumstances inside a healthcare organization constantly change. In this paper we present a holistic software environment that provides an IT solution concerning the real time adaptation of healthcare processes. The software comprises a healthcare process execution engine assisted by a semantic info-structure for reconfiguring the pathways. The semantic info-structure utilizes an ontology enclosing the required knowledge and a semantic rule-set. During the execution of clinical pathways, the system reasons over the rules, the knowledge and information, and reconfigures the next steps of the treatment. The results of the rule-set execution may generate knowledge objects to be inserted in the ontology. A graphical designer is provided for the definition of the rule set for the clinical pathways adaptation.

Th.1.2.2 **10:45-11:15**
Optimization Procedure for the Impact Detection Thresholds in an Accelerometer Smart Sensor

David Naranjo-Hernández[1,2], Laura María Roa-Romero[1,2], Luis Javier Reina-Tosina[2,3] and Miguel Ángel Estudillo-Valderrama[1,2]

[1]Biomedical Engineering Group, University of Seville, Spain
[2]CIBER-BBN, Spain
[3]Dept. of Signal Theory and Communications, University of Seville, Spain

Abstract—The main objective of this work is to perform an optimization methodology of the

temporal parameters and operation thresholds (acceleration and energy) for the impact detection in an Accelerometer Smart Sensor. The procedure is based on a sequential approach to values that improve the sensitivity and the specificity of the impact detection. It was fed in its execution with a set of experiments of different daily activities, with and without impact. The values of the parameters obtained from the optimization were tested with a different set of experiments achieving a 100% success (zero false positives and zero false negatives), confirming the robustness of the procedure.

Th.1.2.3 **10:45-11:15**

C2i: A tool to gather medical indexed information

Laurent Lecornu[1], Clara Le Guillou[2], Gregoire Thillay[1], Pierre-Jean Garreau[2], Helene Jantzem[2] and Jean-Michel Cauvin[3]

[1] *INSTITUT Telecom, Telecom Bretagne UEB; ITI Dpt, Brest, France*
[2] *CHU Brest, Medical Information Departement, Brest, France*
[3]*Inserm, Brest, France*

Abstract— Choosing the appropriate diagnosis codes in a nomenclature is a non-intuitive task for the practitioner. Mistakes are frequent with severe consequences on healthcare evaluation and funding. As in many countries where the coding is accomplished in a decentralized way, most of the French physicians have to assign a code for everything they do and they are not spared with these kinds of errors and the codingexperts at the Medical Information Department supervise the making of the unit discharge abstracts, and their transmission to the HAS (High Authority in Health Care). The proposed system named C2i aims at supporting the medical coding task for the two involved actor types in order to ensure its completeness and to avoid errors without losing time The proposed approach consists in collecting useful and pertinent medical information in accordance with the physician activities and the patient medical context and, thus, in exploiting this data by a generic approach. The C2i platform is at the same time an inference system, a notification system and a tracking system. The C2i inference system gathers and applies the rules dedicated at each information source while the C2i notification system proposes the coding advices of each source independently or in a combined manner. The C2i tracking system conserves all the facts and applied rules as coding warrant for the retained codes by the physician and as an information source for patient further coding. A prototype of the C2i based on relational database is under development and already illustrates the potential of such a system but also the limits of the relational model to manage complex, highly interrelated information.

Th.1.2.4 **10:45-11:15**

Heart Rate Variability in healthy people compared with patients with Congestive Heart Failure

Leandro Pecchia, Paolo Melillo, Mario Sansone and Marcello Bracale

Department of Biomedical, Electronic and Telecommunication Engineering, University of Naples "Federico II", Naples, Italy

Abstract— In this paper we analyze how features of Hearth Rate Variability (HRV) vary in normal subjects, and in patient suffering from Congestive Hearth Failure (CHF), according to pathology severity. We analyzed 1914.4 hours of ECG of 83 patients of which 54 normal and 29 suffering from CHF with NYHA I, II, III, extracted by public databases. Following indication of guidelines, we performed time and frequency analysis in order to measure HRV features. We analyze statistic of these features segmented per NHYA classes. Finally, the correlation matrices for each class are studied. The results we found lead us to conclude that that there are interesting differences between normal subjects and patients suffering from CHF. These differences are related to the severity of the pathology. Finally, we observe that also the correlation matrix change according to the severity of NYHA.

Th.1.2.5 **10:45-11:15**

PERFORM: First steps in the assessment of patient motion status and support to treatment changes

George A Rigas[1], Alexandros T. Tzallas[2], Dina A Baga[2], Themis P Exarchos[2], Christos D Katsis[2], Dimitra A Chaloglou[3], Spiros Th Konitsiotis[4] and Dimitrios I Fotiadis[2]

[1]*Department of Computer Science, University of Ioannina, Greece*
[2]*Unit of Medical Technology and Intelligent Information Systems, Dept. of Material Sciences and Engineering, University of Ioannina, Greece*
[3]*ANCO S.A, Athens, Greece*
[4]*Department of Neurology, Medical School, University of Ioannina, Ioannina, Greece*

Abstract—In the current work, a system for the monitoring, assessment and management of patients with chronic movement disorders such as Parkinson's disease (PD) is presented. The so called PERFORM system consists of the patient and the healthcare center subsystem. PERFORM monitors patient's motion status in daily activities, using a set of light wearable sensors. Based on the analysis of the acquired signals, PERFORM assesses PD symptoms and their severity, integrates patient's demographic, clinical and history data and proposes treatment plans based on advanced data mining algorithms. In this work we present two main modules of PERFORM system, the tremor assessment module and the data miner module.

Th.1.2.6 **10:45-11:15**

Diagnosis of cardiovascular abnormalities from Compressed ECG: A Data Mining based Approach

Ibrahim Khalil

School of CS and IT, University, Melbourne, Australia

Abstract—Usage of compressed Electrocardiography (ECG) for fast and efficient telecardiology application is crucial, as ECG signals are enormously large in size. However, conventional ECG diagnosis algorithms require the compressed ECG to be decompressed before diagnosis can be applied. This added step of decompression before performing diagnosis for every ECG packets introduces unnecessary delays, which is undesirable for cardiovascular patients. In this paper, we first used an attribute selection method that selects only a few features from the compressed ECG. Then we used clustering techniques to create normal and abnormal ECG clusters. 18 different segments (12 normal and 6 abnormal) of compressed ECG were tested with 100 % success on our model. This innovative data mining technique on compressed ECGs, now enables faster identification of cardiac abnormality directly from the compressed ECG, resulting in an efficient telecardiology diagnosis system.

Th.1.2.7 **10:45-11:15**

A user-centered mobile health device to manage life-threatening anaphylactic allergies and provide support in allergic reactions

Luis Hernandez-Munoz and Sandra Woolley

Electronic, Electrical and Computer Engineering Department, University of Birmingham, Edgbaston, UK

Abstract—This paper presents a user-centered mobile health device to help people with life-threatening allergies request emergency services in the case of an anaphylactic attack. The device was designed as a support tool to directly assist anaphylactic people and their carers, as opposed to a medical resource designed for practitioners. It makes use of multimedia technology, for example, with first aid video demonstrations showing how to deliver life-saving adrenaline injections using the injectors typically carried by anaphylactic people. A 3-axis accelerometer mounted on the adrenaline injector sends data via Bluetooth to the Smartphone platform and injections events can be automatically sensed and communicated together with personal information and GPS location. Emergency services can receive an alarm and a web-based application can show a patient record and provide a map of their location. This paper describes the health management and alarm functions of the device and presents usability test results from real anaphylactic users.

Th.1.2.8 **10:45-11:15**
Network Based Clinical Decision Support System

Darius Jegelevicius[1], Algimantas Krisciukaitis[2], Arunas Lukosevicius[1], Vaidotas Marozas[1], Alvydas Paunksnis[2], Valerijus Barzdziukas[2], Martynas Patasius[1], Dovile Buteikiene[2], Alfonsas Vainoras[2] and Liudas Gargasas[2]

[1]*Biomedical Engineering Institute of Kaunas, University of Technology, Lithuania*
[2]*Institute for Biomedical Research of Kaunas, University of Medicine, Lithuania*

Abstract—Developed prototype of network based clinical decision support system consists of database of clinical data and web-based applications for signal and image analysis methods and algorithms. The methods for eye fundus image analysis and ECG P-wave morphology evaluation are the first methods covering two clinical specialties – cardiology and ophthalmology in the system. Network based database and combined analysis of the parameters obtained by means of implemented methods gives a possibility of holistic approach in clinical decision support.

Th.1.2.9 **10:45-11:15**
Robotic Wheelchairs

Giorgos Demetriou
Frederick University Cyprus, Lemesos, Cyprus

Abstract - Robotic wheelchairs are assistive navigation systems for people with limited mobility. A big number of the people with limited mobility find it extremely difficult or impossible to use conventional wheelchairs independently. To improve the mobility of this population, technologies that have been developed for mobile robots are currently being applied to develop “Robotic Wheelchairs” that are able to navigate safely and reliably. These wheelchairs offer the independency and autonomy needed to people with needs. Cost and complexity are the factors that keep robotic wheelchairs from being widely used. This article presents a summary of the technologies of the current state of the art and directions for future research.

Th 1.2.10 **10:45-11:15**
Integrated Web Services Platform for the facilitation of fraud detection in health care e-government services

Anastassios Tagaris[1], George Konnis[1], Xanthi Benetou[1], Thomas Dimakopoulos[2], Kyriakos Kassis[2], Nikolas Athanasiadis[3], Stefan Rueping[4], Henrik Grosskreutz[4] and Dimitris Koutsouris[1]

[1]*Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece*
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[3]*Intrasoft International SA, Brussels, Belgium*
[4]*Fraunhofer IAIS, St. Augustin, Germany*

Abstract—Public healthcare is a basic service provided by governments to citizens which is increasingly coming under pressure as the European population ages and the ratio of working to elderly persons falls. A way to make public spending on healthcare more efficient

is to ensure that the money is spent on legitimate causes. This paper presents the work of the iWebCare project where a flexible, on-line, fraud detection, web services platform was designed and developed. It aims to help those in the Healthcare business, minimize the loss of funds to fraud. The Platform is able to detect erroneous or suspicious records in submitted health care data sets, ensuring homogeneity and consistency and promoting awareness and harmonization of fraud detection practices across health care systems in the EU. Critical objectives included, the development of an ontology of health care data associated with semantic rules, implementation and initial population of an ontology and rules repository, development of a fraud detection engine and implementation of a data mining module. The potential impact of this work can be substantial. More money on healthcare mean better healthcare. Living conditions and the trust of citizens in public healthcare will be improved.

Th 1.2.11 **10:45-11:15**

A Hydrostatic Pressure Approach to Assess Accuracy of Finger Blood Pressure Measurement

Rein Raamat, Kersti Jagomägi, Jaak Talts and Jana Kivastik

Department of Physiology, University of Tartu, Estonia

Abstract—We studied the feasibility of application of consecutive hydrostatic pressure changes to assess accuracy of measurement of finger blood pressure changes in 11 normal volunteers. The results demonstrated that specific physiological responses to hand postural changes were small in healthy subjects and the consecutive hydrostatic pressure changes of controlled magnitude can be applied to assess accuracy of finger blood pressure measurement. As a calibration checking tool the proposed method may be helpful for cardiovascular diagnostics.

Th 1.2.12 **10:45-11:15**

Patient specific computer automated dosimetry calculations during therapy with 111In Octreotide

Ioannis Vamvakas, Nefeli Logopati, Maria Andreou, Marios Sotiropoulos, Athanasios Gatzis, George Limouris, Christos Antypas, Maria Lyra

Department of Medical Physics, Aretaieion Hospital, University of Athens, Athens, Greece

Abstract— The aim of this study was to calculate the absorbed dose of 22 patients that were diagnosed for neuroendocrine tumours in liver and had received therapeutic dose of 111In octreotide. In-111 Octreotide infusion, via intrahepatic catheterization is well established technique in our Institution in hepatocellular carcinoma and neuroendocrine tumours treatments. The patient specific dosimetry calculations, for this way of treatment, were based on anterior and posterior scintigraphy images that were acquired immediately after radiopharmaceutical infusion, through hepatic arterial port and at 24 and 48 hours post-infusion. Gamma – camera was calibrated in order to estimate source organ activity considering count rate, patient's body diameter and source organ size. The results showed that the tumour absorbed dose ranged from 2.5 to 18.4 mGy/ MBq, depending on the lesion size. Patient specific dosimetry calculations helps the physician to optimize the planning of

the treatment, avoid side effects to healthy tissue and assign administered dose to treatment results.

Thursday Morning, Nov. 5

Poster Session: **Th.2.2 Medical Imaging II**

Time & Place: **10:45-11:15, Mezzanine**

Chairperson: **Christos Loizou**
Department of Computer Science, Intercollege, Limassol, Cyprus

Th.2.2.1 **10:45-11:15**
On Enhancing Cardiac Pulse Measurements Through Thermal Imaging

Thirimachos Bourlai[1], Pradeep Buddharaju[1], Ioannis Pavlidis[1] and Barbara Bass[2]

[1]*University of Houston, Houston, TX, U.S.A.*
[2]*Methodist Hospital (Department of Surgery), Houston, TX, U.S.A.*

Abstract-This paper presents methodological advances on pulse measurement through thermal imaging of the face - a modality that recovers thermo-physiological function. Two previous methods that capitalized on heat transfer effects along and across the vessel during pulse propagation, have been brought together in a fusion scheme. In addition, the quality of the extracted physiological signals has improved thanks to sophisticated tracking and noise reduction algorithms. Finally, parameter optimization has fine-tuned harmonic analysis of the signals, thus, strengthening the measurement accuracy. Comparative experiments that were conducted on a data-set of 12 subjects, highlighted the virtues of the new methodology versus the legacy ones. Specifically, the new method reduced the instantaneous measurement error from 10.5% to 7.8%, while it improved mean accuracy from 88.6% to 95.3%. This advancement brings clinical applications of the technology within sight.

Th.2.2.2 **10:45-11:15**
Brain MR Image Normalization in Texture Analysis of Multiple Sclerosis

Christos Loizou[1], Marios Pantzaris[2], Ioannis Seimenis[3] and Constantinos Pattichis[4]

[1]*Department of Computer Science, School of Sciences, Intercollege, Cyprus*
[2]*Cyprus Institute of Neurology and Genetics, Cyprus*
[3]*Medical Diagnostic Center "Ayios Therissos", Cyprus*
[4]*Department of Computer Science, University of Cyprus, Cyprus*

Abstract- A problem that occurs in texture analysis and quantitative analysis of magnetic resonance imaging (MRI), is that the extracted results are not comparable between consecutive or repeated scans or, within the same scan, between different anatomic regions. The reason is that there are intra-scan and inter-scan image intensity variations due to the MRI instrumentation. Therefore, image intensity normalization methods should be applied to magnetic resonance (MR) images prior to further image analysis. The objective of

this work was to investigate six different MRI intensity normalization methods and propose the most appropriate for the pre-processing of brain T2-weighted MR images acquired from 22 symptomatic untreated multiple sclerosis (MS) subjects and 10 healthy volunteers. Following image normalization, texture analysis was carried out in original and normalized images for normal appearing white matter (NAMW) and MS lesions, detected in transverse T2-weighted MR images. The best normalization method (Histogram Normalization (HN)) demonstrated a smaller Kullback Leibler divergence (0.05, 0.06) suggesting appropriateness for pre-processing MR images used in texture analysis of MS brain lesions. This is a prerequisite step in the assessment of texture features as surrogate markers of disease progression.

Th.2.2.3 **10:45-11:15**

Texture based evaluation of Osseo integration of oral implants in dental panoramic radiography

Ioannis Georgakopoulos[1], Stauros Tsantis[2], Panayiotis Korfiatis[2], Lena Costaridou[2], Theodoris Petsas[1] and George Panayiotakis[2]

[1]*Department of Radiology, School of Medicine, University of Patras, Greece*
[2]*Department of Medical Physics, School of Medicine, University of Patras, Greece*

Abstract-In this study texture differentiation associated to bone regeneration properties, around loaded oral implants immersed to Platelets Rich Plasma (PRP), was investigated in panoramic radiographs. The bone-to-implant contact region was analyzed in a follow up clinical sample of 30 digitized panoramic radiographs, 15 corresponding to implant loading (Class I) and 15 after an 8 month period (Class II). This region was sampled by circular Regions of Interest (ROIs) resulting from a specifically designed segmentation stage resulting in 518 ROIs (254 Class I and 264 class II). From each ROI, 42 textural features were extracted, and subjected to statistical analysis in order to evaluate osseo integration of oral implants. A subset of 6 features, selected with stepwise discriminant analysis method, achieved Area Under Curve (AUC) values greater than 0.73, indicating that these features are capable of capturing temporal textural differentiation attributed bone regeneration properties in the bone-to-implant contact region.

Th.2.2.4 **10:45-11:15**

Image Segmentation of the Acetowhite region in Cervix Images Based on Chromaticity

Jun Xiong, Lei Wang and Jia Gu

Institute of Biomedical and Health Engineering, Shenzhen Institute of Advanced Technology Chinese Academy of Sciences, Shenzhe, 518055, China.

Abstract – The authors proposed a novel approach for the acetowhite region segmentation in order to improve the segmentation accuracy. The proposed algorithm took two steps to finish the segmentation work, the first step: applied the watershed algorithm to finish the coarse segmentation and locate the acetowhite region, the second step: adjusted the acetowhite region boundary to plot precise acetowhite region. 163 uterine neck images were selected from a database to verify the segmenting algorithm. To some extend, 97% of the segmentation results were identical with the segmentation results that were marked by radiologist.

Thursday Morning, Nov. 5

Poster Session: **Th.3.2 Biosignals II**

Time & Place: **10:45-11:15, Mezzanine**

Chairperson: **Panagiotis D. Bamidis**
Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece

Th.3.2.1 **10:45-11:15**
Multiclassifiers with Competence Function Applied to the Recognition of EMG Signals for the Control of Bio-Prosthetic Hand

Marek Kurzynski, Tomasz Woloszynski and Andrzej Wolczowski

Wroclaw University of Technology, Department of Systems and Computer Networks, Wroclaw, Poland

Abstract— The paper presents a concept of bio-prosthesis control via recognition of user intent on the basis of myopotentials acquired of his body. We assume that in the control process each prosthesis operation consists of specific sequence of elementary actions. The multiclassifier systems with fusion/selection strategy based on competence function are applied to the recognition of patient's intent. Experimental investigations of the proposed multiclassifiers for real data are performed and results are discussed. Classification results obtained for three simple fusion methods and one multiclassifier system are used for a comparison.

Th.3.2.2 **10:45-11:15**
Identifying Fine Movement Difficulties in Parkinson's Disease Using a Computer Assessment Tool

Laura Cunningham[1], Chris Nugent[1], George Moore[1], Dewar Finlay[2] and David Craig[2]

[1]*Computer Science Research Institute and School of Computing and Mathematics, Faculty of Computing and Engineering, University of Ulster, Northern Ireland*
[2]*Belfast City Hospital/Queen's University, Belfast, Northern Ireland*

Abstract— As a neurodegenerative disease which effects movement, Parkinson's disease can present features such as rigidity, lack of hand and finger control and difficulty initiating movement (bradykinesia), to name but a few. A computer-based assessment tool has been created and an evaluation carried out by 10 participants with Parkinson's disease and a control group of 10 participants without the disease. This assessment tool collects data on the user's mouse movements by asking them to click targets on screen, to allow for identification of certain features of Parkinson's disease. Results showed that the level of

hand control and finger dexterity was considerably less in the participants with the disease compared to those without. Only 1 participant in the control group had any accidental clicks compared to 7 in the Parkinson's disease group. The anticipated use of this tool is to complement the established methods of assessment and to enable the assessment process itself to become less subjective.

Th.3.2.3 **10:45-11:15**

A Simple Algorithm to Monitor HR for Real Time Treatment Applications

Konstantinos Banitsas[1], Panagiotis Pelegris[1], Tuvi Orbach[2], Dionysis Cavouras[2], Spiros Kostopoulos[2] and Konstantinos Sidiropoulos[1]

[1]*Electrical and Computer Engineering Department, Brunel University, West London, Uxbridge, Middlesex, UK*
[2]*Department of Medical Instruments Technology, Technological Educational Institute of Athens, Greece*

Abstract— As the demand for effective and reliable telecare systems increases rapidly over the last years, novel ideas applied on existing consumer products enables the development of innovative solutions that could enhance the user's wellbeing. In this research, we are going to demonstrate the potential of a system that enables users to monitor their own heart beat rate in real time and use specialised software for personal health coaching. In this paper we will explain and demonstrate how to extract heart beat rate information from a user using the camera of a commercially available mobile phone which will enable us to supply the users of the system with vital information and utilize interactive tools useful for personal health coaching. Our industrial partner Health Smart Limited have filed a patent [1] for this application, they retain the full intellectual property of this project.

Th.3.2.4 **10:45-11:15**

ECG - precordial leads reconstruction

Michal Prauzek, Marek Penhaker, Ivan Bernabucci and Silvia Conforto

Abstract— The paper describes possibilities of simplifying the measurement set-up for ECG recordings, by reducing the number of leads. The study proposes a technique to reconstruct ECG leads by neural networks. The results are encouraging and show how it is possible to reconstruct ECG leads.

Th.3.2.5 **10:45-11:15**
Textile-based Monitoring System for Biker

Chang-Ming Yang, Chih-Chung Wu, Chun-Mei Chou and Ching-Wen Yang

Ming Young Biomedical Corp., Jhunan, Miaoli, Taiwan

Abstract— A wearable monitoring system for biker is presented, with textile-based clip type tension sensors on belt and pants to detect biker's breath and steps, respectively, and an accelerometer, together with clip type sensors to detect falling down and other biking conditions. The clip type sensors are fully made of textile, so they are washable, durable, low cost, easily installed on ordinary clothing, and comfortable. The clip sensors and the accelerometer are able to output signals to a microcontroller to derive breath rate, step counts, posture, and flatness of road. The microcontroller will then transmit the information through Bluetooth interface to a PDA for further analyzing and send messages through mobile telephone when necessary. The system provides information about biker's physical condition, movement of bicycle, and road condition, which are important for both health and safety of modern citizen.

Th.3.2.6 **10:45-11:15**
Partitioning Time Series Sensor Data for Activity Recognition

Xin Hong and Chris Nugent

School of Computing and Mathematics and Computer Science Research Institute, University of Ulster, Northern Ireland

Abstract— Monitoring activities of daily living is one of the key functionalities expected from a Smart Living environment providing independent living services for elderly people. Simple state-change sensors have been considered to be a promising sensing technique to observe the environment and consequently provide the data required to form the basis to infer high-level behaviours. From a data analysis point of view, the challenge is how to recognise and detect activity behaviours from low level sensor data over time. In this paper we present a novel approach to partition sensor data and identify the activity undertaken within each sensor data segment. The approach developed was tested on a dataset collected from a single person living in an apartment during a period of 28 days. The results show that our approach can not only accurately recognise annotated activities but also has the ability to identify nonrecorded activities.

Th.3.2.7 **10:45-11:15**
Control of Dexterous Hand – algorithm implementation issues

Jacek Góra[1,2], Przemysław M. Szecówka[3] and Andrzej R. Wołczowski[2]

[1]*Nokia Siemens Networks, RTP Wrocław, Poland*
[2]*Faculty of Electronics, Wrocław University of Technology, Wrocław, Poland*
[3]*Faculty of Microsystems Electronics and Photonics, Wrocław University of Technology, Wrocław, Poland*

Abstract—This paper relates to the research on a dexterous hand prosthesis conducted at the Wroclaw University of Technology. The possibility of aiding the prosthesis control system by utilization of application specific digital circuits is presented. Several exemplary designs, prepared during some of to-date works conducted by authors, have been presented. Discussed solutions are part of a bigger project that is still ongoing and are still being developed.

Th.3.2.8 **10:45-11:15**

Classification of 3T MRS spectra using Support Vector Machines

Ioannis Dimou[1], Ioannis Tsougos[2], Evangelia Tsolaki[2], Kiki Theodorou[2] and Michalis Zervakis[1]

[1]*Technical University of Crete, ECE Dept., Chania, Greece*
[2]*University of Thessaly Medical School, Medical Physics Department, Larissa, Greece*

Abstract— Recent advances in the power and resolution capabilities of MR scanners have extended the reach of Magnetic Resonance Spectroscopy as a powerful non-invasive diagnostic tool. Coupled with MRI techniques it can provide accurate identification and quantification of biologically important compounds in soft tissue. In practice sensor calibration issues, magnetic field homogeneity effects and measurement noise induce distortion into the obtained spectra. Therefore a combination of robust preprocessing models and nonlinear pattern analysis algorithms is needed in order to evaluate and map the underlying relations of the measured metabolites'. In this work we evaluate a set of support vector machine classifiers in the task of brain tumor classification. We aim at providing the human expert with easily interpretable probabilistic metrics to assist in the time, volume and accuracy demanding diagnostic process.

Th.3.2.9 **10:45-11:15**

BioSigBrowser, biosignal processing interface

Juan Bolea[1], Rute Almeida[1], Pablo Laguna[2], Leif Sörnmo[3] and Juan Pablo Martínez[2]

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[2]*Instituto de Investigación en Ingeniería de Aragón (I3A), Departamento de ingeniería electrónica y comunicaciones, Universidad de Zaragoza and with Centro de Investigación Biomédica en Red (CIBER-BBN), Spain*
[3]*Signal Processing Group Dept. of Electrical and Information Technology Lund University, Lund, Sweden*

Abstract— This paper presents a user-friendly interface in Matlab®, called BioSigBrowser, that aims to facilitate the use of algorithms in biomedical signal processing. It includes methods related with cardiovascular signal processing, namely some multimodal analysis. This platform can treat a single signal or work in a batch mode on a given database as is usual in research. Furthermore, its modular characteristic allows easy incorporation of new methods.

Th.3.2.10 **10:45-11:15**

A comparison of text reading speed using square and rectangular arrays for visual prosthesis

Min Hye Chang[1], Hyun Seok Kim[1], Jae Hyuk Shin[1] and Kwang Suk Park[2]

[1]*Interdisciplinary Program of Bioengineering, Graduate School, Seoul National University, Republic of Korea*
[2]*Department of Biomedical Engineering, College of Medicine, Seoul National University, Republic of Korea*

Abstract— With the increase of the number of the blind, demand for visual prosthesis is increasing. Text reading is one of the most important visual functions to the blind. Therefore human trials and simulations of prosthetic vision have already been carried out for testing an improved system or studying rehabilitation of people who implant prosthesis. But although forms of electrode arrays used in those studies were various, differences between performances of them were not considered for the text reading. Therefore we tested reading performances among three different array shapes (square (32°—32), vertical(42°—22) and horizontal(22°—42) shape array) by blind simulation experiment with head mount display device. As a result, horizontal array showed the best performance when window length for horizontal array was 3. However, when the window width for horizontal array increased to 3.5, performances between horizontal array and square array were similar. In the experiment of lower resolution (8°—8) and window width, square array showed the best performance than other arrays.

Th.3.2.11 **10:45-11:15**

Portable Virtual Vestibular Stimulation

Jonathan Synnott[1], Paul McCullagh[1], Greg Kelly[2], Gerry McAllister[1] and Glen Houston[3]

[1]*School of Computing and Mathematics, University of Ulster, Northern Ireland*
[2]*School of Health Sciences, University of Ulster, Northern Ireland*
[3]*Principle Audiological Scientist with the Belfast Trust, Northern Ireland*

Abstract— Vestibular dysfunction is associated with the developmental delay of motor and attention skills. Integrity of the vestibular and visual systems manifest in rapid side to side eye movement called nystagmus. This may be evoked by physical rotation or caloric stimulation to the ear drums. The approach in this technological advance explores whether controlled rotation of the environment can induce the nystagmus in healthy adult subjects. This provides a portable solution which utilizes technology associated with virtual reality. VR allows a level of control not possible in the 'real' world and allows the therapist a degree of control over the environment that is not normally possible. Initial testing illustrates that nystagmus is apparent in the electro-ocular recording during stimulation, but so far, does not persist beyond the stimulation period.

Th.3.2.12 **10:45-11:15**

Noise Removal from Electrocardiogram Signal Employing an Artificial Neural Network in Wavelet Domain

Eiman Farahabdi[1], Amin Farahabadi[1], Hossein Rabbani[1], M. Parsa Mahjoob[2] and Alireza Mehri Dehnavi[1]

[1]*Department of Biomedical Engineering, Isfahan University of Medical Sciences (IUMS), Isfahan, Iran*
[2]*School of Medicine, Jahrom University of Medical Sciences (JUMS), Jahrom, Iran*

Abstract— Electrocardiogram (ECG) signal involves significant information about heart state and is one of the common tools for cardiologist in diagnosis of heart failures. Using adaptive filters for filtering this signal, which inherently has nonstationary features, is used as one of the known methods. In this paper, the wavelet transform and also a neural network (NN) based on adaptive filters are used for removal of undesirable noise from the ECG signal. In this context, in training stage, network weights related to each wavelet sub band is obtained by using the steepest descent algorithm, and filter coefficients for removal of noise from ECG signal are calculated. Results obtained from employing this algorithm on the MIT-BIH database and simulated ECG signal are indicative of improved performance of noise removal in comparison with other methods.

Th.3.2.13 **10:45-11:15**

Accelerating Biomedical Signal Processing Algorithms with Parallel Programming on Graphic Processor Units

Evdokimos Konstantinidis, Christos Frantzidis, Lazaros Tzimkas, Costas Pappas and Panagiotis Bamidis

Lab of Medical Informatics, Medical School, Aristotle University of Thessaloniki, Thessaloniki, Greece

Abstract— This paper investigates the benefits derived by adopting the use of Graphics Processing Unit (GPU) parallel programming in the field of biomedical signal processing. The differences in execution time when computing the Correlation Dimension (CD) of multivariate neurophysiological recordings and the Skin Conductance Level (SCL) are reported by comparing several common programming environments. Moreover, as indicated in this study, the combination of parallel programming with special design techniques dealing with memory management issues such as data transfer between device memory and GPU may further accelerate the processing speed. So, the minimization achieved in the time execution by means of proper parallel architecture design may reach a factor of 29 in comparison with pure C language. Therefore, the role of parallel GPU programming environment may be beneficial for numerous biomedical applications within the sphere of biosignal processing.

Th.3.2.14 **10:45-11:15**

Combined SHG Signal with AFM Imaging to Assess Conformational Changes in Collagen

Andreas Stylianou, Maria Kyriazi, Konstantinos Politopoulos and Dido Yova

Laboratory of Biomedical Optics and Applied Biophysics, School of Electrical and Computer Engineering, National Technical University of Athens, Greece

Abstract— Collagen is the most abundant protein in mammals and is important for a variety of functions and its concentration, structure and function is associated with different pathological states. In this research we correlate structural changes with those changes in the Second Harmonic Generation (SHG) signal. The combination of Atomic Force Microscopy (AFM) imaging with information included in SHG signal can significantly contribute to further understanding of the nonlinear optical properties of collagen.

Th.3.2.15 **10:45-11:15**

Combined Functional Data from Multispectral Non-Ionizing and Non-Invasive Brain Imaging

Irene Karanasiou

National Technical University of Athens, Athens, Greece

Abstract— Ongoing research during the past few years, envisions the development of an integrated functional imaging methodology to study brain function in-vivo and ex-vivo through a multi-modal, multi-spectral approach using nonionizing radiation to provide combined functional information from molecule to tissue level. The scope of this research is threefold: a) provide non-invasive, non-ionizing functional imaging comprising combined blood flow and neural dynamics information, as well as passive measurement of temperature and conductivity fluctuations during activation of specified brain areas in-vivo and b) identify new brain biomarkers related to brain functionality both in health and disease through Terahertz biomolecule imaging ex-vivo. To achieve the abovementioned the stages of our research comprise: 1) exploration of the functional imaging potential of a novel passive microwave imaging device, 2) development of integrated functional imaging systems for concurrent measurements of blood flow, neural activity, temperature and conductivity changes in the brain, 3) definition of biomolecular markers related to brain functionality and disease ex-vivo. The accumulation of a wealth of brain functional data from molecular to system level will lead to a broad range of applications, spanning the delineation of brain networks, improved post-processing of the obtained measurements, understanding the basis of neuropsychiatric diseases and effective treatment design.

Th.3.2.16 **10:45-11:15**

A Hydrostatic Pressure Approach to Assess Accuracy of Finger Blood Pressure Measurement

Rein Raamat, Kersti Jagomägi, Jaak Talts, and Jana Kivastik

Department of Physiology, University of Tartu, Estonia

Abstract—We studied the feasibility of application of consecutive hydrostatic pressure changes to assess accuracy of measurement of finger blood pressure changes in 11 normal volunteers. The results demonstrated that specific physiological responses to hand postural changes were small in healthy subjects and the consecutive hydrostatic pressure changes of controlled magnitude can be applied to assess accuracy of finger blood pressure measurement. As a calibration checking tool the proposed method may be helpful for cardiovascular diagnostics.

Th.3.2.17 **10:45-11:15**

A Method of Monitoring Biological Effect of Radiation Exposure by Excretion of Endogenous Carbon Monoxide in Expired Gas

Alexander I. Dyachenko[1,2], Yurii A. Shulagin[1], Eugene V. Stepanov[2], Anna G. Zizina[1], Vladimir P. Krotov[1], Vladislav M. Petrov[1], Tamila E. Burkovskaya[1]

[1]*Institute of Biomedical Problems of RAS, Moscow, Russia*
[2]*Institute of General Physics named by A.M. Prokhorov of RAS Moscow, Russia*

Abstract— The purpose of this study was a development of a technique of noninvasive estimation of a biological effect of radiation exposure in monkeys by virtue of a laser measurement of endogenous CO content in exhaled air and technique's testing in the experiment with acute radiation exposure. A control and a test groups consisted of two rhesus monkeys each. The test group was exposed to 6 hours radiation exposure with 1.2 Gy dose produced by gamma-rays. We measured the changes of endogenous CO excretion in animals located in the opened system of the box by virtue of the developed laser based CO-meter. We found that CO excretion increased on the 3rd day after radiation exposure. Consumption of oxygen and excretion of carbon dioxide did not change after the exposure.

Thursday Morning, Nov. 5

Special Session: **Th.SS.1.2 LinkSCEEM Meeting: High Performance Computing Applications in Life Sciences II**

Time & Place: **10:45-12:45, Diana**

Chairperson: **Vasilis Promponas**
Bioinformatics Research Laboratory, Department of Biological Sciences, University of Cyprus, Cyprus

Th.SS.1.2.1 **10:45-11:10**
Bioinformatics Applications on Windows and Linux Clusters

Mohamed Abouelhoda

Nile University, Egypt

Abstract - Computer cluster is appropriate technology for setting up scalable computational infrastructure for bioinformatics applications. Linux cluster is well known to the bioinformatics community due to the variety of open source middleware and bioinformatics applications running on it. Recently, Microsoft launched an enhanced computer cluster middleware in its edition of the high performance computing server 2008 (HPC Server 2008). But the Windows server is not well known to the bioinformatics community, simply because few bioinformatics applications can be readily run on it; this is despite the fact that most biologists are more familiar with Windows than with Linux. Therefore, we launched in collaboration with Microsoft the project "WinbioinfTools" as an initiative to provide the life science community with bioinformatics tools running under Windows. WinbioinfTools is open source package including three programs for sequence analysis: 1) Implementation of a parallel global sequence alignment algorithm, 2) parallel implementation of BLAST, and 3) CoCoNUT for pairwise genome comparison. In addition to this development effort, we compared the performance and usability of these tools on Windows and Linux Cluster. In the talk, we will explore the modules of WinbioinfTools and sample biological applications. Furthermore, we will share with the audience our experience in porting Linux based bioinformatics tools to the Windows on single and multiple cluster nodes as well as our observations regarding the performance of Windows and Linux Cluster.

Th.SS.1.2.2 **11:10-11:35**
Computing Some Secrets of Life: Computational Biology and Bioinformatics Research in the BRL@UCY.AC.CY

Vasilis Promponas

Bioinformatics Research Laboratory, Department of Biological Sciences, University of Cyprus, Cyprus

Abstract - Our research is oriented towards the interpretation of large scale genomic data and the use of computational methods in order to reveal the principles governing the Molecular Basis of Life. We are mainly interested in the elucidation of protein sequence to structure/function relationships using sequence similarity, statistical and machine learning techniques.
In particular, our research focuses on:

1. Sequence repeats, low complexity/compositionally biased regions: Investigation of their relation to protein structure and association to protein (mis)function. Study of the evolution of protein repeats.
2. Transmembrane and membrane-associated protein topology and structure prediction: Prediction of structural features of membrane proteins. Evolution of transmembrane protein topology/structure/function.
3. Sequence-based structural/functional classification of proteins
4. Study of bacterial genome evolution
5. Study of different metrics in biological sequence space for clustering protein and DNA sequences
6. Biomedical text mining
7. Biodiversity informatics

All these research projects are based on handling, storing and analyzing increasing amounts of available data. We will briefly present our current research goals and identify bottlenecks imposed by the size and complexity of the data we are working with, highlighting possible solutions using High Performance Computing approaches.

Th.SS.1.2.3 **11:35-12:00**

Applications of high performance computing to network extraction from real-time tomographic estimates of brain activity

Andreas A. Ioannides

Laboratory for Human Brain Dynamics, AAI-SCS Ltd, Nicosia, Cyprus

High performance computing has transformed the way theoretical models can be applied to different domains, including medical imaging. Over the last 20 years our own research in biomagnetism, and magnetoencephalography in particular has been transformed by the availability of ever increasing computational resources. Back in 1987 we developed a non-linear distributed source analysis method, MFT (Magnetic Field Tomography) for source estimation based on theoretical concepts [1,2], and reusing ideas first introduced for solving the inverse scattering problem in nuclear physics [3]. In contrast to other techniques that relied on the use of average signals MFT could use the full information in the data by a computationally demanding non-linear algorithm that had to be applied independently to each timeslice of data. The computational burden was such that at the time (1988) the reconstruction of a single timeslice of data for just one plane of the tomographic analysis required two weeks of computation on the Open University's (UK) VAX cluster! The award of an SERC grant a year later provided a 32 node transputer facility that revolutionize the operations allowing full tomographic imaging of the data and eventually the superposition of anatomical and functional information [4]. The rapid development of PC based hardware in the following years has allowed the development over the last few years of the MFT technology as one of the most refined and powerful tools for the analysis of brain function [5] leading to new insights about basic mechanisms like attention [6]. The computational need for reconstructing the MFT solutions from data is still as demanding as ever but it can

be easily saisfied with hardware routinely available today. The challenge for the next few years is how best to mine the huge information: the task is to search for patterns of activity in the volumes of data (a tomographic image every millisecond, lasting in some cases for minutes and hours) and to relate these patterns in time, so that the neural networks that support cognition and emotion can be revealed [7]. In parallel, the methodology already developed for MEG can only become more accessible and clinically useful with hardware improvements or with translating the algorithms to a cheaper technology, like electroencephalography (EEG). For different reasons, the network analysis and the development of the EEG analysis require computational resources that exceed what is available with conventional hardware, and can at present only be found in dedicated high performance computing.

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Th.SS.1.2.4 **12:00-12:15**

The HPC Project of the Cyprus Institute: Opportunities for Life Sciences Research

Christos Nicolaou

Computation-based Science and Technology Research Center, The Cyprus Institute, Nicosia, Cyprus

Abstract - The Cy-Tera project of the Cyprus Institute (CyI) aims at creating a research facility including a high-performance computing (HPC) infrastructure supporting cutting-edge scientific applications, with associated user support and computational science research and training programs. The Cy-Tera facility will be the first HPC facility at multi-Tflops level in Cyprus, serving the needs of the Cyprus Institute and its partners for frontier research applications in many fields of great scientific and/or societal importance including life sciences research. This talk will present the project and elaborate on the opportunities it will provide to life sciences researchers in need of resources for computing and data intensive problems.

Th.SS.1.2.5 **12:15-12:45**

Panel Discussion: Promoting HPC use in computational science in the Eastern Mediterranean region: The case for Life Sciences Research

Panel members: Prof. K. Schilling (The Cyprus Institute), Prof. D. Fotiadis (University of Ioannina), Prof. G. Turkiyyah (American University of Beirut), Dr. V. Promponas (University of Cyprus) Mohamed Abouelhoda (Nile University, Egypt)

Thursday Morning, Nov. 5

Session: **Th.1.3 eHealth III: e&m Health Systems Devices**

Time & Place: **11:15-12:45, Les Etoiles**

Chairpersons: **Panayiotis Kyriacou**
School of Engineering and Mathematical Sciences,
City University London, London, UK

Anastassios Tagaris
Biomedical Engineering Laboratory,
National Technical University of Athens, Athens, Greece

Th.1.3.1 **11:15-11:30**

My Camera, My Buddy - Legal and Sociological Assessment of the Potential of Video Surveillance in eHomeCare

Griet Verhenneman[1] and Annelies Veys[2]

[1]*Interdisciplinary Centre for Law and ICT, Katholieke Universiteit Leuven, Belgium*
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Abstract— Cameras will soon be installed inside patients' homes for health purposes. Although the positive effects of the use of cameras on patients in homecare has been demonstrated, it also makes care more privacy intrusive, capturing us on film in our most personal, most intimate environment. This paper examines the possibilities, opportunities and challenges video surveillance presents in eHomeCare from two angles, balancing legal and social implications. This will be studied by means of a theoretical analysis and a multi user case study in a care network. The case study was conducted by using a proxy technology approach.

Th.1.3.2 **11:30-11:45**

INTENSA: Heart Failure Patient's Follow-up System Using the ISO/IEEE11073 Standard

Miguel Martínez de Espronceda Cámara[1], Ignacio Martínez Ruiz[2], Santiago Led Ramos[1], Jesús Daniel Trigo Vilaseca[2], Iñigo Oses Galé, Javier Escayola Calvo[2], Luis Javier Serrano Arriezu[1], José García Moros[2] and Antonio García Quintana[3]

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[3]*Cardiology Service of Hospital Dr. Negrín, Canary Islands*

Abstract— This paper presents a novel implementation methodology of ISO/IEEE11073

standards for use in real monitoring platforms based on patterns paradigm. These monitoring platforms include several medical devices based on low voltage-low power microprocessors. As a proof of the concept, INTENSA project which aims to develop and evaluate a heart failure follow-up interoperable system including weigh scale, blood pressure and HOLTIN devices, is briefly described.

Th.1.3.3 **11:45-12:00**

Mobile Technology to Empower People with Diabetes Mellitus: Design and Development of a Mobile Application

Stavroula Mougiakakou[1,2], Ioannis Kouris[1], Dimitra Iliopoulou[1], Andriani Vazeou[3] and Dimitrios Koutsouris[1]

[1]*Faculty of Electrical and Computer Engineering, National Technical University of Athens, Greece*
[2]*ARTORG Center for Biomedical Engineering Research, Faculty of Medicine, University of Bern, CH*
[3]*A' Department of Pediatrics, Diabetes Center, P&A Kyriakou Children's Hospital, Greece*

Abstract—Recent advances in information and communication technologies permitted the design and development of new patient-centric models for the provision of better health care services and enhancement of patient's self-management. This paper presents a prototype mobile phone application which is being designed to improve the self-management of individuals with Type 1 Diabetes Mellitus (T1DM). The developed application using the Microsoft .Net framework runs on 3G mobile phones. The application consists of five major interfaces for the management of: blood glucose measurements, blood pressure measurements, insulin dosage, food/drink intake and physical activity. Furthermore, the user has the following capabilities i) to keep notes, and ii) in case of an emergency to press a button, in order to transmit immediately his/her position to both an emergency call center, and the attendant physician. It has to be noted, that the above mentioned data are stored locally to the mobile phone, and regularly transmitted via the mobile network to a dedicated hospital web-server. Technical evaluation of the prototype indicates that the use of the mobile network makes feasible the self-management of T1DM.

Th.1.3.4 **12:00-12:15**

CHRONIOUS: A Wearable System for the Management of Chronic Disease Patients

Athanasios Papadopoulos[1], Dimitrios I. Fotiadis[1], Michael Lawo[2,3], Fabio Ciancitto[4], Christian Podolak[4], Raffaele L. Dellaca[5], Giulia Munaro[6], Roberto Rosso[6]

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[2]*TZI, Germany*
[3]*Universität Bremen, Bremen, Germany*
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[6]*TESAN Telematic & Biomedical Services S.p.A., Vicenza Italy*

Abstract— CHRONIOUS project contributions supports the design and the development of an open architecture monitoring platform aiming on the detailed description of patient's health status focusing on people with chronic diseases. Essential modules of the CHRONIOUS system are the wearable platform responsible for the collection of several vital body signs, environmental, context and patient's activity signals. These data together with the description of patients' drug intake and dietary habits are analyzed by the CHRONIOUS intelligent module. The patient's history and his demographic data are processed along with the rest of the signals, concluding in the description of his recent health condition and the estimation of his severity status. As pilot studies for the development and the evaluation of the CHRONIOUS system, two of the most frequent chronic diseases have been selected: the Chronic Obstructive Pulmonary Disease (COPD) and the Chronic Kidney Disease (CKD). The architecture of the CHRONIOUS platform as well as some of the initial results are presented in this paper.

Th.1.3.5 **12:15-12:30**

The preservation of the CE mark for a medical device further to a maintenance process

Leandro Pecchia[1], Giorgio Carpino[2,3], Luciano Mirarchi[4] and Marcello Bracale[1]

[1]*Department of Biomedical, Electronic and Telecommunication Engineering University of Naples "Federico II", Naples, Italy*
[2]*DIBET, Università di Napoli Federico II, Naples*
[3]*Laboratory of Biomedical Robotics and Biomicrosystems, Università Campus Bio-Medico di Roma, Roma, Italy*
[4]*Siemens Healthcare Customer Services, Verona, Italy*

Abstract— In this paper we analyze the conditions for the preservation of the CE mark of a medical device further to maintenance process, especially in the case in which the maintenance is managed by a third company. Analyzing the European Directives on medical devices, we observed that the conditions, in which the manufacturer obtained the CE mark, might change when another company manages maintenance. We propose three solutions to face this situation.

Th.1.3.6 **12:30-12:45**

MyCare Card development: the patient held electronic health record device

Victor Rybynok[1], Kyriacou Panayiotis[1], Jacqueline Binnersley[2], Andree Woodcock[2] and Louise Wallace[3]

[1]*School of Engineering and Mathematical Sciences, City University London, London, UK*
[2]*School of Art and Design, Coventry University, Coventry, UK*
[3]*Faculty of Health and Life Sciences, Coventry University, Coventry, UK*

Abstract— In the UK, in emergency situations, health professionals rely on patients to provide information about their medical history. However, in some cases patients may not remember their medication, long term illnesses or allergies, or be able to communicate this information. As a national on-line integrated patient record system has not yet been established, this paper introduces an on-going project 'MyCare Card' abbreviated as MyC2 which aims to design and implement a patient held electronic health record device and

corresponding user interface software.

Thursday Morning, Nov. 5

Session: **Th.2.3 Medical Imaging III: Segmentation I**

Time & Place: **11:15-12:45, Venus**

Chairpersons: **Dimitris Maroulis**
Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens, Athens, Greece

Christos Loizou
Department of Computer Science, Intercollege, Limassol, Cyprus

Th.2.3.1 **11:15-11:30**
Microarray Image Segmentation using Spot Morphological Model

Dimitris Maroulis, Eleni Zacharia

Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens, Athens, Greece

Abstract—The up-to-date segmentation techniques and software programs for microarray image segmentation require human intervention which in turn may detrimentally affect the biological conclusions reached during microarray experiments. In this paper, an automatic approach for segmenting microarray images, based on the morphological modeling of spots, is presented. The conducted experiments have shown that the proposed approach is very effective even when it is applied to noisy images as well as to images containing spots of various shapes and intensities.

Th.2.3.2 **11:30-11:45**
Segmentation of Two-Dimensional Gel Electrophoresis Images containing Overlapping Spots

Michalis Savelonas, Dimitris Maroulis and Eleutheria Mylona

Dept. of Informatics and Telecommunications, University of Athens, Greece

Abstract—This work addresses the segmentation of two dimensional polyacrylamide gel electrophoresis images containing overlapping protein spots. A novel segmentation approach is proposed, which is capable of detecting spot boundaries within the region of overlap. The proposed approach is based on the observation that the spot boundaries in the overlap region are associated with local intensity minima. The experimental evaluation of the proposed approach demonstrates that it is capable of identifying multiple overlapping spots, as opposed to state of the art segmentation approaches. Moreover, it results in more accurate spot delineations, when compared to Progenesis SameSpots.

Th.2.3.3 **11:45-12:00**

Automatic vertebra tracking through dynamic fluoroscopic sequence by smooth derivative template matching

Tommaso Cerciello[1], Paolo Bifulco[1], Mario Cesarelli[1], Maria Romano[1] and Robert Allen[2]

[1]*Dept. of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy*
[2]*Institute of Sound and Vibration Research, University of Southampton, England*

Abstract — Diagnosis of the underlying causes of widespread spinal pathologies such as back pain and whiplash remains problematic. Many studies suggest that segmental instability may occur and that the study of the intervertebral kinematics can be a valuable, objective method to assess spinal segment functionality. Direct measurement of the intervertebral kinematics results very invasive and unpractical; as alternative analysis of dynamic video fluoroscopic can provide intervertebral kinematic data of lumbar and cervical spinal tracts during unconstrained patient motion, with an acceptable low X-ray dose. Estimation of the kinematics relies on accurate recognition of vertebra positions and rotations on each radiological frame; this can be achieved identifying specific feature points or landmarks, but manual selection results tedious and imprecise. The aim of this work is to present an improved procedure and automatic identification of vertebra motion. By opportunely processing the radiological sequences by using smoothed derivative operators the main vertebral body outlines results enhanced; thus, procedures of template matching for vertebra location become more accurate. Furthermore, data interpolation provided sub-pixel accuracy. Kinematic data, obtained by processing real sagittal fluoroscopic sequences of the lumbar spine, were tested against results of previous studies obtained by manual identification and other methods. Time-evolution of intervertebral kinematic parameters resulted less variable than the other methods; root mean square differences and standard deviations were computed. Vertebra trajectories were interpolated by smoothing cubic spline and instantaneous speed and acceleration were computed. Vertebra speed and acceleration resulted more stable, smooth and in accordance with the actual motion preformed by patients.

Th.2.3.4 **12:00-12:15**

Intelligent Feature Selection for Model-Based Bone Segmentation in Digital Radiographs

André Gooßen[1], Dirk Peters[1], Thorsten Gernoth[1], Thomas Pralow[2] and Rolf-Rainer Grigat[1]

[1] *Vision Systems, Hamburg University of Technology, Germany*
[2] *General X-Ray, Philips Healthcare, Germany*

Abstract—In this paper we propose a method to enhance Active Shape Model based bone segmentation. One major weakness of the classic algorithm is the use of a single dedicated image feature. However to model the variation of image content along the object boundaries it is more suitable to use different features for different regions. We derive an automatic intelligent selection of these features and integrate it into the classic Active Shape Model segmentation. We evaluated the proposed algorithm on the task of delineating bone structures in more than 150 clinical radiographs of the lower extremity and achieve superior accuracy compared to previously published approaches.

Th.2.3.5 **12:15-12:30**

Active Shape Model Aided by Selective Thresholding for Lung Field Segmentation in Chest Radiographs

Dimitris Iakovidis[1] and Michalis Savelonas[2]

[1]*Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece*
[2]*Dept. of Informatics and Telecommunications, University of Athens, Greece*

Abstract—Active shape models (ASMs) are statistical, deformable models, exhibiting a remarkable performance for the segmentation of the lung fields in plain chest radiographs. In this paper we propose a novel approach to improving the robustness of the original ASM against weak lung field boundaries, which can cause leaking of the shape's contour into the lung fields. The ASM is shielded against leaking by the prior application of a grey-level selective thresholding scheme that subtracts irrelevant anatomic structures from the radiograph. The proposed approach copes with affine lung field projections and features resistance to the presence of dense external objects used for patient's monitoring and support. Its advantageous performance is demonstrated on a challenging set of chest radiographs obtained from patients with bacterial pulmonary infections.

Th.2.3.6 **12:30-12:45**

Automated Vessel Tree Segmentation: Challenges in Computer Aided Quantification of Diffuse Parenchyma Lung Diseases

Panayiotis Korfiatis, Anna Karahaliou and Lena Costaridou

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

Abstract—Identification and characterization of diffuse parenchyma lung disease patterns challenges Computer Aided Diagnosis (CAD) schemes in Computed Tomography (CT). Accuracy of these preprocessing stages is expected to influence the accuracy of lung CAD schemes. Although algorithms aimed at improving the accuracy of segmentation of lung fields in presence of DPLDs have been reported, the corresponding vessel tree segmentation stage is under-researched. In this paper, an automated vessel tree segmentation scheme is proposed, utilizing a 3D multi-scale vessel segmentation filter based on eignen value analysis of the Hessian matrix and unsupervised segmentation, followed by texture classification refinement to correct possible over-segmentation. Performance of the proposed scheme in vessel tree segmentation was evaluated by means of volume overlap (no refinement: 0.794, refinement: 0.925), true positive fraction (no refinements: 0.938, refinement: 0.902) and false positive fraction (no refinement: 0.241, refinement: 0.077) to pixel exact ground truth of 3 MDCT scans.

Thursday Morning, Nov. 5

Session: **Th.3.3 Biosignals III**

Time & Place: **11:15-12:45, Minerva**

Chairpersons: **Andreas Spanias**
School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, USA

Marios Neophytou
Department of Computer Science, University of Cyprus, Cyprus

Th.3.3.1 **11:15-11:30**

A Complex Discrete Wavelet Transform for Processing Quadrature Doppler Ultrasound Signals

Gorkem Serbes[1] and Nizamettin Aydin[2]

[1]*Mechatronics Engineering Department, Bahcesehir University, Istanbul, Turkey*
[2]*Computer Engineering Department, Yildiz Technical University, Istanbul, Turkey*

Abstract— Unlike the conventional discrete wavelet transform discrete complex wavelet transform is a shift invariant transform with limited redundancy. Quadrature Doppler ultrasound signals are dual channel signals obtained from the systems employing quadrature demodulation. Prior to processing Doppler signals by using discrete Wavelet transform, directional flow signals must be obtained and then two separate transform applied, increasing the computational complexity. In order to decrease computational complexity, a complex discrete wavelet transform algorithm is proposed. A comparison between the new transform and the conventional technique is presented. The results show that the proposed method gives the same output as the conventional technique and the computational complexity for processing quadrature signals using discrete complex wavelet transform is greatly reduced.

Th.3.3.2 **11:30-11:45**

Automatic Optic Disk Detection by the Use of Curvelet Transform

Mahdad Esmaeili[1], Hossein Rabbani[1], Alireza Mehri Dehnavi[1] and Alireza Dehghani[2]

[1]*Department of Biomedical Engineering, Isfahan University of Medical Sciences, Isfahan, Iran*
[2]*Department of Ophthalmology, Isfahan University of Medical Sciences, Isfahan, Iran*

Abstract— Efficient optic disk (OD) localization and segmentation are important tasks in automated retinal screening. In this paper, we take digital curvelet transform (DCUT) of the enhanced retinal image and modify its coefficients based on the sparsity of curvelet coefficients to get probable location of OD. If there are not yellowish objects in retinal

images or their size are negligible, we can then directly detect OD location by performing Canny edge detector to reconstructed image with modified coefficients. Otherwise, if the size of these objects is eminent, we can see circular regions in edge map as candidate regions for OD. In this case, we use some morphological operations to fill these circular regions and erode them to get final locations for candidate regions and remove undesired pixels in edge map. Finally, we choose the candidate region that has maximum summation of pixels in strongest edge map that obtained by performing threshold to curvelet-based enhanced image, as final location of OD. This method has been tested on different retinal image datasets and quantitative results are presented.

Th.3.3.3 **11:45-12:00**

Noise Components Identification in Biomedical Signals based on Empirical Mode Decomposition

Alexandros Karagiannis and Philippos Constantinou

Mobile Radio Communications laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece

Abstract— Hilbert-Huang Transform (HHT) is composed of the Empirical Mode Decomposition (EMD) as the first step of the procedure and Hilbert Spectral analysis (HSA) as the second step. It is a recent tool in the analysis of signals originating from nonlinear processes as well as nonstationary signals. Empirical Mode Decomposition produces a set of Intrinsic Mode Functions and the core idea is based on the assumption that any data consists of different simple intrinsic modes of oscillations. Statistical significance of the Intrinsic Mode Functions and partial signal reconstruction are investigated in this paper. Application of Hilbert-Huang Transform on biomedical signals such as ECG from MIT-BIH database and experimental respiratory signals acquired by means of accelerometers, reveal the adaptive nature of the method.

Th.3.3.4 **12:00-12:15**

Transform Domain Features For Ion-Channel Signal Classification Using Support Vector Machines

Karthikeyan Natesan Ramamurthy, Jayaraman J Thiagarajan, Prasanna Sattigeri, Bharatan Konnanath, Andreas Spanias, Trevor Thornton, Shalini Prasad, Michael Goryll, Stephen Phillips and Stephen Goodnick

School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, USA

Abstract—The study of the behavior of ion-channels can provide significant information to detect metal ions and small organic molecules in solution. Discrimination of different analytes can be performed by extracting appropriate features from the ion-channel signals and using them for classification. In this paper, we consider features extracted from the Fourier, Wavelet and Walsh-Hadamard domain representations of the ion-channel signals. The proposed approach uses the power distribution information in the transform domains as features for discrimination. We compare the performance of all the three sets of features using support vector machines for classification of analytes and present the results. Results

obtained show that the transform domain features achieve high classification rates in addition to high sensitivity and specificity rates.

Th.3.3.5 **12:15-12:30**

The concept of an intelligent, bio-inspired and brain controlled robotic system

Dobrea Dan Marius and Dobrea Monica Claudia

Department of Electronics, Telecommunications and Information Technology, "Gh. Asachi" Technical University, Iaşi, Romania

Abstract— Between the information transfer rate and the classification accuracy of a brain computer interface (BCI) system a balance occurs. If we want higher correct classification rates the BCI system will consequently become slower. Otherwise, a faster (online) BCI system assumes a lower classification rate. If we analyze the human motor system (HMS) we can view the hierarchical organization (with different control levels that receive specific sensorial information) as a corresponding biological solution to solve the problem of the system complexity versus the real time control. The muscular proprioceptors and the receptors from the vestibular system inform (especially at the low motor control levels) the central nervous system about the locomotor mechanics and the body posture. The tactile, visual and auditory information is mainly used by the high control/command levels of the HMS. HMS requires a training time interval for executing a specific motor program (e.q. walking), followed then by a systematic adaptation to the changing of the human living system parameters and of the environment characteristics. This paper presents the concepts of an intelligent, bio-inspired and with auto-organization robotic system (e.g. a wheelchair), iBiAoRS, that will be capable both: to control the system movement dynamics based on a BCI system and to obey the successive hierarchical subordination principle that characterizes the HMS. An autoorganization robotic system is developed and some preliminary results are presented in order to test one of the main concept of iBiAoRS.

Th.3.3.6 **12:45-13:00**

REG-ICA: A New Hybrid Method for EOG Artifact Rejection

Manousos A. Klados[1], Christos L. Papadelis[2] and Panagiotis D. Bamidis[1]

[1]*Group of Applied Neuroscience, Lab of MedicalInformatics, Medical School, Aristotle University of Thessaloniki,Thessaloniki, Greece*
[2]*Center for Brain/Mind Sciences (CIMEC), University of Trento, Mattarello, Trentino*

Abstract—The plethora of Artifact Rejection (AR) techniques proposed for removing electrooculographic (EOG) artifacts from electroencephalographic (EEG) signals can be separated into two main categories. The first category is composed of regression – based methods, while the second one consists of Blind Source Separation (BSS) – methods. A major disadvantage of BSS – based methodology is that the artifactual components include also neural activity, thus their rejection leads to the distortion of the underlying cerebral activity. The current study tries to solve the aforementioned problem by proposing a new hybrid algorithm for EOG AR. According to this automatic approach, called REG-ICA, Independent Component Analysis (ICA) is used to decompose EEG signals into spatial independent components (ICs). Then an adaptive filter, based on a stable Version of the Recursive Least Square (sRLS) algorithm, is applied to ICs so as to remove only EOG artifacts and maintain

the neural signals intact. Then the cleaned ICs are projected back, reconstructing the artifact – free EEG signals. In order to evaluate the performance of the proposed technique, REG-ICA has been compared with the Least Mean Square (LMS) approach, in simulated EEG data. Two criteria were used for the comparison: how successfully algorithms remove eye blinking artifacts, and how much the EEG signals are distorted. Results support the argument that REG-ICA removes successfully EOG activity, while it minimizes the distortion of the underlying cerebral activity in contrast to LMS.

Friday Morning, Nov. 6

Session : **Keynote Fr. 1 & 2**

Time & Place: **8:15-9:30, Les Etoiles**

Chairperson: **Sotiris Pavlopoulos**
National Technical University of Athens, Greece

8:15
Paving the path towards eHealth for Cyprus Public Healthcare Ecosystem

Kyriacos Kokkinos

General Manager, IBM Italia SpA, Cyprus Branch

Abstract **-** The presentation elaborates on the introduction of Integrated HealthCare Information System IHCIS project for Nicosia and Famagusta Hospitals, its implementation considerations and critical success factors. Project attributes that go beyond IT systems, such as people, structure, culture etc, are described and lessons learned the way forward are discussed with emphasis on the expected benefits, productivity gains and improvement in healthcare services. The topic covers the following: i. Overview of Health Information System (HIS): HIS Status Overview, Next steps; ii. Business Functionality: Business areas addressed, and 'Early Wins' through IHCS; and iii. Organizational Readiness: Systems, Hospital Processes, and Culture.

8:45
A Low Cost and Effective Electronic Medical Record System for Developing Countries

Metin Akay

Professor, School of Biological and Health System Engineering, Ira Fulton School of Engineering–ASU, Tempe, Arizona, USA

Abstract - Developing countries face a slew of health problems that threaten the lives of millions of people each day. However, without a proper system of organization, these problems are amplified by the fact that the doctors must waste their time and resources finding and organizing patient information in often chaotic paper based systems. This paper focuses on the proof of concept of creating an electronic medical records or EMRs that could be used in one of these nations. In this paper, we define what an EMR is, discuss some current electronic medical records used in developed as well as developing countries, and introduce the Alzheimer's Institute Database (AID). This database is currently being used at Banner Alzheimer's Institute (BAI). It is created in the FileMaker® program and is originally designed as an Alzheimer's database. However, it serves as a proof of concept for a low cost and effective implementation of a fully customizable EMR for developing countries due to the flexibility and customizability afforded by using this program.

Friday Morning, Nov. 6

Session: **Fr.1.4 eHealth III: e&m Health Systems on the Web**

Time & Place: **09:30-11:00, Les Etoiles**

Chairpersons: **Lena Costaridou**
Department of Medical Physics, School of Medicine, University of Patras, Greece

Ilias Maglogiannis
University of Central Greece, Department of Computer Science and Biomedical Informatics, Greece

Fr.1.4.1 **9:30-9:45**

An Integrated Web-based Platform for the Provision of Personalized Advice in People at High Risk for CVD

Stavroula Mougiakakou[1,2], Ioannis Valavanis[1], George Karkalis[1], Stathis Marinos[1], Keith Grimaldi[1] and Konstantina Nikita[1]

[1]*Faculty of Electrical and Computer Engineering, National Technical University of Athens, Greece*
[2]*ARTORG Center for Biomedical Engineering Research, Faculty of Medicine, University of Bern, CH*

Abstract — Aim of the manuscript is to present an integrated web-based platform which is able to assess a person's risk to develop Cardiovascular Disease (CVD) using the Body Mass Index (BMI) as independent risk factor based on genetic and lifestyle information and in parallel to provide personalized advice in order to reduce this risk. A subject fills out a web available questionnaire regarding his/her lifestyle in terms of nutrition and food habits, while his/her biological material is send for DNA analysis. Data regarding lifestyle and genetic information are sent to a web server, in order to be used for the assessment of the subject to develop high BMI. The assessment is based on an artificial intelligence based system. The result of risk assessment is fed to a remote server where it is integrated with all values corresponding to the answers of the subject to the questionnaire. All values are transferred through the platform in an .xml file. Then, through appropriate mechanism, a report is generated as a document file (a pdf Acrobat file) which includes the result of risk assessment and the corresponding advice on lifestyle habits. Appropriate quality control actions are taken into consideration during the various processes, while access to the platform is permitted only to authenticated personnel. The latter is ensured by an authentication procedure in the user interface of the software and appropriate usernames/passwords.

Fr.1.4.2 **9:45-10:00**

A web-accessible mammographic image database dedicated to combined training and evaluation of radiologists and machines

Zinon Antoniou[1], Georgia Giannakopoulou[2], Ioannis Andreadis[1], Konstantina Nikita[1], Panos Ligomenides[3] and George Spyrou[3]

[1]*National Technical University of Athens, Greece*
[2]*School of Medicine, University of Athens, Greece*
[3]*Academy of Athens Biomedical Research Foundation, Athens, Greece*

Abstract—We designed and implemented a web-accessible database entitled MIRaCLe DB (Mammography Image reading for Radiologists' and Computers' Learning Database) that composes a dynamic repository for machines and radiologists training and evaluation. Up to now, 204 mammograms have been collected from 196 patients; they have been classified according to the type of the lesions, the type of the biopsy finding, the type of the mammography finding and the available CADs performance. A user can access the database in two modes: (a) for classification software evaluation and (b) for radiologists' education evaluation. In the mode for classification software evaluation, the user has the ability to query the database and retrieve cases with certain characteristics and certain difficulty. Also, there is the possibility to download the existing cases in order to facilitate the evaluation of a new classifier. In the other mode, the user (radiologist) can be trained in real time through a sequence of presentations and furthermore can be evaluated through different evaluating scenarios. At the duration of evaluation, the user can examine the mammography images through a web-based digital magnifier and process the corresponding image in real time. MIRaCLe DB is the first database that combines the machine and human needs for training and evaluation in mammographic image reading.

Fr.1.4.3 **10:00-10:15**

AMICA telemedicine platform: a design for management of elderly people with COPD

Luis Felipe Crespo Foix[1], Daniel Sanchez Morillo[1], Mario Crespo Miguel[1], Nicole Gross[2], Kostas Giokas[3], Jose Antonio Jimenez Millan[1] and Christophe Kunze[2]

[1]*Biomedical Engineering and Telemedicine Lab, University of Cadiz, Cadiz, Spain*
[2]*Research Center for Information Technology, Kalrsruhe, Germany*
[3]*Institute of Communication and Computer Systems, National Technical University of Athens, Greece*

Abstract— The aim of this work is to establish some basic methodological aspects that should not be ignored in the arduous task of the development of telemedical platforms for the efficient control and management of chronic elderly patients. Among the main methodological proposed concepts should be: an integrated market-oriented approach, a usercentered design, an evaluation-driven development and a work plan organization. This work presents the methodology applied to Autonomy, Motivation,& Individual Self Management for COPD (Chronic Obstructive Pulmonary Disease) Patients (AMICA), project funded by the European Union (EU).

Fr.1.4.4 **10:15-10:30**

Privilege Management Infrastructure for Virtual Organizations in Healthcare Grids

Isabel Román[1], Jorge Calvillo[1,2], Sergio Rivas[1,2] and Laura M. Roa[1,2]

[1]*Área de Ingeniería Telemática, Universidad de Sevilla, Seville, Spain*
[2]*ISCIII initiative CIBER of Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN) Seville, Spain*

Abstract— This paper is focused in the management of virtual organizations (VO) inside healthcare environments where GRID technology is used as middleware for a healthcare services oriented architecture (HSOA). Some of the main tasks considered for the provision of a well established VO management are: management of users, assignation of roles to users, assignation of privileges to roles, definition of resources access policies. These tasks are extremely close to privilege management infrastructures (PMI), so we face VO management services as part of the PMI supporting access control to healthcare resources inside the HSOA.

Fr.1.4.5 **10:30-10:45**

Distributed Processing Methodology for Biomedical Sensor Networks: An Optimal Approach

Miguel Ángel Estudillo-Valderrama[1,2], Laura María Roa-Romero[1,2], Luis Javier Reina-Tosina[2,3] and David Naranjo-Hernández[1,2]

[1]*Biomedical Engineering Group, University of Seville, Spain*
[2]*CIBER-BBN, Spain*
[3]*Dept. of Signal Theory and Communications, University of Seville, Spain*

Abstract—In this paper, the major advantages of a distributed processing methodology developed in the context of Biomedical Sensor Networks (BSN) are compared to the most usual wireless communication topology architectures developed in the literature. These advantages are highlighted in the context of a distributed fall detection system developed by the authors in terms of more facilities for system personalization to the end user and multimodal functionality in order to extend the biomedical application domain of the system. As the main result, a lower power consumption of the devices pertaining to the system is shown.

Fr.1.4.6 **10:45-11:00**

Home care phonocardiography: an Italian experience

Maria Romano[1], Mario Cesarelli[1], Mariano Ruffo[1], Paolo Bifulco[1], Mariano Iaccarino[2] and Stefania Iaccarino[2]

[1] Department of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy
[2]"Iaccarino", Naples, Italy

Abstract— In this work we describe an Italian experience of foetal home monitor, based on a pilot system consisting of three phonocardiograph home monitors by Pentavox. Phonocardiography is non invasive and passive in nature and allows developing of low-cost and easy to use equipments. Its application in a telemonitoring system enhances diagnostic capabilities, allowing long-term measurements. The home monitors can have telemedicine

facilities as far as they can transfer data by GPRS to a remote server. Six selected patients, without effective pregnancy risk, were supplied with a lightweight ambulatory cardiotocograph (Fetaphon-home) equipped with two probes: a microphone and a pressure transducer. Monitoring covers the measurement of foetal heartbeat, uterine contractions and foetal movements. The selected patients were instructed by trained personnel in the use of the monitoring device. Patients were asked to perform the recording two times a week once and to transmit 20-min signal to the computer sever of reference centre. The home monitoring sessions were performed in addition to the routine surveillance at the clinic; thus, the study monitoring did not replace clinic visits. Preliminary measurements on the selected pregnant women have shown that the use of this methodology significantly reduces the need of travel for patients and consequently their stress. Moreover, the obtained results, even if performed on normal foetuses, suggest that, after a short training, pregnant women are able to record and transmit long traces without troubles. Use of telemedicine system was generally well accepted by pregnant women increasing the possibility of foetal long-term home surveillance which in turn could increase the efficiency of the service offered to pregnant women.

Friday Morning, Nov. 6

Special Session: **Fr.SS.2.1 2nd International Workshop on Computational Intelligence in Medical Imaging (CIMI 2009)**

Time & Place: **09:30-11:00, Venus**

Chairperson: **Gerald Schaefer**
Department of Science, Loughborough University, Loughborough, U.K.

Fr.SS.2.1.1 **9:30-9:45**
A new method for the detection of microcalcifications in mammograms

Farhang Sahba[1] and Anastasios Venetsanopoulos[2]

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[2]*Vice President of Research and innovation at Ryerson University, Toronto, Canada, and Professor Emeritus, University of Toronto, Toronto, Canada*

Abstract— The presence of microcalcifications clusters, which appear as small bright spots in mammographic images, can be considered as a very important sign for breast cancer diagnosis. They can, however, be hard to detect due to their size and low contrast from surrounding normal tissue. In this paper, a new fuzzy-based method is presented to provide an appropriate segmentation of microcalcifications. This approach consists of five major steps. In these steps, the selection of appropriate parameters for the required operations is performed based on the specific image characteristics. The experimental results show that this method can detect microcalcifications in a fast manner and give attractive performances compared to some other approaches.

Fr.SS.2.1.2 **9:45-10:00**
Filtering Normal Retinal Images for Diabetic Retinopathy Screening Using Multiple Classifiers

Jonathan Goh[1], Lilian Tang[1], George Saleh[2], Lutfiah Al turk[3],Yu Fu[1], Antony Browne[1]

[1]*Department of Computing, University of Surrey, Surrey, UK*
[2]*Moorfields Eye Hospital NHS Foundation Trust, London, UK*
[3]*Department of Statistics, King Abdulaziz University, Kingdom of Saudi Arabia*

Abstract— Diabetic retinopathy is a complication of diabetes and early detection is essential for effective treatment. In this paper, a novel technique for the separation of normal and abnormal retinal images is described. Various features are extracted from local sub images and then fed through multiple classifiers to categorise them into interim classes followed by a reasoning process to give a more reliable and robust result. This is then followed by a global analysis to decide the normality of the whole image.

Fr.SS.2.1.3 **10:00-10:15**

Skin lesion segmentation using cooperative neural network edge detection and colour normalisation

Gerald Schaefer[1], Maher Rajab[2], M. Emre Celebi[3] and Hitoshi Iyatomi[4]

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[2]*Department of Computer Engineering, Umm Al-Qura University, Makkah, Saudi Arabia*
[3]*Department of Computer Science, Louisiana State University, Shreveport, USA*
[4]*Department of Electrical Informatics, Hosei University, Tokyo, Japan*

Abstract— Lesion segmentation is an important step in analysing dermoscopic skin lesion images. In this paper we achieve accurate lesion segmentation using a co-operative neural network-based edge detection approach coupled with a pre-processing step that enhances colour information and contrast of the images. Extensive experiments are carried out on a dataset of 100 dermoscopic images with known ground truths obtained from three expert dermatologists. The results show that our approach is capable of providing good segmentation performance while the colour enhancement step leads to improved segmentation accuracy.

Fr.SS.2.1.4 **10:15-10:30**

Multi-agent segmentation for 3D medical images

Richard Moussa, Pascal Desbarats and Marie Beurton-Aimar

Laboratory Labri, Talence cedex, France

Abstract— Many medical image segmentation techniques have been proposed by lots of authors but they are mainly dedicated to particular solutions. There is no generic method for solving the image segmentation problem. The difficulty comes from that two types of noise are presented in medical images: physical noise due to the acquisition system, for example, Optical, X-rays and MRI1, and physiological noise due to the patient status. In this paper, we present a social spidersmethod which implements amulti-agent system with a biological behavior. After a presentation of the principles of this method, we will compare its results on brain MRI images with two other ones: Region Growing and Otsu thresholding methods. The segmentation method based on social spiders appears to be more robust to noise than classical methods on brain MRI images. Drawbacks of this method are also identified and solutions are proposed as a conclusion.

Fr.SS.2.1.5 **10:30-10:45**

3D-2D Image registration for craniofacial superimposition in forensic medicine using covariance matrix adaptation evolution strategy

Jose Santamaria[1], Oscar Cordon[2], Sergio Damas[2] and Oscar Ibañez[2]

[1]*University of Ja´en, Ja´en, Spain*
[2]*European Centre for Soft Computing, Mieres, Spain*

Abstract—Photographic supra-projection is a forensic process that aims to identify a missing person from a photograph and a skull found. One of the crucial tasks throughout all this process is the craniofacial superimposition which is usually carried out manually by forensic anthropologists; thus being very time consuming and presenting several difficulties when trying to find a good fit between the 3D model of the skull and the 2D photo of the face.
In this contribution we tackle craniofacial superimposition as a 3D-2D image registration problem by means of a covariance matrix adapted evolutionary strategy. Results on different superimposition problems of real-world identification cases solved by the Physical Anthropology lab at the University of Granada (Spain) are considered to test our proposal.
Index Terms—Image registration, evolutionary algorithms, CMA-ES, forensic identification, craniofacial superimposition.

Fr.SS.2.1.6 **10:45-11:00**
Perioperative cardiac risk prediction

Hitoshi Iyatomi[1], Tomotaka Kasamatsu[2], Jun Hashimoto[3], M.Emre Celebi[4], Gerald Schaefer[5] and Koichi Ogawa[1]

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[4]*Department of Computer Science, Louisiana State University in Shreveport, USA*
[5]*Department of Computer Science, Loughborough University, UK*

Abstract— In this study, which is based on data collected from 1351 referred patients, we used myocardial perfusion single-photon emission computed tomography (SPECT) for risk stratification before non-cardiac surgery. We generated binary classifiers using support vector machine (SVM) and conventional linear models for predicting perioperative cardiac events. Input data comprising clinical and surgical risk factors as well as SPECT findings was interpreted to predict the occurrence of all and hard cardiac events. Our SVM models achieved 0.884 and 0.892 in terms of AUC (area under the receiver operating characteristic curve) in predicting all cardiac events and hard events respectively, and were shown to be superior to linear models for risk stratification. We also found an incremental prognostic value of SPECT results over information about clinical and surgical risk.

Friday Morning, Nov. 6

Session: **Fr.3.4 Biosignals IV: Fetus and Newborn**

Time & Place: **09:30-11:00, Minerva**

Chairperson: **Lenka Lhotská**
Dept. of Cybernetics FEE CTU in Prague, Prague, Czech Republic

Fr.3.4.1 **9:30-9:45**
PSD modifications of FHRV due to CTG storage rate

Mario Cesarelli, Maria Romano, Mariano Ruffo, Paolo Bifulco, Giulio Pasquariello and Antonio Fratini

Department of Biomedical, Electronic and Telecommunication Engineering, University "Federico II", Naples, Italy

Abstract—Cardiotocographic data provide physicians information about foetal development and, through assessment of specific parameters (like accelerations, uterine contractions, …), permit to assess conditions such as foetal distress. An incorrect evaluation of foetal status can be of course very dangerous. In the last decades, to improve interpretation of cardiotocographic recordings, great interest has been dedicated to FHRV spectral analysis. It is worth reminding that FHR is intrinsically an uneven series and that to obtain evenly sampled series, many commercial cardiotocographs use a zero-order interpolation (storage rate of CTG data equal to 4 Hz). This is not suitable for frequency analyses because interpolation introduces alterations in the FHR power spectrum. In particular, this interpolation process can produce artifacts and an attenuation of the high-frequency components of the PSD that, for example, affects the estimation of the sympathovagal balance (SVB - computed as low-frequency/high-frequency ratio), which represents an important clinical parameter. In order to estimate the frequency spectrum alterations due to zero-order interpolation and other CTG storage rates, in this work, we simulated uneven FHR series with set characteristics, their evenly spaced versions (with different storage rates) and computed SVB values by PSD. For PSD estimation, we chose the Lomb method, as suggested by other authors in application to uneven HR series.

Fr.3.4.2 **9:45-10:00**
Fetal heart rate data pre-processing and annotation

Václav Chudáček[1], Michal Huptych[1], Lenka Lhotska[1], Michal Koucký[2], Lukáš Bauer[1] and Jiří Spilka[1]

[1]*Cybernetics FEE CTU in Prague, Prague, Czech Republic*
[2]*Gyneacology and Obsterics unit of the Charles University Hospital, Prague, Czech Republic*

Abstract— Recording of the cardiotocogram (CTG) consists of fetal heart rate (fHR) and tocographic signal. This method is used routinely for intrapartal evaluation of the well being of the fetus. In this paper we present our approach to preprocessing of the fHR signal. Additionally we present annotation software that was developed in order to obtain new expert annotations of the recordings in our newly established database.

Fr.3.4.3 **10:00-10:15**

Assessment of non-linear features for intrapartal fetal heart rate classification

Jiří Spilka[1], Václav Chudáček[1], Michal Koucký[2] and Lenka Lhotská[1]

[1]*Dept. of Cybernetics FEE CTU in Prague, Prague, Czech Republic*
[2]*Gyneacology and Obsterics unit of the Charles University Hospital, Prague, Czech Republic*

Abstract — Fetal heart rate (fHR) is used to evaluate the fetal well-being during the delivery. It provides information of fetal status and allows doctors to detect ongoing hypoxia. The routine intrapartal evaluation is based on description of macroscopic morphological features of the fHR baseline. FHR contains more information than is used so far, therefore in this work we have focused on evaluation of nonlinear features for fHR signal description. Our data set consists of 189 recordings. Signals with umbilical artery pH less then 7.15 were considered pathological. From each record, 20-minute segment directly preceding the delivery, was chosen. Artifacts were removed from the data and all segments were resampled to 4 Hz sampling frequency. Fractal dimension of attractor, fractal dimension of waveform, entropy, and complexity were used as features. The particular methods used to compute the features were: correlation method for estimation of attractor dimension; Higuchi's, variance, and box counting method for estimation of waveform fractal dimension; approximate and sample method for estimation of entropy and also the Lempel Ziv Complexity was computed. All features were evaluated using Mann-Whitney U test and those fulfilling the statistical significance with $p<0.01$ were used for further computations. Ten fold cross-validation classification using decision tree and SVM approach was carried out. Overall sensitivity and specificity of 70%, comparable to inter-observer variability, was acquired.

Fr.3.4.4 **10:15-10:30**

Feature Extraction and Classification of EEG Sleep Recordings in Newborns

Vladana Djordjevic[1], Natasa Reljin[2], Vaclav Gerla[3], Lenka Lhotska[3] and Vladimir Krajca[4,5]

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[2]*Dept of Mathematical Sciences, Delaware State University, DE, USA*
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[4]*Department of Neurology, Faculty Hospital Na Bulovce, Prague, Czech Republic*
[5]*Faculty of Biomedical Engineering, Czech Technical University in Prague, Czech Republic*

Abstract—Visual evaluation of long-term EEG recordings is very difficult, time consuming and subjective process. This paper aims to present the research and development of a comprehensive scheme for computer-assisted recognition of behavioral states of sleep in

newborns. In clinical practice, the ratio of behavioral states (wakefulness, quiet and active sleep) is used as an important indicator of the brain maturation. Analysis was performed offline, on real clinical data, with the assumption that each EEG channel in recording was independent from others and equally important for analysis and classification. The proposed solution comprises several consecutive steps of signal preprocessing and processing, with focus on segmentation, feature extraction and selection, and classification. Performed classification was based on linear support vector machines and performance was evaluated through cross validation. Obtained results can be used as a reference for developing or enhancing neonatal sleep EEG/PSG classification algorithms.

Fr.3.4.5 **10:30-10:45**

Visualization Methods used for Evaluation of Neonatal Polysomnographic Data

Vaclav Gerla[1], Vladana Djordjevic[1], Lenka Lhotska[1] and Vladimir Krajca[2]

[1]*Czech Technical University in Prague, GerstnerLaboratory, Prague, Czech Republic*
[2]*Czech Technical University in Prague, Faculty of Biomedical Engineering, Czech Republic*

Abstract— Polysomnographic (PSG) signal processing represents a complex process consisting of several subsequent steps, namely pre-processing, segmentation, extraction of descriptive features, and classification. In this paper we focus on visualization methods that are also unseparable part of the whole process. The aim of these methods is to ease the work of medical doctors and to show trends that are not obvious when performing a manual inspection of the recorded signal. In this study, the designed methods are applied to neonatal PSG data and enable the enhancement in visual differentiation between three important behavioral states: quiet sleep (QS), active sleep (AS) and wakefulness (WK). The ratio of these states is a significant indicator of the maturity of the newborn brain in clinical practice.

Friday Morning, Nov. 6

Session: **Fr.4.1.O Diagnostic & Therapeutic Systems I**

Time & Place: **09:30-11:00, Diana**

Chairperson: **George Spyrou**
Academy of Athens Biomedical Research Foundation, Athens, Greece

Fr.4.1.1 **9:30-9:45**

Prognosis of collapse of the osteonecrosis of the femoral head for patients treated with a tantalum rod by determining location and size of the lesion

Stelios Koumpoyiannis[1], Nikolaos Aravas[2], Socrates Varitimidis[3], Konstantinos Malizos[3] and Elias Houstis[3]

[1]*Department of computer and Communication Engineering University of Thessaly, Volos, Greece*
[2]*Department of Mechanical Engineering University of Thessaly, Volos, Greece*
[3]*Orthopaedic Department, University Hospital of Larissa, Larissa Greece*

Abstract—The purpose of this study is to predict the osteonecrosis of the femoral head by examining the location and size of the lesion of the femoral head. A triangulation approximation algorithm is used for the computation of the geometric center of the lesion based on magnetic resonce imaging scans for patients treated with a tantalum rod. Twenty eight patients (thirty four hips) with osteonecrosis of the femoral head were treated with the tantalum rod procedure. Then mean age was 39,21 years (14 - 59). All necrotic lesions were confirmed by magnetic resonance imaging. A customized triangulation approximation algorithm was de-veloped in order to compute the geometric center of the lesion of the reconstructed model. Lesion volume, the distance from the origin (ρ or R), latitude (ϕ) and longitude (θ) of the geometric center of the lesion within the femoral head were calculated. The mean follow-up was 3 (1-7) years. Ten hips (29.4%) showed radiographic progression. Statistical method Cox regression analysis showed that lesion volume and longitude angle (θ) were important factors to predict radiographic progression. Lesions having an angle (θ) of [15º - 35º] and [50 º- 60 º] and size c in Steinberg scale with lesion size greater than 27% of the femoral head were more likely to develop radiographic progression. For hips that developed radiographic progression out of this range, lesion size was the only significant factor. The results suggest that lesion volume is an important factor strongly correlated with the risk of collapse of the femoral head. The location of the lesion of the necrotic area is an important supplemental parameter in order to predict with accuracy the progression of the disease. However further studies with the current algorithm that computes the geometric center of the lesion, larger study groups and long-term follow-up are needed in order to predict accurately the progression of the disease and the collapse of the femoral head.

Fr.4.1.2 **9:45-10:00**

Feature Selection on Chronic Pain Self Reporting Data

Yan Huang[1], Huiru Zheng[1], Chris Nugent[1], Paul McCullagh[1], Norman Black[1], Kevin Vowles[2] and Lance McCracken[3]

[1]*University of Ulster, Jordanstown, UK*
[2] *Centre for Pain Research, University of Bath, UK & Haywood Hospital, Stoke-on-Trent, UK*
[3]*University of Bath, UK*

Abstract— Chronic pain is a common long-term condition that changes patients' physical and emotional functioning. Currently, the integrated biopsychosoical approach is the mainstay treatment for patients with chronic pain. Self reporting (the use of questionnaires) is one of the most common methods to evaluate treatment outcome. Nevertheless, a large number of questions (for example 329 questions in this study) may be required and as such may be viewed as not being convenient for patients to complete. This paper has applied the theory of information gain to rank the questions in addition to investigating important factors related to the treatment outcome. Analysis within the study ranked the questions from 1 to 329 based on information gain (highest to lowest). Results showed that questions related to chronic pain coping strategies and value-based actions had high information gain. Four supervised learning classifiers were used to investigate the correlations between feature numbers and classification accuracy. The results showed classifier that a Multi-layer Perceptron classifier obtained the highest classification accuracy (96.05%) on an optimized subset which consisted of 133 questions.

Fr.4.1.3 **10:00-10:15**

Clinical Massage Therapy with the Oral-Rehabilitation Robot in Patients with Temporomandibular Joint Disorders

Yuichi Obokawa[1], Jorge Solis[3], Hiroyuki Ishii[2], Hiroki Koga[1], Atsuo Takanishi[4] and Akitoshi Katsumata[5]

[1]*Department of Modern Mechanical Engineering, Waseda University, Japan*
[2]*Consolidated Research Institute for Advanced Science and Medical Care, Waseda University, Japan*
[3]*Department of Modern Mechanical Engineering, Waseda University; and at the Humanoid Robotics Institute (HRI), Waseda University, Japan*
[4]*Department of Modern Mechanical Engineering, Waseda University & Humanoid Robotics Institute (HRI), Waseda University, Japan*
[5]*Department of Dentistry, Asahi University, Gifu, Japan*

Abstract— It is well known that the massage therapy is useful for the rehabilitation of various diseases (i.e. oral health problems, etc.). Although various apparatus have been developed for the massage of the torso and limbs, there is still little knowledge about their real effectiveness. For this purpose, authors have proposed the development of a robotic system that provides massage therapy of the maxillofacial region to patients with temporomandibular joint disorders. As a result of our research, we have developed the Waseda Asahi Oral-Rehabilitation No.1 (WAO-1), which it is composed by two six degrees of freedom arms with plungers attached at their end effector. Preclinical tests were carried out to confirm the effectiveness of the proposed system. In order to evaluate the safety

measures of the applied forces during the massage therapy, we have based our analysis on the Visual Analogue Scale (VAS) which is a conventional subjective evaluation methods commonly used in the medical field. From the experimental results, we could confirm the effectiveness of the therapy provided by WAO-1.

Fr.4.1.4 **10:15-10:30**

Design of MR-compatible robotic devices: magnetic and geometric compatibility aspects

Christoforos Keroglou[1], Nikolaos Tsekos[1], Ioannis Seimenis[2], Eleni Eracleous[2], Christodoulos Christodoulou[3], Constantinos Pitris[1] and Eftychios Christoforou[4]

[1]*Dept. of Electrical and Computer Engineering, University of Cyprus, Cyprus*
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Abstract—Specially designed robotic manipulators have been proposed for the performance of minimally invasive interventions under real–time magnetic resonance imaging (MRI) guidance. The design of MR–compatible robotic systems is a challenging task given the limitations imposed by the magnetic nature of the scanning environment but also the geometry of a high–field cylindrical scanner. These issues are discussed with special emphasis on geometric MR– compatibility. Acquired MR images are used for the analysis of the available space inside the scanner in order to provide the necessary input for the design of interventional devices

Fr.4.1.5 **10:30-10:45**

Liver ablation using a high intensity focused ultrasound system and MRI guidance

Christakis Damianou[1], Cleanthis Ioannides[2], Nicos Mylonas[1,3], Venediktos HadjiSavvas[1,3], Andreas Couppis[1,3] and Dimitris Iosif[1,3]

[1]*Frederick University Cyprus, Nicosia, Cyprus*
[2]*Polikliniki Igia, Limassol, Cyprus*
[3]*City University, London, UK*

Abstract—The effectiveness of magnetic resonance imaging (MRI) to monitor thermal lesions created by High Intensity Focused Ultrasound (HIFU) in rabbit liver in vivo is investigated. The MRI sequences of T1-weighted, and T2-weighted fast spin echo (FSE) were evaluated. The main goal in this paper was to find the range of repetition time (TR) and range of echo time (TE) which maximizes the contrast to noise ratio (CNR). An ultrasonic transducer operating at 2 MHz was used, which is navigated using a positioning device. With T1W FSE the range of TR under which CNR is maximized ranges from 400 to 900 ms. The maximum contrast measured is pproximately 25. With T2W FSE the range of TE that establishes maximum contrast is between 40 ms and 80 ms, with CNR of approximately 14. T1W FSE is much better than T2W FSE in detecting thermal lesions in liver. Both T1W and T2 W FSE were proven successful to image thermal lesions created by HIFU in rabbit liver in vivo.

Fr.4.1.6 **10:45-11:00**

Penetration of high intensity focused ultrasound ex vivo and in vivo rabbit brain using MR imaging

Venediktos Hadjisavvas[1,2], Christakis Damianou[1,3], Panayiotis Kyriacou[2], Cleanthis Ioannides[4], Nicos Mylonas[1,2], Andreas Couppis[1,2], Dimitris Iosif[1], Gavriella Parea[3] and Theodoros Chadjicharalambous[3]

[1]*Frederick University Cyprus, Nicosia, Cyprus*
[2]*City University, London, UK*
[3]*MEDSONIC LTD, Limassol, Cyprus*
[4]*Polikliniki Igia, Limassol, Cyprus*

Abstract—In this paper magnetic resonance imaging (MRI) is investigated for monitoring the penetration of high intensity focused ultrasound (HIFU) in vitro and in vivo rabbit brain. A single element spherically focused transducer of 5 cm diameter, focusing at 10 cm and operating at 2 MHz was used. A prototype MRI- compatible positioning device is described. MRI images were taken using fast spin echo (FSE). The length of the lesions in vivo rabbit brain was much higher than the length in vitro, proving that the penetration in the in vitro brain is limited by reflection due to trapped bubbles in the blood vessels.

Friday Morning, Nov. 6

Session: **Fr.1.5 eHealth IV: e&m Health Systems**

Time & Place: **11:30-13:00, Les Etoiles**

Chairperson: **Efthyvoulos Kyriacou**
Department of Computer Science,
Frederick Institute of Technology, Nicosia, Cyprus

Fr.1.5.1 **11:30-11:45**
An e-Health Solution for Ambulatory Facilities

Petar Rajkovic, Dragan Jankovic and Tatjana Stankovic

Faculty of Electronic Engineering, University of Nis, Nis, Serbia

Abstract —Ambulatory segment of the Serbian public health system has a complex organization and much operational inefficiency, so it needs significant information technology (IT) support to perform all its operational aspects better. Our main goal is to create software, suited to satisfy the needs of the Serbian public healthcare system. This system development experience paper presents the results of our project that aims to develop IT support for public ambulatory healthcare facilities, with special emphasis on the improvement of environment for the work of general practitioners. Architectural overview, as well as main usage scenario of proposed solution is presented by this paper in order to illustrate how we are including and adapting modern MIS concepts in challenging circumstances of a health care organization in our country. Another crucial requirement for our software, due to too low level of IT education of medical staff in Serbia, was that the medical information system (MIS) interface should resemble the actual paper documents as much as possible.

Fr.1.5.2 **11:45-12:00**
Localisation of Forgotten Items using RFID Technology

Josef Halberg[1], Chris Nugent[2], Richard Davies[2] and Mark Donnelly[2]

[1]*Computer Science and Electrical Engineering department at Luleå University of Technology, Sweden*
[2]*Computer Science Research Institute and School of Computing and Mathematics at University of Ulster, Northern Ireland*

Abstract— The frequency with which items are misplaced increases with age, leading to increased frustration and anxiety especially for those who develop cognitive impairments such as dementia. Providing ICT support to assist with relocating items can significantly contribute to sustain independent living. In this paper we present a method for locating RFID tagged items throughout a home environment. Specifically, items are located by comparing

and analysing signal strength, received from tagged items, with that received from a number of fixed location reference tags. This paper presents experiments which have been performed within a typical living environment using homogeneous and practical placement of reference tags. This is performed to consider the feasibility of RFID positioning in such environments. Results obtained indicate that the approach provides acceptable location estimation in pervasive environments with sparsely placed reference tags, however, further investigation is required to accurately quantify its value.

Fr.1.5.3 **12:00-12:15**

SCP-ECG in an ISO/IEEE 11073-PHD world: Store-and-Forward Transmission and Messaging Part

Jesús Trigo[1], Franco Chiarugi[3], Álvaro Alesanco[1], Miguel Martínez de Espronceda[2], Luis Serrano[2], Catherine Chronaki[3], Javier Escayola[1], Ignacio Martínez[1] and José García[1]

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[3]*Biomedical Informatics Laboratory, Institute of Computer Science (ICS), Foundation for Research and Technology – Hellas (FORTH), Heraklion, Crete, Greece*

Abstract—The storage and retrieval of digital ECGs in a standard-compliant way has been a key issue during the last decades. The SCP-ECG standard, one of the top efforts in this area, has been recently approved as part of the ISO/IEEE 11073 (x73) family of standards, a reference standard for medical device interoperability. For the Personal Health Device (PHD) version of the x73 standard several devices have been defined, but an ECG device specialization is not yet available. In this paper, the relationships between the SCP-ECG fields and messages and the particular way of the x73-PHD standard to deal with stored data are investigated and discussed. A proofof- concept implementation of the x73-PHD storage and retrieval method applied to ECGs is also presented, identifying open issues and potential modifications to be considered for the wider interoperability adoption of x73-PHD standards.

Fr.1.5.4 **12:15-12:30**

Short-term relaxation responses to a voice-guided mobile phone relaxation application and self-guided relaxation

Juho Merilahti[1], Elina M. Mattila[1], Johan Plomp[1], Klaus Laine[2] and Ilkka Korhonen[1]

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[2]*Finnish Institute of Occupational Health, Finland*

Abstract—Short-term relaxation responses to a mobile phone based voice guided relaxation (SelfRelax) and a selfguided relaxation are studied. The relaxation responses are measured with State-Trait Anxiety Inventory's Form Y-1 (state), blood pressure, heart rate, and heart rate variability features (HRV). Data from fourteen subjects and 73 relaxation sessions were included in the analysis. Relaxation sessions were made in two days during normal daily life. The relaxation decreased STAI Form Y-1 scores by 5.5 points on average when pre- and post-relaxation levels were compared. Small differences were observed between the two

relaxation methods. Systolic blood pressure decreased significantly with both relaxation methods in subjects whose pre-relaxation pressures were > 140 mmHg. Data collected with a beat-tobeat heart rate logger turned out to be poor quality and were analysed as separate cases. Overall, the subjects gave positive feedback on the mobile phone application.

Fr.1.5.5 **12:30-12:45**

Implementation of a Prescription Fraud Detection Software Using RDBMS Tools and ATC Coding

Anastassios Tagaris, Panteleimon Mnimatidis and Dimitrios Koutsouris

Biomedical Engineering Laboratory, National Technical University of Athens, Athens, Greece

Abstract – During the last years, need for increased funding for national health services offered to citizens is rising [1]. The reasons are (i) decreased ratio of working population/pensioners, as well as (ii) increase of life expectancy. Thus, high priority should be given to safeguarding the reliable administration of the financial resources devoted to this purpose. This paper describes the application of a "clever" system which can be used by social security bodies (SSBs) and healthcare providers for: a) Electronic data entry of prescriptions written by doctors to patients, b) Check of prescriptions against predefined rules entered in the system for errors or possible fraud, reporting all «suspicious» cases. In addition, an integrated system for administering prescriptions was implemented, that offers the ability to query, view and print data in the format required by the user. The application was designed and implemented using Microsoft Access 2002 relational database system environment. For testing the application, data by the Greek Social Security Body of people working in Healthcare (namely T.S.A.Y.) were used; all personal information was removed.

Fr.1.5.6 **12:45-13:00**

Integrated platform for continuous monitoring of children with suspected cardiac arrhythmias

Efthyvoulos Kyriacou[1], Demetris Hoplaros[2], Constantinos Pattichis[2], Antonis Josif[3], Kounoudes Anastasis[4], Milis Marios[4]

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[2]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*
[3]*Paedi Center for Specialized Pediatrics, Cyprus*
[4]*Signal Generix, Cyprus*

Abstract – Children cardiac arrhythmias constitute one of the most difficult problems in cardiology both in terms of diagnosis and management. In such cases continuous monitoring of ECG vital signs and environmental conditions can significantly improve the identification of a possible arrhythmia. In this study we present the design and development of a system which enables continuous monitoring of children, from the hardware and software perspective. The system is able to do real-time acquisition and transmission of ECG signals, and facilitate an alarm scheme able to identify possible arrhythmias so as to notify the on-call doctor and the relatives of the child that an event may be happening. In-house monitoring of a child is performed using a sensor network able to record and transmit ECG and the living conditions, while outside the house, monitoring is performed through a GPRS

enabled device. The transmitted information can be accessed through a web based platform which facilitates previous medical record and monitoring information of the patient. The system initial design and development steps are finished and the initial tests performed on healthy volunteers proved to be very promising.

Friday Morning, Nov. 6

Session: **Fr.2.4 Medical Imaging IV: Segmentation II**

Time & Place: **11:30-13:00, Venus**

Chairperson: **Styliani Petroudi**
Department of Electrical and Computer Engineering,
University of Cyprus, Cyprus

Fr.2.4.1 **11:30-11:45**
Improving Medical Image Perception By Hierarchical Clustering Based Segmentation

Arul N. Selvan[1], Reza Saatchi[1] and Christine M. Ferris[2]

[1]*Faculty of Arts Computing, Engineering and Sciences, Sheffield Hallam University, Sheffield, United Kingdom*
[2]*Faculty of Health and Wellbeing, Engineering and Sciences, Sheffield Hallam University, Sheffield, United Kingdom*

Abstract— It has been well documented that radiologists' performance is not perfect: they make both false positive and false negative decisions. For example, approximately thirty percent of early lung cancer is missed on chest radiographs when the evidence is clearly visible in retrospect [1]. Currently Computer-Aided Detection (CAD) uses software, designed to reduce errors by drawing radiologists' attention to possible abnormalities by placing prompts on images. Alberdi et al examined the effects of CAD prompts on performance, comparing the negative effect of no prompt on a cancer case with prompts on a normal case. They showed that no prompt on a cancer case can have a detrimental effect on reader sensitivity and that the reader performs worse than if the reader was not using CAD. This became particularly apparent when difficult cases were being read. They suggested that the readers were using CAD as a decision making tool instead of a prompting aid. They conclude that "incorrect CAD can have a detrimental effect on human decisions" [2]. The goal of this paper is to explore the possibility of using Hierarchical Clustering based Segmentation (HCS) [3], as a perceptual aid, to improve the performance of the reader.

Fr.2.4.2 **11:45-12:00**
Extended Vector Field Convolution Snake for Highly Non-convex Shapes Segmentation

Tiberiu Radulescu and Vasile Buzuloiu

Image Processing and Analysis Laboratory, Universitatea "Politehnica" din Bucuresti, Romania

Abstract—Snakes, or active contours, are one of the major paradigms in image segmentation and they are extensively applied for the processing of the biomedical images.

With the vector field convolution (VFC) as external force, they have a larger capture range and the ability to progress into concave boundaries. However, when we have to deal with highly nonconvex shapes, the VFC field forms an area where the forces point in opposite directions and the snake stops before getting into the concavity if it is initialized outside. This field could be tailored by adding an anisotropic term that has as the result a displacement of the vector field upon a certain direction. We use this feature to drain the vector field out of the highly nonconvex boundaries and we propose in this paper an image driven mechanism to generate this anisotropic term.

Fr.2.4.3 **12:00-12:15**

Phase Based Level Set Segmentation of Ultrasound Images

Ahror Belaid[1], Djamal Boukerroui[1], Jean-Francois Lerallut[1] and Yves Maingourd[2]

[1]*Université de Technologie de Compiègne, Centre de Recherches de Royallieu, France*
[2]*Pediatric Échocardiographic Center, CHU Amiens, France*

Abstract—Ultrasound images segmentation is a difficult problem due to speckle noise, low contrast and local changes of intensity. Intensity based methods do not perform particularly well on ultrasound images. However, it has been previously shown that these images respond well to local phase-based methods which are theoretically intensity-invariant. Here, we use level set propagation to capture the left ventricle boundaries. This uses a new speed term based on local phase and local orientation derived from the monogenic signal, which makes the algorithm robust to attenuation artefact. Furthermore, we use Cauchy kernels, instead of the commonly used log-Gabor, as pair of quadrature filters for the feature extraction. Preliminary results show that the proposed method can robustly handle noise, and captures well the low contrast boundaries.

Fr.2.4.4 **12:15-12:30**

Mammographic Segmentation Based on Mammographic Parenchymal Patterns and Spatial Moments

Wenda He[1], Erika Denton[2] and Reyer Zwiggelaar[1]

[1]*Department of Computer Science, Aberystwyth University, Aberystwyth, UK*
[2]*Department of Radiology, Norfolk & Norwich University Hospital, Norwich, UK*

Abstract—Strong evidence shows that characteristic patterns of breast tissues as seen on mammography, referred to as mammographic parenchyma patterns, provide crucial information about breast cancer risk. Quantitative evaluation of the characteristic mixture of breast tissues can be used as for mammographic risk assessment as well as for quantification of change of the relative proportion of different breast tissue patterns. This paper investigates mammographic segmentation based on spatial moments and prior information of mammographic building blocks (i.e. nodular, linear, homogenous, and radiolucent) as described by Tab´ar's tissue models to describe parenchyma patterns. The algorithm extracted texture features from a set of subsampled mammographic patches. Tab´ar's mammographic building blocks were modeled as statistical distribution of clustered filter responses based on spatial moments. Evaluation was based on the Mammographic Image Analysis Society (MIAS) database. The experimental results indicated that the

developed methodology is capable of modeling complex mammographic images and can deal with intraclass variation and noise aspects. The results show realistic segmentation on tissue specific regions with respect to breast anatomy and Tab´ar's tissue models. In addition, the segmentation results were used for mammographic risk based classification of the entire MIAS database resulting in s70% correct low/high risk classification.

Fr.2.4.5 **12:30-12:45**

Segmentation of Colorectal Pathology Images using Level Sets

Styliani Petroudi[1,2] and Michael Brady[2]

[1]*Department of Electrical and Computer Engineering, University of Cyprus, Cyprus*
[2]*Wolfson Medical Vision Lab, Department of Engineering Science, University of Oxford, UK*

Abstract—Colorectal cancer is the third most common cancer diagnosed in men and women. Generally surgery is by total excision of the mesorectum (TME), though it often has a poor outcome due to affected lymph nodes close to the resection boundary. Advancements in diagnosis and treatment of colorectal cancer require integration of information from different sources such as pathology macroscopic and microscopic images and Magnetic Resonance Images. Evaluation of the mesorectal fascia and the rectal wall are important for both staging the cancer and predicting the outcome of the TME. An algorithm is developed for segmentation of the rectal wall on macroscopic pathology slice images. The information is vital for registration of the images for reconstruction of the resected volume but more importantly for fusion of images in order to evaluate different measures and establish correspondences across modalities. The resected specimen is segmented from the background using thresholding. Following, a number of features such as intensity different order statistics and phase information are evaluated for the region of interest. The features are incorporated in a level set framework for the segmentation of the rectal wall.

Fr.2.4.6 **12:45-13:00**

Segmentation of MR Brain Images with Bias Artifact

Edoardo Ardizzone, Roberto Pirrone, Orazio Gambino and Francesco Alagna

DINFO – Dipartimento di Ingegneria Informatica viale delle Scienze, Universita' degli Studi di Palermo, Palermo, Italy

Abstract-MR Images corrupted by RF–Inhomogeneity (bias artifact) exhibit brightness variations across the image. As a consequence, a standard Fuzzy C-Means (fcm) segmentation algorithm may fail. In this work we show a new general purpose bias removing algorithm, which can be used as a preprocessing step for a fcm segmentation. We also compare our experimental results with the ones achieved by using E2DHUM filter, showing an improvement in brain segmentation and bias removal.

Friday Morning, Nov. 6

Session:	**Fr.3.5 Biosignals V: ECG**
Time & Place:	**11:30-13:00, Minerva**
Chairperson:	**Christina Orphanidou** ***Institute of Biomedical Engineering, Dep. of Engineering Science, University of Oxford, Oxford, UK***

Fr.3.5.1 **11:30-11:45**

Intensive Care Window: Real time monitoring and analysis in the Intensive Care environment

Nikolas Stylianides[1], Marios Dikaiakos[1], George Panayi[2] and Theodoros Kyprianou[2]

[1]*Dept. Computer Science, University of Cyprus, Cyprus*
[2]*Intensive Care Unit, Nicosia General Hospital, Cyprus*

Abstract— This paper introduces a novel, open source software named Intensive Care Window, ICW. ICW enables communication with intensive care unit bedside installed medical devices over standard and proprietary communication protocol stacks, facilitates the acquisition of vital signs and physiological parameters exported from patient attached medical devices and sensors. Moreover, ICW provides run-time and/or post analysis procedures for data annotation, data visualisation, data query and analysis. The ICW application can be deployed as a stand alone solution or in conjunction with existing clinical information systems providing a holistic solution to inpatient medical condition monitoring, early diagnosis and prognosis.

Fr.3.5.2 **11:45-12:00**

Development of heart rate and respiration rate measurement system using body-sound

Hiroyasu Miwa[1] and Kensaku Sakai[2]

[1]*Digital Human Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Tokyo, Japan*
[2]*Feel Fine Co. Ltd., Tokyo, Japan*

Abstract— Humans are subjected to large amounts of stress during daily life. Mental health and stress management in daily life are essential to prevent mental illness. We investigate whether or not mental stress shows recognizable displacements of measurable physiological signals. We have therefore been developing new physiological signal sensors for measurement of daily stress. The present study focused on “body-sound”, as the sounds generated inside the human body and included large amounts of information about physiological and mental conditions. We then developed a prototype of body-sound sensor, and measured heart rate and respiratory rate simultaneously from body-sound at the neck using continuous wavelet transformation. Finally, we compared the body-sound with electrocardiogram and respiratory waveform to evaluate the performance of proposed method.

Fr.3.5.3 **12:00-12:15**

Spectral fusion for estimating respiratory rate from the ECG

Christina Orphanidou[1], Oliver Brain[1], Shahab Khan[3], Jacques Feldmar[2], James Price[3] and Lionel Tarassenko[1]

[1]Institute of Biomedical Engineering, Dep. of Engineering Science, University of Oxford, Oxford, UK
[2]Oxford BioSignals, Brook House, Abingdon, UK
[3]John Radcliffe hospital, Oxford, UK

Abstract— A new method for extracting respiratory signals from the electrocardiogram ECG) is proposed. The method performs AR spectral analysis on heart rate variability and beat morphology information extracted from the ECG and identifies the closest matched frequencies which then provide an estimate of the respiration frequency. Fusing frequency information from different sources reliably rejects noise and movement-induced artefact and is promising for application to ambulatory hospital data. The performance of the method was validated on two databases of simultaneously recorded ECG and reference respiration signals. The spectral fusion technique is found to correctly estimate respiratory rate 90% of the time in the case of non-ambulatory data and 86% of the time in the case of ambulatory data with a root mean square error of 0.92 and 1.40 breaths per minute, respectively.

Fr.3.5.4 **12:15-12:30**

A new approach of unconstrained sleep monitoring and Pulse Transit Time extraction using PPG pillow and CC-ECG electrode system

Jeong Su Lee, Gih Sung Chung, Do Un Jeong, and kwang Suk Park

Interdisciplinary Program of Bioengineering, Graduate School, Seoul National University, Republic of Korea

Abstract— In this paper, an unconstrained and noninvasive system to detect heart rate (HR), respiratory rate and extract pulse transit time (PTT) during sleep is proposed. The system consists of PPG sensor module embedded in a pillow and CC-ECG (capacitor coupled-ECG) sensor module. From the PPG sensor, we acquired heart rate and respiratory rate during sleep with simple peak detection algorithm. Besides, by employing extraction algorithms, PTT can be extracted from signal acquired with a CC-ECG electrode placed on a mattress. The result shows that HR and respiratory rate detection and PTT extraction have been successfully completed regardless of sleep position. This study suggests that the proposed system is promising to be used for continuous and unconstrained estimation of blood pressure during sleep.

Fr.3.5.5 **12:30-12:45**

CardioGrid: ECG Analysis on Demand to Detect Cardiovascular Abnormalities

Ibrahim Khalil, and Fahim Sufi

School of Computer Science and IT, RMIT University, Melbourne, Australia

Abstract— As the number of Cardiovascular related deaths is increasing not only in the western world but also in the developing countries, and there are only limited cardiac diagnosis related resources, it is expected that many healthcare centres will turn to automated diagnosis of ECGs for large number of patients. While systems and tools have been proposed and developed for a handful of cardiovascular diseases, no integrated system exists that can process and analyze very large number of patients on a powerful networked platform to serve healthcare centers online in a cost effective manner. In this paper, we therefore, propose an architecture of a CardioGrid system that allows large number of healthcare centers to submit electrocardiogram (ECGs) of their patients and receive analyzed and annotated reports online. Various functional components of the system have been explain ed to show how the system would work in real-life. A prototype has been built that is capable of diagnosing numerous Cardiovascular diseases, but the proposed architecture also allows the system to continuously learn abnormal patterns from submitted ECGs and annotations from cardiologists. We expect such a system to be useful not only for serious cardiac patients and ageing populations, but also for people that want to get their status checked for wellness monitoring.

Fr.3.5.6 **12:45-13:00**

Methods for Evaluation of Central Hemodynamics and Detection of Indicators of Risk of Sudden Cardiac Death for Network Based Clinical Decision Support System

Algimantas Krisciukaitis[1], Renata Simoliuniene[1], Andrius Macas[2], Giedre Baksyte[2] and Remigijus Zaliunas[1]

[1]*Kaunas University of Medicine, Lithuania*
[2]*Clinics of Kaunas University of Medicine, Lithuania*

Abstract— Two methods for evaluation of crucial factors describing status of cardiologic patients based on advanced signal processing methods were incorporated into prototype network based clinical decision support system: a) novel method for chest impedance signal analysis enabling reliable evaluation of central hemodynamics in non-invasive way; b) method for automatic detection and evaluation of ECG T-wave alternans – predictor of sudden cardiac death. Both methods supplement each other and improve the quality of monitoring of patient status in intensive care unit.

Friday Morning, Nov. 6

Session: **Fr.4.2 Diagnostic & Therapeutic Systems II**

Time & Place: **11:30-13:00, Diana**

Chairpersons: **Costas Pitris**
Department of Electrical and Computer Engineering, University of Cyprus, Cyprus

Christodoulos Christodoulou
Department of Computer Science, University of Cyprus, Cyprus

Fr.4.2.1 **11:30-11:45**

Experimental Simulations of Ultrasonic Field Time-Development in 3D Ultrasonic Transmission Tomography

Dusan Hemzal[1], Igor Peterlík[2], Jiri Jan[3] and Jiri Rolecek[3]

[1]*Dept. of Condensed Matter Physics, Masaryk University, Brno, Czech Republic*
[2]*Faculty of Informatics, Masaryk University, Brno, Czech Republic*
[3]*Department of Biomedical Engineering, FEEC, Brno University of Technology, Brno, Czech Republic*

Abstract—The contribution presents the preliminary results of the 4D simulation (time-development in 3D space) of the ultrasonic field in the experimental computerized transmission tomography system. The temporal development is synthesized here from the dynamic-steady-state 3D harmonic simulations (based on Helmholtz formulation) by linearly combining those using proper complex weights. The results of the proposed method are then qualitatively compared to the measurements from the real equipment. The level to which the 4D simulations can be compromised by the used approximate boundary conditions is discussed. The ultimate aim of these simulations is to get better insight into the physics of the ultrasonic computed transmission tomography, which would enable better image reconstruction.

Fr.4.2.2 **11:45-12:00**

Spectral Analysis for Scatterer Estimation in Optical Coherence Tomography Images

Evgenia Bousi, Andreas Kartakoullis and Costas Pitris

Department of Electrical and Computer Engineering, University of Cyprus, Cyprus

Abstract—Optical Coherence Tomography (OCT) is an emerging medical imaging technology able to detect tissue microstructure in vivo and in situ. However, many changes, associated with diseases such as cancer, result in cellular and sub-cellular variations which are very important for the diagnosis but are below the resolution limit of OCT. Since the spectrum of

scattered light is structure-dependent, the spectral content of OCT signals depends on such features and can be used to extract information otherwise unavailable in standard OCT images. Spectral analysis of OCT has resulted in improved contrast which corresponds to scatterer size changes. In this paper, novel spectral analysis techniques, by means of autoregressive spectral estimation, discriminant analysis, clustering, and scatterer size calculations, are presented. These procedures result in quantitative and significantly more accurate measurements compared to previous techniques. They were initially tested on samples of microspheres, successfully identifying each with sensitivity and specificity of >90% and yielding diameter estimates within 16% of the actual size. The techniques were also applied to in vivo images of xenopus laevis tadpoles and ex vivo neurological samples and provided increased contrast between different tissues. Such methods could provide a very useful procedure for the identification of subtle changes in OCT images and could make available a tool for differentiating tissues based on scatterer size. Such a tool could prove extremely valuable in the evaluation of disease features which now remain below the resolution limit of OCT.

Fr.4.2.3 **12:00-12:15**

Retinal Image Analysis Aimed at Support of Early Neural-layer Deterioration Diagnosis

Jiri Jan, Jan Odstrcilik, Jiri Gazarek and Radim Kolar

Department of Biomedical Engineering, University of Technology Brno, Czech Republic

Abstract — The contribution aims at designing and testing an automatic method to estimate the status of the retinal neural fibre layer (NFL) based on analysing the output of the most common ophthalmological imaging modality – fundus camera images. As the neural layer manifests itself in these images rather faintly and is often hardly visible, the method has to utilize subtle features discoverable, with a reasonable reliability, only by combining different texture analysis approaches. The texture analysis must be preceded by detecting and removing the eye vessel structure overlaid on the neural layer thus hindering the proper NFL detection. The results of both analytic phases – the vessel structure segmentation and the neural layer detection – were evaluated using sets of both clinically obtained and international standard retinal image databases.

Fr.4.2.4 **12:15-12:30**

Thick Film Transducers for High Frequency coded Ultrasonography

Andrzej Nowicki[1], Janusz Wojcik[1], Rasmus Lou-Moeller[2], Marcin Lewandowski[1], Ryszard Tymkiewicz[1], Wanda Wolny[2] and Tomasz Zawada[3]

[1]*Institute of Fundamental Technological Research, Ultrasonic Department, Warsaw, Poland*
[2]*InSensor A/S*
[3]*Ferroperm Piezoceramics A/S – Hejreskovvej, Kvistgaard, Denmark*

Abstract—Recently a new technology of piezoelectric transducers based on PZT thick film has been developed as a response to a call for devices working at higher frequencies suitable for production in large numbers at low cost. Eight PZT thick film based focused transducers with resonant frequency close to 40 MHz were fabricated and experimentally investigated. The PZT thick films were deposited on acoustically engineered ceramic substrates by pad

printing. Considering high frequency and nonlinear propagation it has been decided to evaluate the axial pressure field emitted (and reflected by thick metal plate) by each of concave transducer differing in radius of curvature - 11 mm, 12 mm, 15 mm, 16 mm. All transducers were activated using AVTEC AVG-3A-PS transmitter and Ritec diplexer connected directly to Agilent 54641D oscilloscope. As anticipated, in all cases the focal distance was up to 10% closer to the transducer face than the one related to the curvature radius. Axial pressure distributions were also compared to the calculated ones (with the experimentally determined boundary conditions) using the angular spectrum method including nonlinear propagation in water. The computed results are in a very good agreement with the experimental ones. The transducers were excited with Golay coded sequences at 35-40 MHz. Introducing the coded excitation allowed replacing the short-burst transmission at 20 MHz with the same peak amplitude pressure, but with almost double center frequency, resulting in considerably better axial resolution. The thick films exhibited at least 30% bandwidth broadening comparing to the standard PZ 27 transducer, resulting in an increase in matching filtering output by a factor of 1.4-1.5 and finally resulting in a SNR gain of the same order. Examples of skin scans obtained with the new thick film transducers are presented.

Fr.4.2.5 **12:30-12:45**

Akamas: Mining Association rules using a new algorithm for the Assessment of the Risk of Coronary Heart Events

[1]Minas Karaolis[1], J.A. Moutiris[2], L. Papaconstantinou[1], C.S. Pattichis[1]

[1]Department of Computer Science, University of Cyprus, Nicosia, Cyprus
[2]Department of Cardiology, Paphos General Hospital, Paphos, Cyprus

Abstract – Many algorithms have been developed for rule mining in large transaction databases. Discovery of some important association rules is a main database mining problem. The objective of this study was to develop a new data mining algorithm named AKAMAS using different measures to extract the most important association rules for the assessment of heart event related risk factors. The implemented measures were: support, confidence, p-value, chi square, coverage, prevalence, recall, specificity, accuracy, lift, leverage, added value, relative risk, odds ratio, and conviction. The AKAMAS algorithm is a variant of the Apriori algorithm, the main difference is that it does not use the iterative technique of k-itemset to build the (k +1)-itemsets. It needs only one pass for extracting frequent itemsets. Although AKAMAS gave similar rules to Apriori it offers a wide selection of measures for filtering the best rules, including the computation of the chi square test, and its associated probability value (i.e. if a rule is statistically significant or not). Moreover, the rules are more comprehensively represented and are more easily to interpret.

Fr.4.2.6 **12:45-13:00**

An Ontology and Rule Based Intelligent System to Detect and Predict Myocardial Diseases

Antonio J. Jara, Francisco J. Blaya, Miguel A. Zamora and Antonio F. G. Skarmeta

University of Murcia, Computer Science Faculty, Murcia, Spain

Abstract— Elderly people have a high risk of myocardial diseases. Hence, here an architecture for Ambient Assisted Living (AAL) and telemedicine that supports pre-hospital health emergencies, remote monitoring of patients with chronic conditions and medical collaboration through sharing health related information resources is proposed. Furthermore, it is going to use medical data from vital signs for, on one hand, the detection of symptoms using a rule system based on Jess (tachycardia, arrhythmia …) and, on the other hand, the prediction of illness using chronobiology algorithms (prediction of myocardial infarction eight days before). This paper proposes a knowledge base to represent general human information, heart details and electrocardiogram parameters based on ontologies and a Jess' rule system to detect anomalies and patterns from electrocardiogram information. This solution has been tested by the research team's staff, using a wearable electrocardiogram.

Friday Afternoon, Nov. 6

Session : **Keynote Fr. 3 & 4**

Time & Place: **14:15-15:30, Les Etoiles**

Chairperson: **Dimitris Koutsouris**
Biomedical Engineering Laboratory,
National Technical University of Athens, Athens, Greece

14:15
Personal Health Record and Value-Based Healthcare

Niilo Saranummi

Research Professor, VTT Technical Research Centre of Finland, Finland

Abstract **-**PHR's and PHR based services will be an important tool in reforming healthcare. What we are aiming at is to contribute towards the creation of a health service environment where citizens have the possibility and means to take charge of managing their own health and care in partnership with healthcare professionals. In this environment citizens are genuinely active and equal partners in managing their health and care. In this equal partnership it is understood and accepted that whereas healthcare professionals are experts in healthcare related issues citizens are experts in how they lead their lives, what life styles they adopt and what choices they make. The presentation structure is the following: First a look at what is driving health reform concluding with the need to make "value" the first priority. Then the role of citizens and patients in the value drive: They must be empowered to act as co-producers in cooperation with healthcare professionals. Lastly, the role of the PHR and services based on the PHR will be elaborated.

14:45
Signal processing in patient assessment and care: from hospital to home

Robert Allen

Professor of Biodynamics and Control Institute of Sound and Vibration Research University of Southampton, UK

Abstract - Biomedical signal processing and control is a rapidly growing area of research This is not really surprising, however, given the increasing interest in general, with the availability of low-cost, reliable computing power, the wealth of algorithms already developed and the potential to communicate the results of processing using efficient graphical interfaces. Despite these developments, however, the nursing staff measure body temperature with a thermometer placed under the tongue, plot the reading as a point on a graph and then, with little justification, join up the dots to produce a graph of the time series. What happened to the temperature between readings? How was the sampling frequency selected? Despite these considerations, such charts still form the bedrock of patient management at the

bedside, perhaps rightly so, and are part of the nurse-patient relationship. After all, the nurse is the primary monitor of the patient's condition.

This is, of course, supplemented now by monitors and the results of diagnostic tests where the results are produced using signal or image processing. In the operating theatre or intensive care unit, monitoring systems abound to display vital signs in real time. Biomedical signals have their own characteristics and analysis techniques require appropriate development for clinical application. Many algorithms for noise reduction, feature extraction or manipulation have already been developed and, although perhaps many have not yet been used in regular clinical practice, the potential has been clearly demonstrated. Medical imaging is one area where many developments are very much down to the processing and many diagnostic tests depend upon the extraction or manipulation of signal features at some stage. Indeed, it is probably fair to say that signal processing, in some form or another, underpins much of clinical decision-making and patient management. Control of management delivery is also on the increase through regulation of drug infusion, electrical stimulation of muscle, and so on.

This paper with present an overview of biomedical signal processing applications in patient management and will also indicate trends in the delivery of patient care that is increasingly available to the patient in their own home. Novel, bio-inspired approaches to signal processing will be described that are currently under development that may lead to advances in areas such as medical ultrasound imaging.

Friday Afternoon, Nov. 6

Session: **Fr.5.1 Systems Biology and Modeling Methodologies**

Time & Place: **15:30-17:00, Les Etoiles**

Chairperson: **Aristotelis Chatziioannou**
National Hellenic Research Foundation,
Institute of Biological Research & Biotechnology, Athens, Greece

Fr.5.1.1 **15:30-15:45**

GRISSOM web based Grid portal: Exploiting the power of Grid infrastructure for the interpretation and storage of DNA microarray experiments

Aristotelis Chatziioannou[1], Ioannis Kanaris[2], Ilias Maglogiannis[3], Charalampos Doukas[2], Panagiotis Moulos[1], Eleftherios Pilalis[1] and Fragiskos Kolisis[1]

[1]*National Hellenic Research Foundation, Institute of Biological Research & Biotechnology, Athens, Greece*
[2]*University of the Aegean, Department of Information and Communication Systems, Samos, Greece*
[3]*University of Central Greece, Department of Computer Science and Biomedical Informatics, Greece*

Abstract-DNA Microarrays have dramatically reshaped modern biological research by deriving profiles of genome-wide expression of living organisms, and producing an unprecedented wealth of quantitative data. Given this characteristic, microarray experiments are considered high-throughput both in terms of data (data intensive) and processing (computationally intensive). GRISSOM enables exploitation of GRID resources for DNA microarray distributed processing. It provides experts with a complete web-based solution for managing, searching and disseminating biological knowledge in the context of gene expression patterns on a genomic scale. The platform is developed and deployed using open source software components. Through the use of web service technologies (WSDL language) GRISSOM can be encapsulated in other biomedical processing workflows, thus rendering access to its algorithms transparent and generic.

Fr.5.1.2 **15:45-16:00**

Nonlinear, data-driven modeling of cerebrovascular and respiratory

Georgios Mitsis

University of Cyprus, Nicosia, Cyprus

Abstract-We present applications of recently developed algorithms for data-driven nonlinear systems identification to the study of cardiovascular and respiratory control mechanisms on an integrated systems level, utilizing experimental data obtained during resting conditions. Specifically, we consider cerebrovascular regulation during normal conditions in a two-input context, as well as respiratory control during a model opioid drug (remifentanil) infusion in a closed-loop context. The results illustrate the potential of using data-driven modeling approaches, which do not rely on prior assumptions about model structure, for modeling physiological systems, as they are well-suited to their complexity. They also illustrate the potential of utilizing spontaneous physiological variability, which can be monitored noninvasively and does not require experimental interventions, to extract rich information about the function of the underlying mechanisms.

Fr.5.1.3 **16:00-16:15**

Model of Cardiovascular Control During Valsalva Maneuver

Michel Kana[1] and Jiri Holcik[2]

[1]*Czech Technical University in Prague, Chez Republic*
[2]*Masaryk University Brno, Chez Republic*

Abstarct-We developed a physiologically-based model to quantify cardiovascular control during the Valsalva Maneuver. Our mathematical model analyses measured heart rate and peripheral vascular resistance dynamics and takes into account the hemodynamic changes occurring during intra-thoracic and intra-abdominal pressure elevation. Furthermore the model includes simulation of the baroreflex and could fit 44 data sets obtained from 19 healthy subjects with low residual errors. We developed parameters to quantify the tone of sympathetic and parasympathetic discharge on the cardiovascular system, what gives an insight view on the regulatory processes triggered during the Valsalva Maneuver. Additionally our model predicts left ventricle stroke volume change, baroreceptors firing rate, as well as the duration and strength of each phase of the Valsalva Maneuver.

Fr.5.1.4 **16:15-16:30**

Volume estimation of non-geometric shape cavity using an array of normal distributed distance sensors on a spherical mount, applicable in the right ventricle

Petros Toumpaniaris, Ilias Skalkidis, Aggeliki Giakoumaki and Dimitris Koutsouris

Biomedical Engineering Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, Greece

Abstract-The aim of this work is to estimate the volume of a random shape cavity using distance sensors which transmit on a surface of a sphere, where sensors are mounted in a

normal distribution. It is based on a variant method of convex surface volume measurement using triangulation. The innovation in the present work is that the measurements of distances for triangulation are taken from a random point of the cavity, to the inner wall. This method could be applied in cardiac ventricles; ventricles volume is an important hemodynamic factor for heart failure patients. The necessity for a new method of volume measurement by catheterization is more compulsory in the right ventricle due to its shape singularity than in the case of the left ventricle, whose practicable shape helps in easier volume estimation.

Fr.5.1.5 **16:30-16:45**

Quantitative Evaluation of a Mammographic Software Phantom Generator

Kristina Bliznakova and Nicolas Pallikarakis

Department of Medical Physics, University of Patras, Patras, Greece

Abstarct-This paper presents an evaluation of an algorithm for generation of 3D breast software phantoms for mammography. For this purpose, thirty breast phantoms of different shape, size and composition and with no pathology included were generated. Mammographic images of these breast models were produced by simulating mammographic image acquisition. Quantitative texture analysis included calculation of fractal dimension, skewness, kurtosis, and power spectral analysis of simulated and real mammograms as well as comparison with similar calculations published in the literature. Calculated parameters from simulated images matched closely those calculated from real mammograms and published data. As such the mammographic software phantom generator can be used to create breast models suitable for carrying out feasibility studies in mammography.

Fr.5.1.6 **16:45-17:00**

An Open Web Services – based Framework for Data Mining of Biomedical Image Data

Charalampos Doukas[1], Ilias Maglogiannis[2] and Aristotle Chatziioannou[3]

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[2]*University of Central Greece, Department of Computer Science and Biomedical Informatics, Samos, Greece*
[3]*Institute of Biological Research & Biotechnology, National Hellenic Research Foundation, Athens, Greece*

Abstract-Mining of biomedical image data is a complex procedure that requires several processing phases, such as data acquisition, preprocessing (e.g., image enhancement, color processing), feature extraction and classification. Tools exist that provide each one of these functions individually, however proper integration is required for complex image analysis tasks. This paper presents an open framework based on web services that provides access to tools and methods for data mining of biomedical image data. The described tools implemented as web services can be directly integrated to the TAVERNA or a similar workflow management platform, allowing their integration in several workflows corresponding to different image processing pipelines. Proper authentication and encryption

mechanisms have been utilized in order to guarantee the appropriate security. A case study of classification of skin lesion images is presented to demonstrate the functionality of the proposed framework.

Friday Afternoon, Nov. 6

Session: **Fr.2.5 Medical Imaging V: Analysis**

Time & Place: **15:30-17:00, Venus**

Chairpersons: **Marios S. Pattichis**
Dep. of Electrical and Computer Engineering,
University of New Mexico, NM, USA

Andreas Anayiotos
Cyprus University of Technology, Limassol, Cyprus

Fr.2.5.1 **15:30-15:45**
AM-FM Analysis over Spatially Bounded Domains for Applications in Medical Imaging

Marios S. Pattichis and Victor Murray

Dep. of Electrical and Computer Engineering, University of New Mexico, NM, USA

Abstract— AM-FM analysis methods have been used in several biomedical imaging applications. In this paper, we are interested in the development of AM-FM analysis methods for small components, regions of interests (ROIs), and segmented objects. For detecting small components, we propose the use of a new multi-scale AM-FM edge and peak analysis system. The new system uses the product of gradient estimates from multiple scales. For small ROIs, we propose the use of a new nested optimization scheme. We show that separable designs based on 1-D designs with 15 coefficients can lead to excellent AM-FM estimates.

Fr.2.5.2 **15:45-16:00**
Evolutionary Conformal Prediction for Breast Cancer Diagnosis

Antonis Lambrou[1], Harris Papadopoulos[2] and Alexander Gammerman[1]

[1]*Computer Learning Research Centre, Royal Holloway, University of London, London, UK*
[2]*Computer Science and Engineering Department, Frederick University, Cyprus*

Abstract—Conformal Prediction provides a framework for extending traditional Machine Learning algorithms, in order to complement predictions with reliable measures of confidence. The provision of such measures is significant for medical diagnostic systems, as more informed diagnoses can be made by medical experts. In this paper, we introduce a Conformal Predictor based on Genetic Algorithms, and we apply our method on the Wisconsin Breast Cancer Diagnosis (WBCD) problem. We give results in which we show that our method is efficient, in terms of accuracy, and can provide useful confidence measures.

Fr.2.5.3 **16:00-16:15**

Combined Texture Features for Improved Classification of Suspicious Areas in Autofluorescence Bronchoscopy

Panagiotis Bountris[1], Afroditi Apostolou[1], Maria Haritou[1], Elisavet Passalidou[3] and Dimitris Koutsouris[1]

[1]*Biomedical Engineering Laboratory, School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece*
[2]*Fluorescence Bronchoscopy and Laser Treatment Unit, Sismanoglio General Hospital of Attica, Athens, Greece*

Abstract—Autofluorescence bronchoscopy (AFB) has been utilized over the past decade, proving to be a powerful tool for the detection and localization of premalignant and malignant lesions of the airways. AFB is, however, characterized by low specificity and a high rate of false positive findings (FPFs). The majority of FPFs are due to inflammations, as they often fluoresce at the same wavelengths with cancer. According to several clinical trials, the percentage of the FPFs is about 30%. In this paper we present an intelligent computing system based on combined texture features, feature selection methods and classification models, for improved classification of suspicious areas of the bronchial mucosa, in order to decrease the rate of FPFs, to increase the specificity and sensitivity of AFB and enhance the overall diagnostic value of the AFB method.

Fr.2.5.4 **16:15-16:30**

Discrete Wavelet Transform vs. Wavelet Packets for Texture Analysis of Ultrasound Images of Carotid Atherosclerosis

Nikolaos Tsiaparas[1], Spyretta Golemati[2], John Stoitsis[1] and Konstantina Nikita[1]

[1]*Dep. of Electrical and Computer Engineering, National Technical University of Athens, Greece*
[2]*Medical School, National Kapodistrian University of Athens, Greece*

Abstract— In this paper, a scale/frequency approach, based on the wavelet transform, was used in an attempt to characterize carotid atherosclerotic plaque from B-mode ultrasound. Two wavelet decomposition schemes, namely the discrete wavelet transform (DWT) and wavelet packets (WP), and three basis functions, namely Haar, symlet3 and biorthogonal3.1, were investigated in terms of their ability to discriminate between symptomatic and asymptomatic cases. A total of 12 detail sub-images were extracted using the DWT and 255 using the WP decomposition schemes. It was shown that WP analysis by the use of Haar filter and the l-1 norm as texture descriptor could reveal differences not only in high but also in low frequencies, and therefore characterize efficiently the atheromatous tissue. Additional studies applying and further extending the above methodology are required to ensure the usefulness of wavelet-based texture analysis of carotid atherosclerosis.

Fr.2.5.5 **16:30-16:45**

Effect Of Posture Change On The Geometric Features Of The Healthy Carotid Bifurcation

Andreas Anayiotos[1,5], Nicolas Aristokleous[1], Ioannis Seimenis[2], Yiannis Papaharilaou[3], Georgios Georgiou[4] and Brigitta Brott[5]

[1]*Cyprus University of Technology, Limassol, Cyprus*
[2]*Medical Diagnostic Center Ayios Therissos, Nicosia, Cyprus*
[3]*IACM-FORTH (Institute of Applied and Computational Mathematics), Nicosia, Cyprus*
[4]*University of Cyprus, Nicosia, Cyprus*
[5]*Division of Cardiovascular Disease, University of Alabama, Birmingham, USA*

Abstract — Segmented cross sectional MRI images were used to construct 3D virtual models of the carotid bifurcation in 5 healthy volunteers. Geometric features such as bifurcation angle, planarity angle, asymmetry angle tortuosity and curvature were calculated for the normal head posture and were compared to the equivalent values acquired with the head rotated clockwise by up to 80 degrees. The results obtained have shown that head rotation causes: 1) significant variations in bifurcation angle, planarity angle, asymmetry angle and internal carotid artery angle 2) tortuosity changes for the braches but not for the common carotid and 3) significant curvature changes for the common carotid artery (CCA) but not for the branches. The significant geometric changes observed in most subjects with head posture, may cause significant changes in hemodynamics and warrants future investigation of the hemodynamic parameters related to the development of atherosclerotic disease such as low oscillating wall shear stress and particle residence times.

Fr.2.5.6 **16:45-17:00**

Automatic Standardisation of a Zebrafish Embryo Image Database

Fernando Boto[1], Céline Paloc[1], Alexis Verbeke[1], Carles Callol[2], Ainhoa Letamendia[2], Izaskun Ibarbia[2], Olaia Holgado[2] and J.M Virto[2]

[1]*Vicomtech, San Sebastian, Spain*
[2]*Biobide, San Sebastian, Spain*

Abstract-Recently, there has been an increasing interest to propose computational approaches based on image processing to automate the comparison of spatial gene expression patterns contained in transgenic embryo images. The first step is typically to classify the images between lateral and dorsal/ventral views, and then to align them along the anterior and posterior ends. While some methodologies have been recently proposed for standardizing images in Drosophila database, the case of zebrafish embryos have never been tackled. In this paper, we propose a standardisation methodology for building a zebrafish embryos image database. Details of our approach and the results of using this approach on a pilot dataset are presented. A quality test first allows rejecting images presenting artefacts and which cannot be processed. The retained images are then classified, achieving a success rate of 93%.

Friday Afternoon, Nov. 6

Session: **Fr.3.6 Biosignals VI: CAD Systems**

Time & Place: **15:30-17:00, Minerva**

Chairperson: **Christodoulos Christodoulou**
Department of Computer Science, University of Cyprus, Cyprus

Fr.3.6.1 **15:30-15:45**

Estimating the Depth of Anesthesia by Applying Sub Parameters to an Artificial Neural Network during General Anesthesia

Mehrab Ghanatbari[1], Hossein Rabbani[1], Alireza Mehri Dehnavi[1] and A. R. Mahoori[2]

[1]*Department of Biomedical Engineering, Isfahan University of Medical Sciences, Isfahan, Iran*
[2]*Department of Anesthesia, Urmia Medical University, Urmia, Iran*

Abstract— This paper presents two artificial neural network (ANN) structures to estimate the depth of anesthesia (DOA). First, a clinical study involved on 33 patients is proposed to construct reference data and also to compare the results with BIS monitor (Aspect Medical, Vista), which represents satisfactory correlation with clinical assessments. Secondly, to extract features from electroencephalogram (EEG) signals, we extract some features in frequency and time domain as well as in wavelet (Daubechies) domain. Finally, to integrate EEG features to estimate DOA, ANNs based on back propagation (BP) algorithm are proposed. Since each of the proposed features may has good performance only for a specific range of DOA, this model proved to have good prediction properties, and the output of the proposed ANN has a high correlation with the output of the BIS index.

Fr.3.6.2 **15:45-16:00**

Neural network application to the development of a novel diabetic neuropathy diagnosis tool using the Valsalva index and the SCR

Pedro V. Rivera Farina[1], Javier Perez Turiel[1], Lorena Gonzalez Sal[1], Enrique Gonzalez Sarmiento[1], Alberto Herreros[1] and Sara Higuero[2]

[1]*Biomedical Engineering Division, CARTIF, Foundation, Boecillo, Valladolid, Spain*
[2]*University Hospital of Valladolid, Valladolid, Spain*

Abstract— Diabetes mellitus is a chronic metabolic disease that displays hyperglycaemia and that is strongly linked to micro and macro-vascular complications and neuropathic ones. The World Health Organization (WHO) states that there are around 171 million diabetic patients in the world, it's also estimated that this amount will double by 2030. We have performed a preliminary study on 35 volunteers, including diabetic patients and controls, whose results suggest that the skin conductance response (SCR) measured during the Valsalva Maneuver could be used in the development of a diagnosis index of diabetic neuropathy. The phasic

component and the Valsalva Index of each patient were used as input for a neural network to identify patients with diabetic neuropathy. Preliminary results indicate that the index obtained through the neural network is indeed a viable approach to a fast subject classification.

Fr.3.6.3 **16:00-16:15**

Classification of Surface Electromyographic Signals using AM-FM Features

Christodoulos Christodoulou[1], Prodromos Kaplanis[1], Victor Murray[2], Marios Pattichis[2] and Constantinos S. Pattichis[1]

[1]Department of Computer Science, University of Cyprus, Cyprus
[2]Department of Electrical and Computer Engineering, University of New Mexico, Albuquerque, NM, USA

Abstract— The objective of this study was to evaluate the usefulness of AM-FM features extracted from surface electromyographic (SEMG) signals for the assessment of neuromuscular disorders at different force levels. SEMG signals were recorded from a total of 40 subjects, 20 normal and 20 patients, at 10%, 30%, 50%, 70% and 100% of maximum voluntary contraction (MVC), from the biceps brachii muscle. From the SEMG signals, we extracted the instantaneous amplitude, the instantaneous frequency and the instantaneous phase. For each AM-FM feature their histograms were computed for 32 bins. For the classification, three classifiers were used: (i) the statistical K-nearest neighbour (KNN), (ii) the neural self-organizing map (SOM) and (iii) the neural support vector machine (SVM). For all classifiers the leave-one-out methodology was implemented for the classification of the SEMG signals into normal or pathogenic. The test results reached a classification success rate of 80% when a combination of the three AM-FM features was used.

Fr.3.6.4 **16:15-16:30**

Classification of the emotional states based on the EEG signal processing

Martin Macas, Michal Vavrecka, Vaclav Gerla and Lenka Lhotska

Gerstner Laboratory, Czech Technical University in Prague, Prague, Czech Republic

Abstract— The paper proposes a method for the classification of EEG signal based on machine learning methods. We analyzed the data from an EEG experiment consisting of affective picture stimuli presentation, and tested automatic recognition of the individual emotional states from the EEG signal using Bayes classifier. The mean accuracy was about 75 percent, but we were not able to select universal features for classification of all subjects, because of interindividual differences in the signal. We also identified correlation between the classification error and the extroversion-introversion personality trait measured by EPQ-R test. Introverts have lower excitation threshold so we are able to detect the differences in their EEG activity with better accuracy. Furthermore, the use of Kohonen's self-organizing map for visualization is suggested and demonstrated on one subject.

Fr.3.6.5 **16:30-16:45**

On the Use of Cepstral Coefficients and Multilayer Perceptron Networks for Vocal Fold Edema Diagnosis

João Vilian, Joseana Fechine, Herman Gomes and Silvana Costa

[1]*Universidade Federal de Campina Grande, Campina Grande, Brazil*
[2]*Instituto Federal de Educação, Ciência e Tecnologia da Paraíba, João Pessoa, Brazil*

Abstract—Laryngeal diseases affect many professionals who use their voices as the main working tool, such as teachers, singers, radio and TV presenters, among others. Advanced diagnosis techniques of these diseases are typically invasive, causing much discomfort to the patient. In recent years techniques of Digital Voice Processing have been investigated to obtain non-invasive systems to aid the diagnosis by a specialist. This work proposes a method of analysis that employs Cepstral coefficients to represent the voice signals, and Multilayer Perceptron Neural Networks for discrimination among normal voice, voices affected by local fold Edema and voices affected by other pathologies (nodules, cysts and paralysis). An experimental evaluation of the method has demonstrated that this is a promising approach to the problem, reaching a correct classification rate above 99% for normal voice, 96% for Edema and 93% for other pathologies.

Fr.3.6.6 **16:45-17:00**

Identification of auditory cues utilized in human echolocation – Objective measurement results

Timos Papadopoulos, David S. Edwards, Daniel Rowan and Robert Allen

Institute of Sound and Vibration Research (ISVR), Southampton, UK

Abstract— We present objective measurements of source-toear responses obtained in a previously established human echolocation experimental paradigm. We identify the auditory cues that allow humans to perform echolocation tasks in that specific scenario and we discuss the salience of those cues with respect to more complex scenarios. This work allows us to formulate an experimental protocol for conducting more detailed and informative subjective listening test experiments in human echolocation.

Friday Afternoon, Nov. 6

Session: **Fr.6.1 Biological Data Analysis and Integration**

Time & Place: **15:30-17:00, Diana**

Chairpersons: **Vasilis Promponas**
Department of Biological Sciences, University of Cyprus, Nicosia, Cyprus

Pavlos Manolis Christodoulakis
Department of Electrical and Computer Engineering
University of Cyprus, Cyprus

Fr.6.1.1 **15:30-15:45**
Multi-platform Data Integration in Microarray Analysis

Georgia Tsiliki[1], Michalis Zervakis[2], Marina Ioannou[1], Elias Sanidas[3], Eustathios Stathopoulos[3], Manolis Tsiknakis[4] and Dimitris Kafetzopoulos[1]

[1]*Institute of Molecular Biology and Biotechnology, FORTH, Crete, Greece*
[2]*Technical University of Crete, Crete, Greece*
[3]*Medical School, University of Crete, Crete, Greece*
[4]*Institute of Computer Science, FORTH, Crete, Greece*

Abstract—An increasing number of studies have profiled gene expressions in tumor specimens using distinct microarray platforms and analysis techniques. With the accumulating amount of microarray data, one of the most challenging tasks is to develop robust statistical models to integrate their findings. We compare some recent methodologies on the field, with respect to ER status, and focus on a unified among platforms scale suggested by Parmigiani et al. (2002) and Shen et al. (2004), which is based on a Bayesian mixture model. Under this unified scale, we study the intensity similarities between four breast cancer data sets derived from various platforms. We evaluate our results with an independent data set in terms of ER sample clustering given the derived gene ER signatures of the integrated data. We found that intensity and fold-change variability similarities between different platform measurements can greatly assist the statistical analysis of independent microarray data sets.

Fr.6.1.2 **15:45-16:00**
Gene Expression Classifiers and Out-Of-Class Samples Detection

Alfredo Benso, Stefano Di Carlo and Gianfranco Politano

Department of Control and Computer Engineering, Torino, Italy

Abstract—The proper application of statistics in routine clinical diagnostics to classify

diseases using their genetic expression profile is still a challenge. A critical issue is the overall inability of most state-of the-art classifiers to deal with out-of-class samples, i.e., samples that do not belong to any of the available classes. This paper shows a possible explanation for this problem and suggests how, by analyzing the distribution of the class probability estimates generated by the classifier, it is possible to build decision rules able to significantly improve classifiers' performances.

Fr.6.1.3 **16:00-16:15**

Investigating the minimum required number of genes for optimum classification of myopathy microarray data

Argiris Sakellariou[1], Despina Sanoudou[2] and George Spyrou[2]

[1]*National & Kapodistrian University of Athens, Greece*
[2]*Biomedical Research Foundation of the Academy of Athens, Greece*

Abstract— The investigation of potential microarray markers which in turn will speed up the molecular analysis and provide reliable results on the benefit of patient care is of significant importance. Feature selection techniques which aim at minimizing the dimensionality of the microarray data by keeping the most significant genes according to their expression values is a necessary component towards this goal. In the current article, we present an investigation regarding the minimum required subsets of genes which best classify myopathy data. For this purpose we developed a web-based tool that facilitates the users to easily access/use multiple feature selection methods and subsequently perform classification of data. For the current study five feature selection methods on datasets from two different myopathies have been utilized. Our findings reveal subsets of very small number of genes which can successfully classify gene expression datasets from different patients with skeletal myopathies. In addition, we observe that similar classification results may be obtained from completely different subsets of genes. The developed tool can expedite the identification of small gene subsets with high classification accuracy that could ultimately be used in the genetics clinics for diagnostic, prognostic and pharmacogenomic purposes.

Fr.6.1.4 **16:15-16:30**

ANN-based simulation of transcriptional networks in Yeast

Maria Manioudaki[1,2] and Panayiota Poirazi[2]

[1]*Department of Chemistry, University of Crete, Heraklion, Crete, Greece*
[2]*Institute of Molecular Biology and Biotechnology (IMBB), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Crete, Greece*

Abstract— Artificial Neural Networks (ANNs) have recently been used to quantitatively model stress-induced transcriptional changes in gene regulatory networks, based on gene expression and DNA-binding information. Here, we extend this approach to study the MSN2/4 regulatory networks in Yeast, which are known to be involved in the stress response. We also refine the ANN models by incorporating the dynamics of transcriptional regulation and test our method on three networks involving YAP1. For the latter we make an extensive search in order to identify potential latencies between transcriptional activation and corresponding changes in the expression of targeted genes. Finally, we test our model's

ability to replicate gene-deletion findings in the YAP1 networks. We find that our models can accurately capture the regulatory effect of different transcription factors, under both normal and gene knockout conditions and that incorporating latencies in the ANN models results in significantly higher performance. Overall, we show that ANNs can be used to provide quantitative predictions about the expression profile of targeted genes during the stress response in Yeast.

Fr.6.1.5 **16:30-16:45**

A Proposal for Gene Signature Integration

Michalis Blazadonakis[1], Michalis Zervakis[1] and Dimitrios Kafetzopoulos[2]

[1]*Technical University of Crete, Greece*
[2]*Institute of Molecular Biology and Biotechnology, Foundation for Research and Technology, Greece*

Abstract— Gene expression patterns that can distinguish to a clinically significant degree disease subclasses not only play a prominent role in diagnosis but also lead to therapeutic strategies that tailor treatment to the particular biology of each disease. Nevertheless, gene expression signatures derived through statistical feature identification procedures on population datasets have received rightful criticism, since they share only few genes in common for a particular pathology, even if they derived from the same dataset using different methodologies. An optimistic view to this problem emerging from the wealth of biological interactions is that a statistical solution may not be unique. The derived signatures may be complementary parts of a global one, with each individual signature intersecting only a small part of biological evidence. In this work we focus on the biological knowledge hidden behind different gene signatures and propose a methodology for integrating such knowledge towards retrieving a unified signature.

Fr.6.1.6 **16:45-17:00**

Optimal Graph Design Using A Knowledge-driven Multi-objective Evolutionary Graph Algorithm

Christos A. Nicolaou[1,2,3], Christos Kannas[2,3], and Constantinos S. Pattichis[3]

[1]*Cyprus Institute, Nicosia, Cyprus, University of Cyprus, Nicosia, Cyprus*
[2]*Noesis Chemoinformatics, Nicosia, Cyprus*
[3]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*

Abstract—Designing appropriate graphs is a problem frequently occurring in several common applications ranging from designing communication and transportation networks to discovering new drugs. More often than not the graphs to be designed need to satisfy multiple, sometimes conflicting, objectives e.g. total length, cost, complexity or other shape and property limitations. In this paper we present our approach to solving the multi-objective graph design problem and obtaining a set of multiple equivalent compromising solutions. Our method uses multi-objective evolutionary graphs, a graph-specific meta-heuristic optimization method that combines evolutionary algorithms with graph theory and local search techniques exploiting domain-specific knowledge. In the experimental section we present results obtained for the problem of designing molecules satisfying multiple

pharmaceutically relevant objectives. The results suggest that the proposed method can provide a variety of valid solutions.

Friday Afternoon, Nov. 6

Session: **Fr.7.1 Meet the Editors**

Time & Place: **17:30-19:00, Les Etoiles**

Chairperson: **Niilo Saranummi**
VTT Technical Research Centre of Finland, Finland

Biomedical Signal Processing & Control
Robert Allen

IEEE Transactions on Information Technology in Biomedicine
Yuan-Ting Zhang

IEEE EMBS Book Series
Metin Akay

Friday Afternoon, Nov. 6

Special Session: **Fr.SS.3.1 1st International Workshop on Computational Methods in Orthopedic Biomechanics and Rehabilitation (COMOR 2009) 1/2**
(workshop to be continued on Saturday morning 09:30-11:00)

Time & Place: **17:30-19:00, Venus**

Chairpersons: **George Papaioannou**
"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA

Nikos Pleros
Department of Informatics, Aristotle University of Thessaloniki, Thessaloniki, Greece

Adeeb Rahman
Dep. of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee

Fr.SS.3.1.1 **17:30-17:50**

Assessment of Vacuum-assisted trans-tibial amputee socket dynamics

George Papaioannou[1], Christos Mitrogiannis[1], George Nianios[1] and Goeran Fiedler[2]

[1]*Dep. of Civil Engineering and Applied Sciences, University of Wisconsin, Milwaukee, USA*
[2]*Dep. of Human Movement, College of Health Sciences, University of Wisconsin, Milwaukee, USA*

Abstract— Daily volume loss of the residual limp is reported as one of the greatest challenges in socket fitting. Assisted vacuum socket systems were developed to prevent stump's volume loss and maintain sufficient socket fit. There is however very little quantitative biomechanical research for the evaluation of below knee sockets with assisted vacuum systems. Highly accurate in-vivo measurements became recently available using high-speed, high resolution Biplane Dynamic Rontgen Stereogrammetric Analysis (DRSA) instrumentation. This study presents the first effort to evaluate the efficiency of the vacuum assisted liner socket using DRSA. This in-vivo patient specific information is highly accurate and can significantly influence the iterative cycle of trans-tibial socket fitting and evaluation.

Fr.SS.3.1.2 **17:50-18:10**

Optical Fiber Sensors in Orthopedic Biomechanics and Rehabilitation

Nikos Pleros[1], George Kanellos[1,2] and George Papaioannou[2,3]

[1]*Department of Informatics, Aristotle University of Thessaloniki, Thessaloniki, Greece*
[2]*S.S.F. Safe Smart Fabric Adaptable Surface Ltd, Cyprus*
[3]*Department of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee, USA*

Abstract— We report on the application perspectives of optical fiber strain and shear sensor configurations in the fields of orthopedic biomechanics and rehabilitation. The principle of operation of Fiber Bragg Grating (FBG) sensing elements is presented revealing their potential for introducing intelligence in biotechnological products for orthopedics and rehabilitation. Finally, we present recent advances in the development of fiber sensing structures for utilization in Human Machine Interfaces (HMI) employed in clinical beds, amputee sockets and wheelchair seating systems, targeting pressure ulcer and wound treatment.

Fr.SS.3.1.3 **18:10-18:30**

On Modeling Electric Fields for Microscale Cell Manipulation

Ilya Avdeev and Michael Lovell

University of Wisconsin, Milwaukee, WI, USA

Abstract— Strongly-coupled finite element analysis is applied to modeling micromachined cell manipulating devices. Non-uniform, fringing electric fields in heterogeneous media are accurately represented by 3-D models. Cell manipulation by direct contact and dielectrophoresis is discussed in detail. Two design cases are studied using the developed finite element methodology: a DEP cell sorter and a micro stage device for cell stretching. Results of simulation are in agreement with the experimental observations reported in the literature.

Fr.SS.3.1.4 **18:30-18:50**

Thin Film Overlaid Long Period Fibre Grating Sensors: Examples and Prospects for Advanced Health Monitoring Applications

Stavros Pissadakis[1], Nikolaos Vainos[2,3] and Maria Konstantaki[1]

[1]*Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, Heraklion, Greece*
[2]*National Hellenic Research Foundation, Theoretical and Physical Chemistry Institute, Athens, Greece*
[3]*Department of Materials Science, University of Patras, Patras, Greece*

Abstract—Long period fibre gratings with suitable thin film overlayers can constitute a strong platform for the development of versatile and multi-functional sensing devices for serving diverse Biological and Health monitoring applications. Herein, we present two cases of thin film overlaid long period gratings that can find direct application in health related

applications: the first example refers to a humidity sensing device utilizing PEO/CoCl2 overlayers, and, the second refers to a simple radiation dose sensor utilizing spiropyran doped PMMA overlayers. The proof of principle of these devices is presented, in conjunction with experimental results on their performance, while their application in health related applications is projected and discussed.

Friday Afternoon, Nov. 6

Session: **Fr.3.7 Biosignals VII: CAD Systems II**

Time & Place: **17:30-19:00, Minerva**

Chairpersons: **Michalis Zervakis**
Technical University of Crete, Greece

Costas Neocleous
Department of Mechanical Engineering,
Cyprus University of Technology, Cyprus

Fr.3.7.1 **17:30-17:45**
Classification of Raman Spectra using Support Vector Machines

Alexandros Kyriakides[1], Costas Pitris[1] and Evdokia Kastanos[2]

[1]*Department of Electrical and Computer Engineering, University of Cyprus, Cyprus*
[2]*Dept. of Life and Health Sciences, University of Nicosia, Cyprus*

Abstract— The classification of Raman Spectra is useful in identification and diagnosis applications. We have obtained Raman Spectra from bacterial samples using three different species of bacteria. Before any form of classification can be carried out on the Raman Spectra it is important that some form of normalization is used. This is due to the nature of the readings obtained by the acquisition equipment. The method used for normalization greatly affects the accuracy of the results. We have carried out experiments using Support Vector Machines and the correlation kernel. Our observations have led us to the hypothesis that the correlation kernel is ”self-normalizing” and gives satisfactory results without the need of any other normalization technique.

Fr.3.7.2 **17:45-18:00**
Raman Spectroscopy for UTI Diagnosis and Antibiogram

Katerina Hadjigeorgiou[1], Evdokia Kastanos[2], Alexandros Kyriakides[1] and Costas Pitris[1]

[1]*Department of Electrical and Computer Engineering, University of Cyprus, Cyprus*
[2]*Dept. of Life and Health Sciences, University of Nicosia, Cyprus*

Abstract— Urinary tract infection diagnosis and antibiogram require a 48 hour waiting period using conventional methods. This results in ineffective treatments, increased costs and most importantly in increased resistance to antibiotics. In this work, a novel method for classifying bacteria and determining their sensitivity to an antibiotic using Raman spectroscopy is described. Raman spectra of three species of gram negative Enterobacteria, most commonly responsible for urinary tract infections, were collected. The study included 25 samples each of E.coli, Klebsiella p. and Proteus spp. A novel algorithm based on spectral

ratios followed by discriminant analysis resulted in classification with over 94% accuracy. Sensitivity and specificity for the three types of bacteria ranged from 88-100%. For the development of an antibiogram, bacterialsamples were treated with the antibiotic ciprofloxacin to which they were all sensitive. Sensitivity to the antibiotic was evident after analysis of the Raman signatures of bacteria treated or not treated with this antibiotic as early as two hours after exposure. This technique can lead to the development of new technology for urinary tract infection diagnosis and antibiogram with same day results, bypassing urine cultures and avoiding all undesirable consequences of current practice.

Fr.3.7.3 **18:00-18:15**

Raman Spectroscopy for Determining Nutritional Facts

Christos Moustakas and Costas Pitris

Department of Electrical and Computer Engineering, University of Cyprus, Cyprus

Abstract— The estimation of the nutritional parameters of food products is a difficult and laborious process. Many companies spend considerable financial and other resources to frequently check the nutritional facts of their products. In addition, current methods are unsuitable for day-to-day, restaurant or home use. A new device, that would automatically estimate the nutritional facts of any edible product, could prove very useful in all of the above situations. To achieve that goal, Raman Spectroscopy was used to examine a wide variety of commonly available food products. There was minimal sample preparation, mainly homogenization and dilution. Raman spectra were collected with 785 nm excitation and 4.5 cm-1 resolution. The spectra were analyzed and solutions to linear differential equations resulted in estimates of nutritional facts. When the analysis techniques were optimized, several nutritional parameters could be estimated, such as calories, fat, protein, carbohydrates, sugars, and fiber, with an error between 2.9 % and 6.7 %. The results imply that Raman spectroscopy can be used for the estimation of the nutritional facts of food products with an error less than what is required for labeling. A device based on this technique could prove to be a very useful tool for dieticians, hospitals, food companies, health care organizations, restaurants and even home users, who want to be informed about the content of the food that they consume.

Fr.3.7.4 **18:15-18:30**

Pit Pattern Classification using Extended Local Binary Patterns

Michael Häfner[1], Alfred Gangl[1], Michael Liedlgruber[2], Andreas Uhl[2], Andreas Vécsei[3] and Friedrich Wrba[4]

[1]*Department of Gastroenterologyand Hepatology, Medical University of Vienna, Austria*
[2]*Department of Computer Sciences, Salzburg University, Austria*
[3]*St. Anna Children's Hospital, Vienna, Austria*
[4]*Department of Clinical Pathology, Medical University of Vienna, Austria*

Abstract— In this work we present a method for automated classification of endoscopic images according to the pit pattern classification scheme. Images taken during colonoscopy are transformed using a modified version of the Local Binary Patterns operator (LBP). Then, two-dimensional histograms based on the LBP data from different color channels are

created. Finally, the classification is carried out by employing the nearest-neighbors (1-NN) classifier in conjunction with the Bhattacharyya distance metric. The experimental results show that the extended LBP operator delivers superior results and an automated classification of endoscopic images based on the pit pattern classification scheme is feasible.

Fr.3.7.5 **18:30-18:45**

An integrated CAD system for supporting diagnosis in gynaecological cancer of the endometrium

Ioannis Constantinou[1,2], C. A. Koumourou[1], M. S. Neofytou[1,2], V. Tanos[3], C. S. Pattichis[2], E.C. Kyriacou[4]

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Abstract— In this study we present an integrated system for supporting the diagnosis in gyneacological cancer. The system consists of an electronic patient record and a CAD system for the early detection of gyneacological cancer of the endometrium. The electronic patient record is based on information collected from: appointment, patient info, hysteroscopy reporting and pharmacy. The CAD system is based on ROI manual or semi-automated extraction, texture feature computation and SVM and C4.5 classification into normal/abnormal. The highest percentage of correct classifications score (%CC) for the SVM classifier was 79% for the YCrCb color system using the SF+SGLDS texture feature sets for differentiating between normal vs abnormal ROIs. The C4.5 gave comparable classification scores, but also classification rules. The system offers an integrated platform to the physician for assessing suspicious areas of endometrial cancer. Further work is needed to validate the system with more cases and more users of the prototype.
Manuscript received July 14, 2009. This work was supported by the Ministry of Commerce, Industry and Tourism of the Republic of Cyprus.

Fr.3.7.6 **18:45-19:00**

Neural networks to investigate the effects of smoking and alcohol abuse on the risk for preeclampsia

Costas Neocleous[1], Kypros Nikolaides[3], Kleanthis Neokleous[2] and Christos Schizas[2]

[1]Department of Mechanical Engineering, Cyprus University of Technology, Cyprus
[2]Department of Computer Science, University of Cyprus, Cyprus
[3]Harris Birthright Research Centre for Fetal Medicine, King's College Hospital Medical School, London, UK

Abstract— Following the application of a large number of neural network schemes that have been applied to a large data base of pregnant women, aiming at generating a predictor for the risk of preeclampsia occurrence at an early stage, we investigated the importance of the parameters of smoking and alcohol intake on the classification yield. A number of feedforward neural structures, both standard multilayer and multi-slab, were tried for the prediction. The database was composed of 6838 cases of pregnant women in UK, provided

by the Harris Birthright Research Centre for Fetal Medicine in London. For each subject, 24 parameters were measured or recorded. Out of these, 15 parameters were considered as the most influential at characterizing the risk of preeclampsia occurrence, including the characteristics on whether the pregnant woman was an active smoker or not, and on whether she was consuming alcohol. The same data were applied to the same neural architecture, after excluding the information on smoking and alcohol, in order to study the importance of these two parameters on the correct classification yield. It has been found that both information parameters, i.e. on whether the woman was an active smoker or not, and on whether she was or not abusing alcohol, were needed in order to achieve a correct classification as high as 83.6% of preeclampsia cases in the whole dataset, and of 93.8% in the test set. The preeclampsia cases prediction, for the totally unknown verification test, was 100%. When information on smoking and alcohol intake were not used, the results deteriorated significantly.

Friday Afternoon, Nov. 6

Session: **Fr.6.2 Sequence and Structure Analysis of Biological Macromolecules**

Time & Place: **17:30-19:00, Diana**

Chairpersons: **Vasilis Promponas**
Department of Biological Sciences,
University of Cyprus, Nicosia, Cyprus

Pavlos Antoniou
Department of Computer Science, King's College, London, UK

Fr.6.2.1 **17:30-17:45**

Weighted Amino Acid Composition based on Amino Acid Indices for Prediction of Protein Structural Classes

Sundeep Singh Nanuwa, Andre Dziurla and Huseyin Seker

De Montfort University, Leicester, UK

Abstract – Prediction of protein structural classes is one of the most important and challenging tasks in the bioinformatics field. A protein is classified into one of the four main types of protein structural classes; all α, all-β, α/β and α+β. This paper investigates the role of amino acid indices (AAI) combined with traditional amino acid composition (AAC) to create a weighted amino acid composition (WAAC) feature-set to predict the structural class of a protein. There are over 500 amino acid indices that can be used to develop the novel weighted amino acid composition feature-set which has a great potential of increasing accuracy for the prediction of protein structural classes. For evaluation of these indices a high quality 40% homology dataset is used that contains over 7000 protein sequences (the largest of its kind) extracted from proteomic databases. The predictive technique developed is an optimum k-nearest-neighbour classifier, named multiple-k-nearest neighbour (MKNN). In order to evaluate the classifier a 10- fold cross-validation test procedure is used throughout the study. Over 1 million analyses were carried out, the highest accuracy obtained was from index LEVM780101 at 48.35%, which is 9% higher than traditional AAC and 6.6% higher than that of the best sequence-driven-feature sub-set used in other studies. There is great potential for further improvement as WAAC is a feature-set with the least number of attributes without any feature selection and the numbers of indices that yielded higher accuracies than traditional AAC and other sequence-driven-features are 536 and 435, respectively, out of the 548 amino acid indices analysed in this study.

Fr.6.2.2 **17:45-18:00**

Parallel Interacting Multiview Learning: An Application to Prediction of Protein Sub-nuclear Location

Cemal Okan Şakar[1], Olcay Kurşun[2], Hüseyin Şeker[3], Fikret Gürgen[1], Nizamettin Aydin[4] and Oleg Favorov[6]

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[3]*Bio-Health Informatics Research Group at the Centre for Computational Intelligence, Department of Informatics, Faculty of Technology, De Montfort University, Leicester, UK*
[4]*Department of Computer Engineering, Yildiz Technical University, Istanbul, Turkey*
[5]*Department of Biomedical Engineering, University of North Carolina, Chapel Hill, USA*

Abstract—In some machine learning problems, the dataset has multiple views which may be obtained using different sensors or applying different sampling techniques. These views may have sufficient or partial information about the target concept. In this paper, a method that we called parallel interacting multiview learning (PIML) is proposed in which the views interact during the training process using the predictions of each other together with their original features. This way, the views are expected to strengthen the prediction accuracies of the other views feeding their predictions to the others even during the training process. This technique avoids the way of simply merging features of all views and reaches higher accuracy than its counterparts that do not interact during learning but only combine their predictions after the learning process. PIML is demonstrated on a real bioinformatics dataset for predicting protein sub-nuclear locations.

Fr.6.2.3 **18:00-18:15**

A simple clustering approach for pathogenic strain identification based on local and global amino acid compositional signatures from genomic sequences: the *Escherichia* genus case

Vasilis Promponas

Department of Biological Sciences, University of Cyprus, Nicosia, Cyprus

Abstract—Cluster analysis offers a suite of powerful unsupervised methods, commonly used as exploratory data analysis tools. Such tools can be proven especially useful when we face the situation of analyzing large data sets and want to get an intuitive insight at subtle correlations between instances of the data. In this work, we demonstrate that simple hierarchical clustering approaches (based on compositional features extracted from the amino acid sequences encoded in the complete genomic sequences of 25 species/strains belonging to the proteobacterial genus *Escherichia*) can be used to accurately discriminate between pathogenic and nonpathogenic strains of those bacteria.

Fr.6.2.4 **18:15-18:30**

A Parallel Implementation of a Multi-objective Evolutionary Algorithm

Christos Kannas[1,2], Christos A. Nicolaou[1,2,3] and Constantinos S. Pattichis[3]

[1]*Noesis Chemoinformatics, Nicosia, Cyprus*
[2]*Cyprus Institute, Nicosia, Cyprus, University of Cyprus, Nicosia, Cyprus*
[3]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*

Abstract—Multi-objective Evolutionary Algorithms (MOEAs) have features that can be exploited to harness the processing power offered by modern multi-core CPUs. Modern programming languages offer the ability to use threads and processes in order to achieve parallelism that is inherent in multi-core CPUs. In this paper we present our Parallel implementation of a MOEA algorithm and its application to the de novo drug design problem. The results indicate that using multiple processes that execute independent tasks of a MOEA, can reduce significantly the execution time required and maintain comparable solution quality thereby achieving improved performance.

Fr.6.2.5 **18:30-18:45**

Mapping uniquely occuring short sequences derived from high throughput technologies to a reference genome

Pavlos Antoniou[1], Jackie Daykin[1], Costas Iliopoulos[1], Derrick Kourie[2], Laurent Mouchard[3] and Solon Pissis[1]

[1]*Department of Computer Science, King's College, London, UK*
[2]*Department of Computer Science, University of Pretoria, Pretoria, South Africa*
[3]*LITIS, University of Rouen, Saint-Etienne-du-Rouvray, France*

Abstract—Novel high throughput sequencing technology methods have redefined the way genome sequencing is performed. They are able to produce tens of millions of short sequences (reads) in a single experiment and with a much lower cost than previous sequencing methods. Due to this massive amount of data generated by the above systems, efficient algorithms for mapping short sequences to a reference genome are in great demand. In this paper, we present a practical algorithm for addressing the problem of efficiently mapping uniquely occuring short reads to a reference genome. This requires the classification of these short reads in unique and duplicate matches. In particular, we define and solve the Massive Exact Unique Pattern Matching problem in genomes.

Saturday Morning, Nov. 7

Session: **Keynote Sa.1**

Time & Place: **8:45-9:30, Les Etoiles**

Chairperson: **Panagiotis D. Bamidis**
Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece

8:45
Medicine 2.0 - new opportunities and challenges in the provision of health information and elearning

Gunther Eysenbach

Associate Professor at the Department of Health Policy Management and Evaluation at the University of Toronto

Abstract **-** In this keynote, Dr Eysenbach will reflect on the impact of "Medicine 2.0" approaches on learning. “Medicine 2.0” applications, services, and tools have been defined as Web-based services for health, medicine, and biomedical research, that use Web 2.0 technologies and/or semantic web and virtual reality approaches, featuring 1) social networking, 2) participation, 3) apomediation, 4) openness, and 5) collaboration. Examples are given, and opportunities and challenges are discussed.

Special Session: **Sa.SS.4.1 1st International Workshop on Information Technology for Patient Safety (ITPS 2009)**

Time & Place: **09:30-11:00, Les Etoiles**

Chairperson: **Dimitris Iakovidis**
Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece

Sa.SS.4.1.1 **9:30-9:43**
Knowledge management activities in Patient Safety

Fujii Mai

Patient Safety Programme, A World Alliance for Safer Health Care Information, Evidence and Research (IER), World Health Organization, Geneva, Switzerland

Abstract—WHO is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends. The Patient Safety Programme is organized into a set of programmes, with five major programmes. These are: Research and Knowledge Management, Global Patient Safety Challenges, Patients for Patient Safety and New Programmes, including Education and Technology.

Core Objectives of Patient Safety Programme:

WHO Patient Safety was originally launched as the World Alliance for Patient Safety in October 2004. The Programme has three core objective areas listed as below.

1. Research & Knowledge Management
   - Disseminate global priorities for patient safety research and monitor uptake
   - Release first estimate of global burden of unsafe care
   - Facilitate tools for applied research in data poor environments
   - Strengthen capacity for research through targeted funding for research projects and education
   - Develop and disseminate the first ever patient safety classification
2. Global Patient Safety Challenges
   - Clean Care is Safer Care: revised hand hygiene tools for health care and integration of hand hygiene within national infection control strategies
   - Safe Surgery Saves Lives: revised checklist and implementation tools with global dissemination. Development and distribution of low cost pulse oximeters for low resource settings
   - Tackling Antimicrobial Resistance: develop global workplan and surveillance network
3. Awareness raising and capacity strengthening
   - Delivery of regional workshops and dissemination of patient safety guidelines, standard operating protocols and/or checklists.

- Development and testing of multi-professional patient safety curricula.
- Development and support for an international network of patient champions.

In this presentation, the activities particularly focused upon knowledge management will be introduced.

Sa.SS.4.1.2 **9:43-9:56**

A Federated Data Collection Application for the Prediction of Adverse Hypotensive Events

Anthony Stell, Richard Sinnott and Jipu Jiang

National e-Science Centre, University of Glasgow, Glasgow, UK

Abstract—The Avert-IT project (EU FP7) is an initiative to develop a system that can predict the onset of hypotensive events in patients over a feasible timescale (e.g. 15 mins) and allow clinicians to administer the appropriate treatment. To produce this system requires the additional development of a data collection platform, based at six leading clinical centres throughout Europe, with real-time integration to established patient monitoring systems and conversion of this data to accepted standards developed previously by the Brain-IT consortium (www.brain-it.org). This paper describes the motivation of Avert-IT, the clinical background, the development and implementation of the data collection platform, and the design considerations behind the predictor system ("Hypo-Predict" engine).

Sa.SS.4.1.3 **9:56-10:09**

The RAPS Process Model: A framework for the identification and the management of risks against patient safety (RAPS)

Efstathia Kormari[1], Minas Pertselakis[1], Christos Pateritsas[1], Giorgos Siolas[1], Andreas Stafylopatis[1] and Fernando Gumma[2]

[1]*Institute of Communication and Computer Systems, National Technical University of Athens, Greece*
[2]*Aminio AB Stoccolma Lugano Branch, Switzerland*

Abstract—ReMINE is a novel framework architecture for the management of risk against patient safety (RAPS) in health care systems. ReMINE allows for the collection and analysis of RAPS-related data through a semantic approach which offers a fast and secure extraction of data and correlation of the information across several domains. In this respect, the ReMINE platform will promote an early RAPS detection and forecast that will assist risk managers to provide reliable solutions. The core mechanism to control and handle all the knowledge and data from the various system components is called RAPS Process Model. This mechanism interacts also with the user by receiving and transmitting information using business process modeling and ontological engineering methodologies.

Sa.SS.4.1.4 **10:09-10:22**

Automatic Evaluation of the Progress of Bacterial Pulmonary Infections in Temporal Radiographic Image Sequences

Spyros Tsevas[1,2] and Dimitris Iakovidis[2]

[1]*Dept. of Computer Science, University of Geneva, Switzerland*
[2]*Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece*

Abstract— Pulmonary radiographs are essential tools to the evaluation and diagnosis of suspected infections of the lower respiratory system. Interpretation of a radiograph in the clinical context is a valuable diagnostic adjunct to the selection and the management of a specific clinical protocol for therapy. The key element in the proper diagnosis of a bacterial pulmonary infection is the analysis of the radiographic data accumulated over time. A dynamic consultation system that captures the progress of a disease over time can prove a valuable means to patients' monitoring and follow-up. The aim of this work is to provide an initial framework which can be used to describe the progress of a bacterial pulmonary infection based on the spatial variation of its radiographic manifestation in temporal image sequences. This is realized by the unsupervised discrimination of inflammatory areas from normal lung parenchyma in chest radiographs and their quantitative evaluation over time. Inflammatory areas, which are visually discriminated by their relative opacity within the lung fields, are identified by using an hierarchical cluster merging scheme based on successive non-negative matrix factorizations (NMF) of radiographic patterns of intensity and texture. The experimentation results validate the effectiveness of the proposed methodology along with its advantage over standard supervised methodologies where the need for feature normalization between the diverse images is prevalent.

Sa.SS.4.1.5 **10:22-10:35**

An Ontology of Image Representations for Medical Image Mining

Dimitris Iakovidis[1], Daniel Schober[2], Martin Boeker[2] and Stefan Schulz[2]

[1]*Deptartment of Informatics and Computer Technology, Technological Educational Institute of Lamia, Lamia, Greece*
[2]*Department of Medical Biometry and Statistics, University of Freiburg, Germany*

Abstract—Ontologies are an effective means to formally specify and constrain knowledge. They have proved their utility in various data mining applications, especially in annotating text to render it machine interpretable. More challenging research perspectives arise when ontologies are used to annotate images where the information is encoded in numeric pixel values rather than in natural language. Current approaches to bridge the gap between the pixel-based foundational representation and high level image semantics include the utilization of taxonomies describing 2D spatial relations between the depicted objects and hence linking image features with semantics. To this end we present a novel ontological approach that formalizes concepts and relations regarding image representations for medical image mining. It provides descriptors for pixels, image regions, image features, and clusters. It extends previous approaches by including assertions of spatial relations between clusters in multidimensional feature spaces. The relational assertions enable the linkage between a given image, image region and feature(s) to the object they represent. The

proposed approach is more general than most current approaches and can be easily extended to support multimodal data mining.

Sa.SS.4.1.6 **10:35-10:48**

Management of uncomplicated urinary tract infections using fuzzy cognitive maps

Elpiniki Papageorgiou[1], Chris Papadimitriou[2] and Stavros Karkanis[1]

[1]*Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece*
[2]*Dept. of Informatics with Applications in Biomedicine, University of Central Greece, Lamia, Greece*

Abstract—Urinary Tract Infection (UTI) is a bacterial infection that affects any part of the urinary tract. It can be classified as uncomplicated (patients with urinary tracts that are normal from both structural and functional perspective) and complicated The treatment of uncomplicated urinary tract infections is a complex medical task where a number of parameters, tests, symptoms and laboratory results are present. The knowledge of physicians according to the symptoms and clinical measurements are the main point to succeed a diagnosis, suggest a therapeutic treatment and monitoring patient status. This paper presents the results of our investigation on the problem of handling medical knowledge for decision making by using the soft computing technique of fuzzy cognitive maps. The fuzzy cognitive map (FCM) is an efficient technique for modeling and representing experts' knowledge. Due to its easy graphical representation and simulation process the proposed FCM can be used to make the medical knowledge widely available through computer consultation systems.

Sa.SS.4.1.7 **10:48-11:00**

Towards the Construction of Intuitionistic Fuzzy Cognitive Maps for Medical Decision Making

Elpiniki Papageorgiou and Dimitris Iakovidis

Dept. of Informatics and Computer Technology, Technological Educational Institute of Lamia, Greece

Abstract—FCMs are appropriate to explicitly encode the knowledge and experience accumulated on the operation of a complex system. Once constructed for a particular domain, an FCM allows a qualitative simulation of the system. In this paper, we investigate a first approach to introduce intuitionistic fuzzy logic into the construction process of FCMs for inproved medical decision making. The theory of intuitionistic fuzzy sets provides a sound mathematical model suitable for modeling the imprecision that is inherent in real world problems. It is employed to the step where the fuzzy if-then rules are used for the determination of cause-effect relationships assigning linguistic weights among the concepts. The novel intuitionistic FCM proposed in this paper are implemented by introducing a factor of hesitancy into the weights of a standard FCM. This factor provides an additional cue on the cause-effect relationships among concepts. The results from its experimental evaluation on a medical decision making problem that is critical to patient safety, indicate its effectiveness and open perspectives for its general applicability.

Special Session: **Sa.SS.3.1 1st International Workshop on Computational Methods in Orthopedic Biomechanics and Rehabilitation (COMOR 2009) 2/2**

Time & Place: **09:30-11:00, Venus**

Chairpersons: **George Papaioannou**
"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA

Nikos Pleros
Department of Informatics, Aristotle University of Thessaloniki, Thessaloniki, Greece

Adeeb Rahman
Dep. of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee

Sa.SS.3.2.1 **9:30-9:50**

Development of a new Bed System with Improved Decubitus Prophylaxis for Bed-Ridden Patients

Goeran Fiedler[1], George Papaioannou[1], Christos Mitrogiannis[1], George Nianios[1] and Theodoros Kyprianou

[1]*"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA*
[2]*Nicosia General Hospital, Cyprus*

Abstract— An adaptable bedding surface for the prophylaxis and treatment of decubitus ulcers was developed and evaluated in a number of preclinical studies. The new bed reduced the average contact pressure peaks in prolonged supine bed rest while significantly decelerating the onset and progression of pressure sores. A special advantage of the surface is its discrete, independently-mobile pin elements that allow localized implementation of sensors and diagnostic tools in the bed structure. The bed is currently being evaluated in clinical trials with at series of different patient populations with different pressure ulcer pathologies. The system's overall ability to prevent the conditions that contribute to the onset of ulcers as indicated by improvements on the ulcer incidence rate is presented here.

Sa.SS.3.2.2 **9:50-10:10**

Accuracy assessment of a photoimaging and scanner-based wound diagnostics method

George Nianios, Christos Mitrogiannis, Vasiliki Baradaki and George Papaioannou

"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA

Abstract— The new Wound Diagnostics Tool (WDT) software package presented here aims to produce wound progress statistics that have clinical significance by linking digital image-based and three-dimensional (3D) geometry maps of the ulcer with existing traditional risk assessment techniques and other wound progress tracking information. All this information is then combined in a detailed electronic report that can be integrated with additional patient progress information in a picture archives communication system or web based database. This study presents data from early clinical trials supporting the increased accuracy and efficiency of the new photoimaging and scanner-based wound diagnostics method.

Sa.SS.3.2.3 **10:10-10:20**

CT-Scan based FEA for the Assessment of the Effect of Bone Density on Femur's Fracture

Adeeb Rahman[1], Shirin Selmi[1], Chris Papadopoulos[1] and George Papaioannou[2]

[1]*Dep. of Civil Engineering and Mechanics, University of Wisconsin, Milwaukee, WI, USA*
[2]*"MOVE" Center, Wisconsin Institute for Biomedical Health Technologies, University of Wisconsin, Milwaukee, WI, USA*

Abstract— The apparent correlation between bone density and susceptibility to fracture was evaluated using finite element modeling. Based on computed tomography data of an actual femur bone, a versatile virtual model was created and modified in order to simulate different bone geometries and densities. Under typical load conditions the highest strains were calculated for the inferior side of the femur shaft, and the anterior side of the femur neck close to the trochanter. Strain values consistently decreased with raising cortical bone content.

Sa.SS.3.2.4 **10:20-10:40**

Validation of 3D Radiographical Image Distortion Correction and Calibration Algorithms

Christos Mitrogiannis, Goeran Fiedler, Chris Papadopoulos, George Nianios and George Papaioannou

Dep. of Civil Engineering and Applied Sciences, University of Wisconsin, Milwaukee, USA

Abstract— Dynamic Roentgen Stereogrammetric Analysis (DRSA) provides a highly accurate research and clinical tool in human movement sciences. Essential for the respective DRSA measurements is proper alignment and calibration of the device. An improved method for determining the sufficiency of those preparations is introduced and discussed.

Saturday Morning, Nov. 7

Special Session: **Sa.SS.5.1 1st International Workshop on Multi-type Content Repurposing and Sharing in Medical Education**
Organised in the context of the EU FP7 eContentplus Programme Best Practice Network: Multi-type Content Repurposing and Sharing in Medical Education

Time & Place: **09:30-11:00, Minerva**

Chairpersons: **Panagiotis D. Bamidis**
Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece

Eleni Kaldoudi
Medical School, Democritus University of Thrace, Alexandroupoli, Greece

Sa.SS.5.1.1 **9:30-9:45**
The Challenge of Standards for Cognitive Styles Adaptable Biomedicine Learning Object

Barry Eaglestone, Peter Holdridge, Nigel Ford

University of Sheffield, UK

Abstract—A standards-based infrastructure for sharing biomedical educational contents should apply standards which address the scope and functionality associated with learning objects from perspectives of all actors involved in their life-cycles. The "learner" actor is arguably the most important but also the most complex, heterogeneous and therefore problematic. This paper discusses impact of the latter view from a cognitive styles perspective. Findings of a study of the impact of cognitive style on search for information on the web are reported and a tentative conceptual framework is presented. The links we have identified between individual differences and search strategies suggest that experience, gender and cognitive styles should all be taken into account when tailoring learning objects to suit individual learners, and hence place additional requirements on related standards.

Sa.SS.5.1.2 **9:45-10:00**
Re-use and exchange of an OpenSim platform based learning environment among different medical specialties for clinical scenarios

Eleni Dafli, Kostas Vegoudakis and Panagiotis Bamidis

Lab of Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Thessaloniki, Greece

Abstract— The aim of this paper is to present the repurposing of a technology application based on an Opensim platform for use in medical education and development of clinical skills, and its reconstruction for use among different medical specialties. The objective of this work was the modification of a learning environment and the adaption to the needs of different medical specialties in the aims of reuse of learning content between several specialties. Initially, a 3-Dimensional environment created by using the Opensimulator platform for use in the era of cardiology. Therupon, the virtual environment was modified so as to be oriented to the needs of phychiatry educational needs. The reconstruction of the learning environment and context and the reformation of the educational scenario offers the abilitity to reuse educational environment adapted to the needs of each medical domain.

Sa.SS.5.1.3 **10:00-10:15**

Graphics Cluster Based Visualization of 3D Medical Objects in Lesson Context

Dorian Gorgan, Adam Bartha, Andrei Truță and Teodor Ştefănuț

Technical University of Cluj-Napoca, Cluj-Napoca, Romania

Abstract— In the last few years the eLearning environments have known a very accelerated development becoming a very important educational alternative to the classical teaching methods. Together with the global extend of the Internet infrastructure, the multimedia elements have been more and more used as learning objects providing new methods of information presentation and user interaction techniques. One of the most complex types of eLearning material is represented by 3D objects which offer a new, complex and very similar to reality perspective to the student. Nevertheless, including 3D models into a lesson is not a trivial action as it requires skills for modeling, specific user interaction techniques and specialized hardware for representation. Addressing these problems, this paper presents a method of remote cluster based visualization of 3D large medical objects – obtained through direct modeling or 3D scanning – in the context of an eLearning application.

Sa.SS.5.1.4 **10:15-10:30**

Depicting Educational Content Re-purposing Context and Inheritance

Nikolas Dovrolis[1], Stathis Konstantinidis[2], Panagiotis Bamidis[2] and Eleni Kaldoudi[3]

[1]*School of Medicine, Democritus University of Thrace, Greece*
[2]*Medical Informatics Laboratory, School of Medicine, Aristotle University of Thessaloniki, Greece*
[3]*Medical Physics Laboratory, School of Medicine, Democritus University of Thrace, Greece*

Abstract—Educational content is often shared among different educators and is enriched, adapted and in general re-purposed so that it can be re-used in different contexts. This paper discusses educational content and content repurposing in medical education, presenting different repurposing contexts. Finally, it proposes a novel approach to content repurposing via Web 2.0 social networking of learning objects. The proposed social network is augmented by a graphical representation module in order to capture and depict the relationships amongst different re-purposed medical learning objects, based on educational content 'families' and inheritance. The ultimate goal is to provide a conceptually different

approach to learning object search and retrieval via 'social' associations amongst learning objects.

Sa.SS.5.1.5 **10:30-10:45**

Feeding back learning resources repurposing patterns into the "information loop": opportunities and challenges

D. Giordano, A. Faro, F. Maiorana, C. Pino, C. Spampinato

University of Catania, Dipartimento di Ingegneria Informatica e Telecomunicazioni, Catania, Italy

Abstract—The paper outlines a model for framing the representation and treatment of information gathered from the reuse and repurposing of learning resources from distributed repositories. The model takes into account as sources of information both static user-edited or automatically generated metadata fields and the emerging, dynamic information clouds that surrounds a learning resource when users comment on it, tags it, or explicitly links it to other learning resources. By coordinating these separate information layers, the advantages that can be achieved are reducing the semantic gap occurring when unanticipated contexts of use are to be described by resorting only to predefined vocabularies; and improvements in the relevance of the retrieved resources after a query. To achieve this "coordination" it is proposed that the textual descriptions of the repurposing activity with respect to the intended learning outcomes and pedagogical strategies are fed to a dynamic unsupervised classification method that operates on the above mentioned information spaces, and that supports exploratory search by suggesting associations. It is argued that the proposed analogical retrieval, as opposed to standard query matching, is more fit to tracking the loci of innovation and sustaining the formation of best practices in the community.

Sa.SS.5.1.6 **10:45-11:00**

From Taxonomies to Folksonomies: a roadmap from formal to informal modeling of medical concepts and objects

Panagiotis D. Bamidis[1], Eleni Kaldoudi[2], Costas Pattichis[3]

[1]*Medical Informatics, Medical School of the Health Sciences Faculty, Aristotle University of Thessaloniki, Greece*
[2]*Medical School, Democritus University of Thrace, Alexandroupoli, Greece*
[3]*Department of Computer Science, University of Cyprus, Nicosia, Cyprus*

Abstract- The exploitation of nomenclatures, taxonomies, terminologies and classification of medical diseases, procedures, guidelines has been pivotal to advances in the healthcare domain. Parallel to those have been evolutions in educational technology and medical education where medical educational content is often shared among different educators and institutions. This paper compares the above parallel evolutions in the light of recent developments in web technology, as well as, perception of use like Web2.0 or Web3.0. The discussion is much influenced by recent progress within the general research arena of medical education and medical content repurposing in specific. It is concluded that novel approaches making use of social networking concepts that will govern the shaping of learning objects or their associated ontological descriptions are envisaged.

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