

Mireya Fernández-Chimeno
Pedro L. Fernandes · Sergio Alvarez
Deborah Stacey · Jordi Solé-Casals
Ana Fred · Hugo Gamboa (Eds.)

Communications in Computer and Information Science

452

Biomedical Engineering Systems and Technologies

6th International Joint Conference, BIOSTEC 2013
Barcelona, Spain, February 11–14, 2013
Revised Selected Papers

Editorial Board

Simone Diniz Junqueira Barbosa

*Pontifical Catholic University of Rio de Janeiro (PUC-Rio),
Rio de Janeiro, Brazil*

Phoebe Chen

La Trobe University, Melbourne, Australia

Alfredo Cuzzocrea

ICAR-CNR and University of Calabria, Cosenza, Italy

Xiaoyong Du

Renmin University of China, Beijing, China

Joaquim Filipe

Polytechnic Institute of Setúbal, Setúbal, Portugal

Orhun Kara

TÜBİTAK BİLGEM and Middle East Technical University, Ankara, Turkey

Igor Kotenko

*St. Petersburg Institute for Informatics and Automation of the Russian Academy
of Sciences, St. Petersburg, Russia*

Krishna M. Sivalingam

Indian Institute of Technology Madras, Chennai, India

Dominik Ślęzak

University of Warsaw and Infobright, Warsaw, Poland

Takashi Washio

Osaka University, Osaka, Japan

Xiaokang Yang

Shanghai Jiao Tong University, Shanghai, China

More information about this series at <http://www.springer.com/series/7899>

Mireya Fernández-Chimeno · Pedro L. Fernandes
Sergio Alvarez · Deborah Stacey
Jordi Solé-Casals · Ana Fred
Hugo Gamboa (Eds.)

Biomedical Engineering Systems and Technologies

6th International Joint Conference,
BIOSTEC 2013

Barcelona, Spain, February 11–14, 2013

Revised Selected Papers

Editors

Mireya Fernández-Chimeno
Universitat Politècnica de Catalunya
Barcelona
Spain

Pedro L. Fernandes
Instituto Gulbenkian de Ciência
Oeiras
Portugal

Sergio Alvarez
Boston College
Chestnut Hill, MA
USA

Deborah Stacey
University of Guelph
Guelph
Canada

Jordi Solé-Casals
University of Vic
Victoria
Spain

Ana Fred
Technical University of Lisbon
Lisbon
Portugal

Hugo Gamboa
New University of Lisbon
Lisboa
Portugal

ISSN 1865-0929

ISBN 978-3-662-44484-9

DOI 10.1007/978-3-662-44485-6

ISSN 1865-0937 (electronic)

ISBN 978-3-662-44485-6 (eBook)

Library of Congress Control Number: 2014953274

Springer Heidelberg New York Dordrecht London

© Springer-Verlag Berlin Heidelberg 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

The present book includes extended and revised versions of a set of selected papers from the Sixth International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2013), held in Barcelona, Spain from February 11 to 14, 2013.

BIOSTEC was sponsored by the Institute for Systems and Technologies of Information, Control and Communication (INSTICC), in collaboration with the University of Vic.

BIOSTEC 2013 was held in cooperation with the Association for the Advancement of Artificial Intelligence (AAAI) and technically co-sponsored by the Biomedical Engineering Society (BMES) and European Society for Engineering and Medicine (ESEM).

The purpose of the International Joint Conference on Biomedical Engineering Systems and Technologies is to bring together researchers and practitioners interested in both theoretical advances and applications of information systems, artificial intelligence, signal processing, electronics, and other engineering tools in knowledge areas related to biology and medicine.

BIOSTEC is composed of four complementary and co-located conferences, each specialized in at least one of the aforementioned main knowledge areas. Namely:

- International Conference on Biomedical Electronics and Devices – BIODEVICES;
- International Conference on Bioinformatics Models, Methods, and Algorithms – BIOINFORMATICS;
- International Conference on Bio-inspired Systems and Signal Processing – BIOSIGNALS;
- International Conference on Health Informatics – HEALTHINF.

The purpose of the International Conference on Biomedical Electronics and Devices (BIODEVICES) is to bring together professionals from electronics and mechanical engineering, interested in studying and using models, equipment, and materials inspired from biological systems and/or addressing biological requirements. Monitoring devices, instrumentation sensors and systems, biorobotics, micro-nanotechnologies, and biomaterials are some of the technologies addressed at this conference.

The International Conference on Bioinformatics Models, Methods, and Algorithms (BIOINFORMATICS) intends to provide a forum for discussion to researchers and practitioners interested in the application of computational systems and information technologies to the field of molecular biology, including for example the use of statistics and algorithms to understanding biological processes and systems, with a focus on new developments in genome bioinformatics and computational biology. Areas of interest for this community include sequence analysis, biostatistics, image analysis, scientific data management and data mining, machine learning, pattern recognition, computational evolutionary biology, computational genomics, and other related fields.

The goal of the International Conference on Bio-inspired Systems and Signal Processing (BIOSIGNALS) is to bring together researchers and practitioners from multiple areas of knowledge, including biology, medicine, engineering, and other physical sciences interested in studying and using models and techniques inspired from or applied to biological systems. A diversity of signal types can be found in this area, including image, audio, and other biological sources of information. The analysis and use of these signals is a multidisciplinary area including signal processing, pattern recognition, and computational intelligence techniques, among others.

The International Conference on Health Informatics (HEALTHINF) aims to be a major meeting point for those interested in understanding the human and social implications of technology, not only in healthcare systems but in other aspects of human-machine interaction such as accessibility issues and the specialized support to persons with special needs.

The joint conference, BIOSTEC, received 392 paper submissions from 57 countries in all continents. To evaluate each submission, a double-blind paper review was performed by the Program Committee. After a stringent selection process, 56 papers were published and presented as full papers, i.e., completed work (10 pages/30 minute oral presentation), 99 papers reflecting work-in-progress or position papers were accepted for short presentation, and another 88 contributions were accepted for poster presentation. These numbers, leading to a full-paper acceptance ratio of about 14 % and a total oral paper presentations acceptance ratio close to 40 %, show the intention of preserving a high quality forum for the next editions of this conference.

BIOSTEC's program includes panels and six invited talks delivered by internationally distinguished speakers, namely: Pedro Gómez Vilda (Universidad Politécnica de Madrid, Spain), Christian Jutten (GIPSA-lab, France), Adam Kampff (Champalimaud Foundation, Portugal), Richard Reilly (Trinity College Dublin, Ireland), Vladimir Devyatkov (Bauman Moscow State Technical University, Russian Federation), and Pietro Liò (University of Cambridge, UK).

We would like to thank the authors, whose research and development efforts are recorded here for future generations.

December 2013

Mireya Fernández-Chimeno
Pedro L. Fernandes
Sergio Alvarez
Deborah Stacey
Jordi Solé-Casals
Ana Fred
Hugo Gamboa

Organization

Conference Co-chairs

Jordi Solé-Casals
Ana Fred

Hugo Gamboa

University of Vic, Spain
Instituto de Telecomunicações, Instituto Superior
Técnico, Technical University of Lisbon, Portugal
CEFITEC/FCT – New University
of Lisbon, Portugal

Program Co-chairs

BIODEVICES

Mireya Fernández-Chimeno

Universitat Politècnica de Catalunya, Spain

BIOINFORMATICS

Pedro L. Fernandes

Instituto Gulbenkian de Ciência, Portugal

BIOSIGNALS

Sergio Alvarez

Boston College, USA

HEALTHINF

Deborah Stacey

University of Guelph, Canada

Organizing Committee

Marina Carvalho
Helder Coelhas
Vera Coelho
Andreia Costa
Bruno Encarnação

INSTICC, Portugal
INSTICC, Portugal
INSTICC, Portugal
INSTICC, Portugal
INSTICC, Portugal

Ana Guerreiro	INSTICC, Portugal
André Lista	INSTICC, Portugal
Carla Mota	INSTICC, Portugal
Raquel Pedrosa	INSTICC, Portugal
Vitor Pedrosa	INSTICC, Portugal
Cláudia Pinto	INSTICC, Portugal
Cátia Pires	INSTICC, Portugal
Susana Ribeiro	INSTICC, Portugal
Sara Santiago	INSTICC, Portugal
Margarida Sorribas	INSTICC, Portugal
José Varela	INSTICC, Portugal
Pedro Varela	INSTICC, Portugal

BIODEVICES Program Committee

Farid Amirouche	University of Illinois at Chicago, USA
Dinesh Bhatia	Biomedical Engineering Department, Deenbandhu Chhotu Ram University of Science and Technology, Murthal, India
Martin Bogdan	Universität Leipzig, Germany
Luciano Boquete	Alcala University, Spain
Egon L. van den Broek	Human-Centered Computing Consultancy/ University of Twente/Radboud UMC Nijmegen, The Netherlands
Juan Jose Ramos Castro	Universitat Politècnica de Catalunya, Spain
Mireya Fernández-Chimeno	Universitat Politècnica de Catalunya, Spain
Fernando Cruz	College of Technology of Setubal/Polytechnic Institute of Setubal, Portugal
Maeve Duffy	NUI Galway, Ireland
G.S. Dulikravich	Florida International University, USA
Michele Folgheraiter	German Research Center for Artificial Intelligence, Germany
Juan Carlos Garcia Garcia	Universidad de Alcala, Spain
Roman Genov	University of Toronto, Canada
Miguel Angel García Gonzalez	Universitat Politècnica de Catalunya, Spain
Clemens Heitzinger	University of Cambridge, UK
Toshiyuki Horiuchi	Tokyo Denki University, Japan
Leonid Hrebien	Drexel University, USA
Takuji Ishikawa	Tohoku University, Japan
Sandeep K. Jha	Banasthali University, India
Bozena Kaminska	Simon Fraser University, Canada
Walter Karlen	UBC, Canada
Frank Kirchner	DFKI, Germany
Anton Koeck	Austrian Institute of Technology (AIT), Austria
Ondrej Krejcar	University of Hradec Kralove, Czech Republic

Hongen Liao	The University of Tokyo, Japan
Xiao Liu	Brunel University, UK
Mai S. Mabrouk	Misr University for Science and Technology, Egypt
Jordi Madrenas	Universitat Politècnica de Catalunya, Spain
Ratko Magjarevic	Faculty of Electrical Engineering and Computing, Croatia
Jarmo Malinen	Aalto University, Finland
Dan Mandru	Technical University of Cluj Napoca, Romania
Raimes Moraes	Universidade Federal de Santa Catarina, Brazil
Raul Morais	ECT-UTAD/CITAB, Portugal
Umberto Morbiducci	Politecnico di Torino, Italy
Toshiro Ohashi	Hokkaido University, Japan
Kazuhiro Oiwa	National Institute of Information and Communica- tions Technology, Japan
Mónica Oliveira	University of Strathclyde, UK
Abraham Otero	Universidad San Pablo CEU, Spain
Danilo Pani	University of Cagliari, Italy
Sofia Panteliou	University of Patras, Greece
Nathalia Peixoto	Neural Engineering Lab, George Mason University, USA
Mark A. Reed	Yale University, USA
Sang-Hoon Rhee	Seoul National University, Korea, Republic of
Wim L.C. Rutten	University of Twente, The Netherlands
Seonghan Ryu	Hannam University, Korea, Republic of
Mario Sarcinelli-Filho	Federal University of Espirito Santo, Brazil
Chutham Sawigun	Mahanakorn University of Technology, Thailand
Michael J. Schöning	Institute of Thin Film and Ion Technology, Research Centre Jülich GmbH, Germany
Mauro Serpelloni	University of Brescia, Italy
Alcimar Barbosa Soares	Universidade Federal de Uberlândia, Brazil
Federico Vicentini	National Research Council of Italy (CNR), Italy
Bruno Wacogne	FEMTO-ST UMR CNRS 6174, France
Shigeo Wada	Osaka University, Japan
Sen Xu	Bristol-Myers Squibb, Co., USA
Jing Yang	Qingdao Institute of Bioenergy and Bioprocess Technology, China
Aladín Zayegh	Victoria University, Australia

BIODEVICES Auxiliary Reviewers

Rodrigo Andreão	Ifes, Brazil
Gianluca Barabino	University of Cagliari, Italy
Mario Cifrek	University of Zagreb Faculty of Electrical Engineering and Computing, Croatia

Alessia Dessi	University of Cagliari, Italy
Ainara Garde	UBC and Childrens's Hospital, Canada
Igor Lackovic	University of Zagreb, Croatia
Dinko Oletic	University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia
Antonio Petošić	Faculty of Electrical Engineering and Computing, Croatia

BIOINFORMATICS Program Committee

Mohamed Abouelhoda	Nile and Cairo University, Egypt
Tatsuya Akutsu	Kyoto University, Japan
Mar Albà	UPF/IMIM, Spain
Charles Auffray	CNRS Institute of Biological Sciences, France
Rolf Backofen	Albert-Ludwigs-Universität, Germany
Tim Beissbarth	University of Göttingen, Germany
Ugur Bilge	Akdeniz University, Turkey
Inanc Birol	BC Cancer Agency, Canada
Carlos Brizuela	Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California, Mexico
Chris Bystroff	Rensselaer Polytechnic Institute, USA
João Carriço	Universidade de Lisboa, Portugal
Ferran Casals	Universitat Pompeu Fabra, Spain
Kun-Mao Chao	National Taiwan University, Taiwan
Francis Y.L. Chin	The University of Hong Kong, Hong Kong
Antoine Danchin	AMAbiotics SAS, France
Thomas Dandekar	University of Würzburg, Germany
Sérgio Deusdado	Instituto Politecnico de Bragança, Portugal
Eytan Domany	Weizmann Institute of Science, Israel
Richard Edwards	University of Southampton, UK
George Eleftherakis	CITY College, International Faculty of the University of Sheffield, Greece
André Falcão	Universidade de Lisboa, Portugal
Pedro Fernandes	Instituto Gulbenkian de Ciência, Portugal
Fabrizio Ferre	University of Rome Tor Vergata, Italy
António Ferreira	University of Lisbon, Portugal
Elisa Ficarra	Politecnico di Torino, Italy
Liliana Florea	Johns Hopkins University, USA
Gianluigi Folino	Institute for High Performance Computing and Networking, National Research Council, Italy
Andrew French	University of Nottingham, UK
Bruno Gaëta	University of New South Wales, Australia
Max H. Garzon	The University of Memphis, USA
Julian Gough	University of Bristol, UK
Reinhard Guthke	Hans Knoell Institute, Germany

Joerg Hakenberg	Hoffmann-La Roche, Inc., USA
Emiliano Barreto Hernandez	Universidad Nacional de Colombia, Colombia
Hailiang Huang	Mass General Hospital, USA
Bo Jin	Sigma-aldrich, USA
Giuseppe Jurman	Fondazione Bruno Kessler, Italy
Inyoung Kim	Virginia Tech, USA
Jirí Kléma	Czech Technical University in Prague, Faculty of Electrical Engineering, Czech Republic
Andrzej Kloczkowski	Ohio State University, USA
Sophia Kossida	Academy of Athens, Greece
Bohumil Kovár	Institute of Information Theory and Automation of the ASCR, Czech Republic
Lukasz Kurgan	University of Alberta, Canada
Yinglei Lai	George Washington University, USA
Matej Lexa	Masaryk University, Czech Republic
Xiaoli Li	Nanyang Technological University, Singapore
Michal Linial	The Hebrew University of Jerusalem, Israel
Pedro Lopes	Universidade de Aveiro, Portugal
Shuangge Ma	Yale University, USA
Xizeng Mao	University of Georgia, Athens, USA
Elena Marchiori	Radboud University, The Netherlands
Majid Masso	George Mason University, USA
Pavel Matula	Faculty of Informatics, Masaryk University, Czech Republic
Petr Matula	Faculty of Informatics, Masaryk University, Czech Republic
Tommaso Mazza	Casa Sollievo della Sofferenza - Mendel, Italy
Nuno Mendes	Instituto de Gulbenkian de Ciência, Portugal
Intraud Meyer	University of British Columbia, Canada
Luciano Milanesi	ITB-CNR, Italy
Catarina Moita	Instituto de Medicina Molecular, Portugal
Pedro Tiago Monteiro	Instituto de Gulbenkian de Ciência, Portugal
Shinichi Morishita	University of Tokyo, Japan
Hunter Moseley	University of Louisville, USA
Vincent Moulton	University of East Anglia, UK
Nicola Mulder	University of Cape Town, South Africa
Chad Myers	University of Minnesota, USA
Radhakrishnan Nagarajan	University of Kentucky, USA
Jean-Christophe Nebel	Kingston University, UK
José Luis Oliveira	Universidade de Aveiro, Portugal
Patricia Palagi	Swiss Institute of Bioinformatics, Switzerland
Florencio Pazos	National Centre for Biotechnology, Spain
Matteo Pellegrini	University of California, Los Angeles, USA
Horacio Pérez-Sánchez	Parallel Computer Architecture Group, Spain
Guy Perrière	Université Claude Bernard - Lyon 1, France
Francisco Pinto	Universidade de Lisboa, Portugal

Miguel Rocha	University of Minho, Portugal
Paolo Romano	IRCCS AOU San Martino - IST National Cancer Research Institute, Italy
Simona E. Rombo	DEIS, Università della Calabria, Italy
Juho Rousu	Aalto University, Finland
Derek Ruths	McGill University, Canada
Yvan Saeys	Ghent University, Belgium
J. Cristian Salgado	University of Chile, Chile
Armindo Salvador	Universidade de Coimbra, Portugal
Mark Segal	University of California, San Francisco, USA
Joao C. Setubal	Universidade de São Paulo, Brazil
Hamid Reza Shahbazkia	Universidade do Algarve, Portugal
Christine Sinoquet	LINA/UMR CNRS 6241, University of Nantes, France
Pavel Smrz	Brno University of Technology, Czech Republic
Gordon Smyth	Walter and Eliza Hall Institute of Medical Research, Australia
Peter F. Stadler	Universität Leipzig, Germany
Yanni Sun	Michigan State University, USA
Sandor Szedmak	University of Innsbruck, Austria
Li Teng	The University of Iowa, USA
Silvio C.E. Tosatto	Università di Padova, Italy
Alexander Tsouknidas	Fredereick University, Nicosia, Cyprus, Cyprus
Jose Ramon Valverde	Spanish Research Council, Spain
Massimo Vergassola	Physics of Biological Systems, Institut Pasteur, France
Juris Viksna	University of Latvia, Latvia
Susana Vinga	INESC-ID, Portugal
Gert Vriend	CMBI, The Netherlands
Yufeng Wu	University of Connecticut, USA
Dong Xu	University of Missouri, USA
Tangsheng Yi	University of California at San Francisco, USA
Yanbin Yin	University of Georgia, USA
Jingkai Yu	Institute of Process Engineering, Chinese Academy of Sciences, China
Qingfeng Yu	Stowers Institute for Medical Research, USA
Erliang Zeng	University of Notre Dame, USA
Jie Zheng	Nanyang Technological University, Singapore
Leming Zhou	University of Pittsburgh, USA

BIOINFORMATICS Auxiliary Reviewers

Stefano Castellana	IRCCS Casa Sollievo della Sofferenza - Mendel, Italy
Santa Di Cataldo	Politecnico di Torino, Italy

Marie-Dominique Devignes	LORIA CNRS-UMR 7503, France
Alessandro Guffanti	Genomnna srl, Italy
Andreas Leha	University Medical Center, Germany
Qin Ma	Computational Systems Biology Lab, USA
Martin Mann	University Freiburg, Germany
Sérgio Matos	University of Aveiro, Portugal
Giuseppe Tradigo	University of Calabria, Italy
Vitaly Volpert	CNRS, France
Jiayin Wang	University of Connecticut, USA
Jin Zhang	University of Connecticut, USA
Min Zhao	Vanderbilt Medical Center, USA

BIOSIGNALS Program Committee

Jean-Marie Aerts	Division Measure, Model and Manage Bioresponses (M3-BIORES), Katholieke Universiteit Leuven, Belgium
Jesús B. Alonso	Universidad de Las Palmas de Gran Canaria, Spain
Fernando Alonso-Fernandez	Halmstad University, Sweden
Sergio Alvarez	Boston College, USA
Oliver Amft	TU Eindhoven, The Netherlands
Peter Bentley	UCL, UK
Jovan Brankov	Illinois Institute of Technology, USA
Tolga Can	Middle East Technical University, Turkey
Francis Castanie	TeSA, France
M. Emre Celebi	Louisiana State University in Shreveport, USA
Joselito Chua	Monash University, Australia
Jan Cornelis	VUB, Belgium
Dimitrios Fotiadis	University of Ioannina, Greece
Esteve Gallego-Jutglà	University of Vic, Spain
Juan I. Godino-Llorente	Dept. Ingeniería de Circuitos y Sistemas, Universidad Politécnica de Madrid, Spain
Aaron Golden	Albert Einstein College of Medicine, USA
Thomas Hinze	Friedrich-Schiller University Jena, Germany
Bart Jansen	Vrije Universiteit Brussel, Belgium
Christian Jutten	GIPSA-lab, France
Visakan Kadiramanathan	The University of Sheffield, UK
Shohei Kato	Nagoya Institute of Technology, Japan
Jonghwa Kim	University of Augsburg, Germany
Georgios Kontaxakis	Universidad Politecnica de Madrid, Spain
Vinod Kumar	IIT Roorkee, India
KiYoung Lee	AJOU University School of Medicine, Korea, Republic of
Lenka Lhotska	Czech Technical University in Prague, Faculty of Electrical Engineering, Czech Republic

Marco Loog	Delft University of Technology, The Netherlands
Hari Krishna Maganti	University of Edinburgh, UK
Emanuela Marasco	West Virginia University, USA
Jan Mares	Institute of Chemical Technology Department of Computing and Control Engineering, Czech Republic
Kostas Marias	FORTH-ICS, Greece
G.K. Matsopoulos	School of Electrical and Computer Engineering, National Technical University of Athens, Greece
Paul Meehan	The University of Queensland, Australia
Mihaela Morega	University POLITEHNICA of Bucharest, Romania
Kayvan Najarian	Virginia Commonwealth University, USA
Nicoletta Nicolaou	University of Cyprus, Cyprus
Wiro Niessen	Erasmus MC, The Netherlands
Mahesan Niranjana	University of Southampton, UK
Kazuhiro Oiwa	National Institute of Information and Communica- tions Technology, Japan
Joanna Isabelle Olszewska	University of Huddersfield, UK
Krzysztof Panczer	University of Information Technology and Management in Rzeszow, Poland
George Panoutsos	The University of Sheffield, UK
Joao Papa	UNESP - Universidade Estadual Paulista, Brazil
Shahram Payandeh	Simon Fraser University, Canada
Hanchuan Peng	Howard Hughes Medical Institute, USA
Gennaro Percannella	University of Salerno, Italy
Ernesto Pereda	University La Laguna, Spain
Tuan Pham	University of Aizu, Japan
Vitor Pires	Escola Superior de Tecnologia de Setúbal - IPS, Portugal
Dirk Poot	Erasmus MC Rotterdam, The Netherlands
Octavian Postolache	Institute of Telecommunications, Portugal
Ales Prochazka	Institute of Chemical Technology, Czech Republic
Dick de Ridder	Delft University of Technology, The Netherlands
José Joaquín Rieta	Universidad Politécnica de Valencia, Spain
Marcos Rodrigues	Sheffield Hallam University, UK
Heather Ruskin	Dublin City University, Ireland
Carlo Sansone	University of Naples, Italy
Andres Santos	Universidad Politécnica de Madrid, Spain
Gerald Schaefer	Loughborough University, UK
Peter Schelkens	Vrije Universiteit Brussel (VUB), Belgium
Emanuele Schiavi	Universidad Rey Juan Carlos, Spain
Tanja Schultz	Karlsruhe Institute of Technology, Germany
Tapio Seppänen	University of Oulu, Finland
David Simpson	University of Southampton, UK
Jordi Solé-Casals	University of Vic, Spain

Carlos Ortiz de Solorzano	Center of Applied Medical Research of the University of Navarra, Spain
Olga Sourina	Nanyang Technological University, Singapore
Hiroki Takada	University of Fukui, Japan
Asser Tantawi	IBM, USA
Wallapak Tavanapong	Iowa State University, USA
Gianluca Tempesti	University of York, UK
Petr Tichavsky	Institute of Information Theory and Automation, Czech Republic
Anna Tonazzini	CNR, Italy
Duygu Tosun	UCSF, USA
Carlos M. Travieso	University of Las Palmas de Gran Canaria, Spain
Mahdi Triki	Philips Research Laboratories, The Netherlands
Bart Vanrumst	Katholieke Hogeschool Kempen/Katholieke Universiteit Leuven, Belgium
Aniket Vartak	Qualcomm Incorporated, USA
Michal Vavrecka	Czech Technical University, Czech Republic
Eric Wade	USC Division of Biokinesiology and Physical Therapy, USA
Yuanyuan Wang	Fudan University, China
Takashi Watanabe	Tohoku University, Japan
Quan Wen	University of Electronic Science and Technology of China, China
Nicholas Wickstrom	Halmstad University, Sweden
Didier Wolf	Research Centre for Automatic Control - CRAN CNRS UMR 7039, France
Pew-Thian Yap	University of North Carolina at Chapel Hill, USA
Li Zhuo	Beijing University of Technology, China

BIOSIGNALS Auxiliary Reviewer

Ashwin Belle	Virginia Commonwealth University, USA
--------------	---------------------------------------

HEALTHINF Program Committee

Sergio Alvarez	Boston College, USA
Francois Andry	Optum / UnitedHealth Group Inc., USA
Philip Azariadis	University of the Aegean, Greece
Adrian Barb	Penn State University, USA
Gillian Bartlett	McGill University, Canada
Rémi Bastide	Jean-Francois Champollion University, France
Ronald Batenburg	Utrecht University, The Netherlands
Bert-Jan van Beijnum	University of Twente, The Netherlands
Riccardo Bellazzi	Universita di Pavia, Italy

Elia Biganzoli	Università degli Studi di Milano, Italy
Egon L. van den Broek	Human-Centered Computing Consultancy/ University of Twente/Radboud UMC Nijmegen, The Netherlands
Edward Brown	Memorial University of Newfoundland, Department of Computer Science, Canada
David Buckeridge	McGill University, Canada
Eric Campo	LAAS CNRS, France
James Cimino	NIH Clinical Center, USA
Miguel Coimbra	Faculdade de Ciências da Universidade do Porto, Portugal
Carlos Costa	Universidade de Aveiro, Portugal
Ricardo João Cruz-Correia	Faculdade de Medicina da Universidade do Porto, Portugal
Julian Dorado	University of Coruña, Spain
Stephan Dreiseitl	Upper Austria University of Applied Sciences at Hagenberg, Austria
Christoph M. Friedrich	University of Applied Science and Arts Dortmund, Germany
Ioannis Fudos	University of Ioannina, Greece
Angelo Gargantini	University of Bergamo, Italy
Alfredo Goñi	University of the Basque Country, Spain
David Greenhalgh	University of Strathclyde, UK
Andrew Hamilton-Wright	Mount Allison University, Canada
Jesse Hoey	University of Waterloo, Canada
Chun-Hsi Huang	University of Connecticut, USA
Ivan Evgeniev Ivanov	Technical University Sofia, Bulgaria
Edward Jones	Florida A&M University, USA
Stavros Karkanis	Technological Educational Institute of Lamia, Greece
Anastasia Kastania	Athens University of Economics and Business, Greece
Andreas Kerren	Linnaeus University, Sweden
Georgios Kontaxakis	Universidad Politecnica de Madrid, Spain
Baoxin Li	Arizona State University, USA
Giuseppe Liotta	University of Perugia, Italy
Daniel Lizotte	University of Waterloo, Canada
Guillaume Lopez	The University of Tokyo, Japan
Martin Lopez-Nores	University of Vigo, Spain
Michele Luglio	University of Rome “Tor Vergata”, Italy
Emilio Luque	University Autònoma of Barcelona (UAB), Spain
José Luis Martínez	Universidade Carlos III de Madrid, Spain
Paloma Martínez	Universidad Carlos III de Madrid, Spain
Alice Maynard	Future Inclusion, UK
Sally Mcclean	University of Ulster, UK
Gianluigi Me	Università degli Studi di Roma “tor Vergata”, Italy

Rob van der Mei	CWI Amsterdam, The Netherlands
Gerrit Meixner	German Research Center for Artificial Intelligence (DFKI), Germany
Mohyuddin Mohyuddin	King Abdullah International Medical Research Center (KAIMRC), Saudi Arabia
Christo El Morr	York University, Canada
Sai Moturu	Massachusetts Institute of Technology, USA
Erik Van Mulligen	Erasmus Medical Center, The Netherlands
Radhakrishnan Nagarajan	University of Kentucky, USA
Hammadi Nait-Charif	Bournemouth University, UK
Goran Nenadic	University of Manchester, UK
Shane O’Hanlon	Graduate Entry Medical School, University of Limerick, Ireland
José Luis Oliveira	Universidade de Aveiro, Portugal
Rui Pedro Paiva	University of Coimbra, Portugal
Chaoyi Pang	The Australian e-Health Research Centre, CSIRO, Australia
Danilo Pani	University of Cagliari, Italy
José J. Pazos-arias	University of Vigo, Spain
Carlos Eduardo Pereira	Federal University of Rio Grande Do Sul - UFRGS, Brazil
Rosario Pugliese	Universita’ di Firenze, Italy
Juha Puustjärvi	University of Helsinki, Finland
Arkalgud Ramaprasad	University of Miami, USA
Marcos Rodrigues	Sheffield Hallam University, UK
Valter Roesler	Federal University of Rio Grande do Sul, Brazil
Stefan G. Ruehm	UCLA (University of California, Los Angeles), USA
George Sakellaropoulos	University of Patras, Greece
Ovidio Salvetti	National Research Council of Italy - CNR, Italy
Akio Sashima	AIST, Japan
Bettina Schnor	Potsdam University, Germany
Kulwinder Singh	University of Calgary, Canada
Paolo Spagnoletti	LUISS Guido Carli University, Italy
Irena Spasic	University of Cardiff, UK
Deborah Stacey	University of Guelph, Canada
Jan Stage	Aalborg University, Denmark
Kåre Synnes	Luleå University of Technology, Sweden
Abdel-Rahman Tawil	University of East London, UK
Francesco Tiezzi	IMT - Institute for Advanced Studies Lucca, Italy
Alexey Tsybmal	Siemens AG, Germany
Aristides Vagelatos	CTI, Greece
Francisco Veredas	Universidad de Málaga, Spain
Justin Wan	University of Waterloo, Canada
Lixia Yao	GlaxoSmithKline, USA

Vera Yashina	Dorodnicyn Computing Centre of the Russian Academy of Sciences, Russian Federation
Xiang Sean Zhou	Siemens Medical Solutions, USA
André Zúquete	IEETA/IT/Universidade de Aveiro, Portugal

HEALTHINF Auxiliary Reviewers

Michael Bales	Columbia University, USA
Eduardo C. Cabrera	UAB, Spain
Alessia Dessì	University of Cagliari, Italy
Atif Khan	University of Waterloo, Canada
Shehroz Khan	University of Waterloo, Canada
Massimiliano Masi	Universita di Firenze, Italy
Manel Taboada	University Autònoma of Barcelona, Spain

Invited Speakers

Pedro Gómez Vilda	Universidad Politécnica de Madrid, Spain
Christian Jutten	GIPSA-lab, France
Adam Kampff	Champalimaud Foundation, Portugal
Richard Reilly	Trinity College Dublin, Ireland
Vladimir Devyatkov	Bauman Moscow State Technical University, Russian Federation
Pietro Liò	University of Cambridge, UK

Contents

Biomedical Electronics and Devices

A 2nd Order CMOS Sigma-Delta Modulator Design Suitable for Low-Power Biosensor Applications	3
<i>Ryan Selby and Tom Chen</i>	
Monitoring Drivers' Ventilation Using an Electrical Bioimpedance System: Tests in a Controlled Environment	13
<i>Raúl Macías, Miguel Ángel García, Juan Ramos, Ramon Bragós, and Mireya Fernández-Chimeno</i>	
Opened-Ring Electrode Array for Enhanced Non-invasive Monitoring of Bioelectrical Signals: Application to Surface EEnG Recording	26
<i>J. Garcia-Casado, V. Zena, J.J. Perez, G. Prats-Boluda, Y. Ye-Lin, and E. Garcia-Breijo</i>	
Development and Application of a Portable Device for Cutaneous Thermal Sensitivity Assessment: Characterizing the Neuropathic Pain Following Spinal Cord Injury	41
<i>Renato Varoto, Fábio Casagrande Hirono, Fernando Ometto Zorzenoni, Ricardo Yoshio Zanetti Kido, William Barcellos, and Alberto Cliquet Jr.</i>	
Pine Decay Assessment by Means of Electrical Impedance Spectroscopy	54
<i>Elisabeth Borges, Mariana Sequeira, André Cortez, Helena Catarina Pereira, Tânia Pereira, Vânia Almeida, Teresa Vasconcelos, Isabel Duarte, Neusa Nazaré, João Cardoso, and Carlos Correia</i>	
Gold Standard Generation Using Electrooculogram Signal for Drowsiness Detection in Simulator Conditions	74
<i>N. Rodríguez-Ibáñez, P. Meca-Calderón, M.A. García-González, J. Ramos-Castro, and M. Fernández-Chimeno</i>	
Dielectric Barrier Discharge Plasma for Endodontic Treatment	89
<i>Avinash S. Bansode, Aumir Beg, Swanandi Pote, Bushra Khan, Rama Bhadekar, Alok Patel, S.V. Bhoraskar, and V.L. Mathe</i>	
Characterization of an Acoustic Based Device for Local Arterial Stiffness Assessment	98
<i>H.C. Pereira, J. Maldonado, T. Pereira, M. Contente, V. Almeida, T. Pereira, J.B. Simões, J. Cardoso, and C. Correia</i>	