

2014 Computing in Cardiology Conference

(CinC 2014)

**Cambridge, Massachusetts, USA
7-10 September 2014**

Pages 1-580



IEEE Catalog Number: CFP14CAR-POD
ISBN: 978-1-4799-4372-2

Computing in Cardiology 2014
Cambridge, USA

Table of Contents

1: Rosanna Degani Young Investigator Award	Chairs Willem Dassen Peter Macfarlane
---	--

Physiology-based Regularization Improves Noninvasive Reconstruction and Localization of Cardiac Electrical Activity	1
Matthijs JM Cluitmans, Monique MJ de Jong, Paul GA Volders, Ralf LM Peeters, Ronald L Westra	
Identification of Myocardial Scar in Ventricular Tachycardia: Correlation between CT based results and Electro-Anatomic Map Findings	5
Sofia Antunes, Antonio Esposito, Giuseppe Macabelli, Anna Palmisano, Caterina Colantoni, Sebastiano Colombo, Paolo della Bella, Sergio Cerutti, Giovanna Rizzo	
Non-invasive Detection of Reentrant Drivers during Atrial Fibrillation: a Clinical-Computational Study	9
Miguel Rodrigo, Andreu M Climent, Alejandro Liberos, Jorge Pedrón-Torrecilla, José Millet, Francisco Fernández-Avilés, Felipe Atienza, Omer Berenfeld, Maria S Guillem	

2-1: Cardiac Mechanics	Chairs Andrew Blaber Elisabete Aramendi
-------------------------------	--

Modeling Mechanical Response of the Chest During the Cardiopulmonary Resuscitation Procedure	13
Ali Jalali, Vinay Nadkarni, C Nataraj	
Empirical Mode Decomposition for Chest Compression and Ventilation Detection in Cardiac Arrest	17
Erik Alonso, Elisabete Aramendi, Digna González-Otero, Unai Ayala, Mohamud Daya, James K Russell	
Evaluation of Aortic Flow Alterations using MRI: Associations with Left Ventricular Remodeling	21
Ioannis Bargiotas, Emilie Bollache, Alain de Cesare, Alban Redheuil, Elie Mousseaux, Nadja Kachenoura	
ECG Analysis during Continuous-flow LVAD	25
O Meste, A Cabasson, L Fresiello, MG Trivella, A Di Molfetta, G Ferrari, F Bernini	
Effects of Cardiac Resynchronization Therapy on the First Heart Sound Energy	29
Ask S Jensen, Samuel E Schmidt, Johannes J Struijk, John Hansen, Claus Graff, Jacob Melgaard, Tanveer A Bhuiyan, Kasper Emerek, Peter Soegaard	

2-2: ECG Noise CancellationChairs John Wang
Aline Cabasson

A Flexible PCA-based ECG Reconstruction Algorithm with Confidence Estimation for ECG during Exercise	33
Steffen A Mann, Reinhold Orglmeister	
Coherence as a Measure of Noise in the ECG	37
Johannes J Struijk, Claus Graff, Joergen K Kanders, Joel Q Xue, Ask S Jensen, Samuel Schmidt	
A Framework for ECG Signal Preprocessing based on Quadratic Variation Reduction	41
Valeria Villani, Antonio Fasano	
Electrocardiogram Baseline Wander Removal based on Empirical Mode Decomposition	45
Mohammadreza Ravanfar, Riadh Arefin, Kouhyar Tavakolian, Reza Fazel-Rezai	
Extracting a Clean ECG from a Noisy Recording: A New Method based on Segmented-Beat Modulation	49
Angela Agostinelli, Corrado Giuliani, Laura Burattini	
A Bayesian Filtering Framework for Accurate Extracting of the Non Invasive FECG Morphology	53
Joachim Behar, Fernando Andreotti, Julien Oster, Gari D Clifford	

2-3: Cellular and Genetic Ventricular Arrhythmic Modeling

Chair Niel Otani

Modelling the Functional Impact of KCNA5 Mutations on the Electrical and Mechanical Activities of Human Atrial Cells	57
Haibo Ni, Michael A Colman, Henggui Zhang	
Simulation of Re-entrant Wave Dynamics in a 2-D Sheet of Human Ventricle with KCNJ2-linked Variant 3 Short QT Syndrome	61
Kuanquan Wang, Cunjin Luo, Yongfeng Yuan, Weigang Lu, Henggui Zhang	
The Effect of Random Cell Decoupling on Electrogram Morphology near the Percolation Threshold in Microstructural Models of Cardiac Tissue	65
Marjorie L Hubbard, Joshua Xu, Craig S Henriquez	
Computational Modeling Supports Induced Pluripotent Stem Cell-derived Cardiomyocytes Reliability as a Model for Human LQT3	69
Michelangelo Paci, Stefano Severi, Jari Hyttinen	
Contribution of Developmental Changes in Energy Metabolism to Excitation-Contraction Coupling of a Ventricular Cell: A Simulation Study	73
Hitomi I Sano, Tamami Toki, Yasuhiro Naito, Masaru Tomita	

2-4: Pathophysiology of Heart Rate VariabilityChairs Luca Mainardi
Luca Citi**Point Process Heartbeat Dynamics Assessment of Neurocardiogenic Syncope in Children****77**Digna M González-Otero, Ronald G García, Gaetano Valenza, Laura M Reyes,
Riccardo Barbieri**Lower Instantaneous Entropy of Heartbeat Dynamics Characterizes Cognitive Impairment in Parkinson's Disease****81**Riccardo Barbieri, Gaetano Valenza, Luca Citi, Maria Guerrisi, Stefano Orsolini,
Carlo Tessa, Stefano Diciotti, Nicola Toschi**Analysing Cardiac Autonomic Neuropathy in Diabetes using Electrocardiogram-derived Systolic-Diastolic Interval Interactions****85**Mohammad Hasan Imam, Chandan Karmakar, Ahsan Khandoker, Herbert F Jelinek,
Marimuthu Palaniswami**Long-term HRV in Critically Ill Pediatric Patients: Coma versus Brain Death****89**

Ana Paula Rocha, Rute Almeida, Argentina Leite, Marta João Silva, Maria Eduarda Silva

Automated Selection of Measures of Heart Rate Variability for Detection of Early Cardiac Autonomic Neuropathy**93**

David Cornforth, Mika P Tarvainen, Herbert F Jelinek

Coupling between Short-Term Heart Rate and Diastolic Period is Reduced in Heart Failure Patients as Indicated by Multivariate Entropy Analysis**97**

Peng Li, Lizhen Ji, Chang Yan, Ke Li, Chengyu Liu, Changchun Liu

3-1: Cardiac MRI & CTChairs Cristiana Corsi
Victor Mor-Avi**Volumetric Identification of Left Atrial Fibrosis from Delayed Enhancement Magnetic Resonance Imaging in Atrial Fibrillation: Preliminary Results****101**

Roberta Leonardi, Federico Veronesi, Stefano Severi, Roberto Mantovan, Cristiana Corsi

A Practical Algorithm for Improving Localization and Quantification of Left Ventricular Scar**105**Brian Zenger, Joshua Cates, Alan Morris, Eugene Kholmovski, Alexander Au, Ravi Ranjan,
Nazem Akoum, Chris McGann, Brent Wilson, Nassir Marrouche, Frederick T Han,
Rob S MacLeod**Fully Automated Assessment of Left Ventricular Volumes, Function and Mass from Cardiac MRI****109**Marco Marino, Federico Veronesi, Giacomo Tarroni, Victor Mor-Avi, Amit R Patel,
Cristiana Corsi

Quantitative Evaluation of Myocardial Ischemia by Cardiac Magnetic Resonance Imaging	113
Siyi Huang, Jingwei Pan, Lin Yu, Xin Yang, Meng Wei	

3-2: Electrophysiology Analysis	Chairs Steven Swiryn Jean-Marc Vesin
--	---

Evaluation of Electromagnetic Field Distribution under 1.5 T MRI Scanning within Human Models of a Virtual Family	117
Yan Liu, Dawei Li, Xiaoyi Min, Shiloh Sison, Gabriel Mouchawar, Ji Chen	
Cardiac Arrhythmia Discrimination using Evolutionary Computation	121
Juan Francisco Martín-García, Inmaculada Mora-Jiménez, Arcadio García-Alberola, José Luis Rojo-Álvarez	
A Morphology-Based Spatial Consistency Algorithm to Improve EGM Delineation in Ventricular Electroanatomical Mapping	125
Alejandro Alcaine, David Soto-Iglesias, David Andreu, Juan Acosta, Antonio Berruezo, Pablo Laguna, Oscar Camara, Juan Pablo Martínez	
Inverse Localization of the Latest-Activated Areas in the Ventricles from Body Surface Potential Maps	129
Jana Svehlikova, Mark Potse, Milan Tysler	

3-3: ECG Decision Support Systems	Chairs Sara Mariani David Mortara
--	--------------------------------------

Comparison of Different Methods and Catheter Designs to Estimate the Rotor Tip Position – A Simulation Study	133
Markus Rottmann, Matthias W Keller, Tobias Oesterlein, Gunnar Seemann, Olaf Dössel	
Analysis of QRS Alterations during Stress Test Recordings on Patients with Brugada Syndrome	137
Daniel Romero, Nathalie Behar, Alba Martín-Yebra, Juan Pablo Martínez, Pablo Laguna, Esther Pueyo, Guy Carrault, Philippe Mabo, Alfredo Hernández	
A New Phase Space Analysis Algorithm for the Early Detection of Syncope during Head-Up Tilt Tests	141
Nadine Khodor, Guy Carrault, David Matelot, Hassan Amoud, Nathalie Ville, Mohamad Khalil, Francois Carre, Alfredo Hernandez	
Automatic Detection of ECG Lead-wire Interchange for Conventional and Mason-Likar Lead Systems	145
Chengzong Han, Richard Gregg, Saeed Babaeizadeh	

3-4: Physionet Inspired StudiesChairs Ikaro Silva
Philip de Chazal

A Multi-modal Approach to Sleep-Wake Classification in Infants using Minimally Invasive Sensors	149
Gregory Cohen, Philip de Chazal	
Classification of Sleep Disordered Breathing in the Evaluation of Acoustic Sound in Correlation with the ECG Signal	153
Klaudia Proniewska, Krzysztof Malinowski, Elżbieta Pociask, Bartosz Proniewski	
Data Preprocessing and Mortality Prediction: the Physionet/CinC 2012 Challenge Revisited	157
Alistair EW Johnson, Andrew A Kramer, Gari D Clifford	
Scaling the PhysioNet WFDB Toolbox for MATLAB and Octave	161
Tristan Naumann, Ikaro Silva	

4-1: Repolarization and RiskChairs T Brennan
Paul Kligfield

A Quantitative QT Hysteresis Model	165
David W Mortara, Fabio Badilini	
Ventricular Arrhythmias Assessment: a New Repolarization Index of Risk	169
Corrado Giuliani, Cees A Swenne, Sumche Man, Angela Agostinelli, Laura Burattini	
Circadian Pattern and Sex Differences of QT/RR and T-peak-to-end/RR Curvatures and Slopes in Chronic Heart Failure Patients	173
Julia Ramírez, Iwona Cygankiewicz, Pablo Laguna, Marek Malik, Esther Pueyo	
T-Wave Alternans Rate of Change with Exercise for Cardiac Risk Assessment	177
Laura Burattini, Sumche Man, Giovanni Ottaviano, Sandro Fioretti, Francesco Di Nardo, Cees A Swenne	
Repolarization Liability Measured by Spatial TT' Angle	181
Larisa G Tereshchenko	
Tensor-based Detection of T Wave Alternans in Multilead ECG Signals	185
G Goovaerts, C Varon, B Vandenbergk, R Willems, S Van Huffel	

4-2: Electrophysiology ModelingChairs Frida Sandberg
Trygve Eftestøl

Controlled Activation for Interrogation of the Electrophysiological Substrate	189
Joshua JE Blauer, Fred Han, Ravi Ranjan, Nassir F Marrouche, Rob S MacLeod	
A Novel Method for Quantifying Localised Correlation of Late-Gadolinium Intensity with Conduction Velocity	193
Rheeda L Ali, Chris D Cantwell, Caroline H Roney, Norman A Qureshi, Phang Boon Lim, Jennifer H Siggers, Spencer J Sherwin, Nicholas S Peters	
Defibrillation Thresholds: A Generalised Polynomial Chaos Study	197
Peter R Johnston	
Formulation of ATP Sensitive K⁺ Current and Action Potential Shape in Models of Human Ventricular Myocytes	201
Mitra Abbasi, Richard Clayton	
High Specificity IEGM Beat Detection by Combining Morphological and Temporal Classification for a Cardiac Neuromodulation System	205
Antje Pohl, Carl Henning Lubba, Maren Thore, Nima Hatam, Steffen Leonhardt	
Fitting Membrane Resistance in Single Cardiac Myocytes reduces Variability in Parameters	209
Jaspreet Kaur, Anders Nygren, Edward J Vigmond	

4-3: Algorithmic and Software ToolsChairs Dana Brooks
Kouhyar Tavakolian

New Additions to the Toolkit for Forward/Inverse Problems in Electrocardiography within the SCIRun Problem Solving Environment	213
Jaume Coll-Font, Brett M Burton, Jess D Tate, Burak Erem, Darrell J Swenson, Dafang Wang, Dana H Brooks, Peter van Dam, Rob S MacLeod	
Analysis of Pressure Gradient Across Aortic Stenosis with Massively Parallel Computational Simulation	217
Amanda Randles, Erik Draeger, Franziska Michor	
Spiral Waves Clustering using Normalized Compression Distance	221
Celal Alagoz, Andrew R Cohen, Allon Guez, John Bullinga	
Interactive Simulation of Multiple Beats: A New Feature of ECGSIM	225
Peter M van Dam, Eelco M van Dam, Adriaan van Oosterom, Thom F Oostendorp	
Myokit: A Framework for Computational Cellular Electrophysiology	229
Michael Clerx, Paul GA Volders, Pieter Collins	

A Novel Method for Rotor Tracking using Bipolar Electrogram Phase	233
Caroline H Roney, Chris D Cantwell, Jennifer H Siggers, Fu Siong Ng, Nicholas S Peters	

4-4: Temporal Aspects of CV Signals	Chair	Olaf Doessel
--	-------	--------------

Analysis of Cardiovascular Time Series using Multivariate Sample Entropy: A Comparison between Normal and Congestive Heart Failure Subjects	237
Chengyu Liu, Dingchang Zheng, Lina Zhao, Peng Li, Changchun Liu, Alan Murray	
Development of Techniques for Measurement of Left Ventricular Ejection Time	241
Wenfeng Duan, Dingchang Zheng, Christopher Eggett, Philip Langley, Alan Murray	
Assessment of Different Methodologies to Include Temporal Information in Classifying Episodes of Sleep Apnea Based on Single-Lead Electrocardiogram	245
Tim Willemen, Carolina Varon, Bart Haex, Jos Vander Sloten, Sabine Van Huffel	
An On-chip Robust Real-Time Automated Non-Invasive Cardiac Remote Health Monitoring Methodology	249
Naresh Vemishetty, Krishna Bharadwaj Chivukula, Sandeep Tiwari, Pavana Ravi Sai Kiran Malyala, Bastin Joseph, Agathya Jagirdar, Jagadish Bandaru, Venkateswara Chowdary, Sivakrishna Y, Amit Acharyya, Rajalakshmi Pachamuthu, Paolo Emilio Puddu	

5-1: Challenge I	Chairs	Ikaro Silva Riccardo Barbieri
-------------------------	--------	----------------------------------

Heart Rate Variability Discovery: Algorithm for Detection of Heart Rate from Noisy, Multimodal Recordings	253
Jan J Gierałtowski, Kamil Ciuchciński, Iga Grzegorczyk, Katarzyna Kośna, Mateusz Soliński, Piotr Podziemski	
Heart Beat Detection in Multimodal Data using Signal Recognition and Beat Location Estimation	257
Thomas De Cooman, Griet Goovaerts, Carolina Varon, Devy Widjaja, Sabine Van Huffel	
Multimodal Information Fusion for Robust Heart Beat Detection	261
Quan Ding, Yong Bai, Yusuf Bugra Erol, Rebeca Salas-Boni, Xiaorong Zhang, Lei Li, Xiao Hu	
Predicting Heart Beats using Co-occurring Constrained Sequential Patterns	265
Shameek Ghosh, Mengling Feng, Hung Nguyen, Jinyan Li	
Rhythm-based Accuracy Improvement of Heart Beat Detection Algorithms	269
Zoltán Gilián, Péter Kovács, Kaveh Samiee	

Identification of a Signal for an Optimal Heart Beat Detection in Multimodal Physiological Datasets	273
Roman Schulte, Johannes Krug, Georg Rose	
Robust Algorithm to Locate Heart Beats from Multiple Physiological Waveforms	277
Lars Johannessen, Jose Vicente, Christopher G Scully, Loriano Galeotti, David G Strauss	
R- Peak Estimation using Multimodal Lead Switching	281
Alistair EW Johnson, Joachim Behar, Fernando Andreotti, Gari D Clifford, Julien Oster	
Robust Detection of Heart Beats in Multimodal Data using Integer Multiplier Digital Filters and Morphological Algorithms	285
Urska Pangerc, Franc Jager	
5-2: Blood Pressure Systems	Chairs Roberto Sassi Madalena Costa
<hr/>	
Respiratory Rate Influence in the Resulting Magnitude of Pulse Photoplethysmogram Derived Respiration Signals	289
Jesús Lázaro, Raquel Bailón, Pablo Laguna, Yunyoung Nam, Ki Chon, Eduardo Gil	
Performance of the Low-frequency Power of the Maximal Amplitude of the First Derivative of Arterial Pressure Waveform as a Cardiac Sympathetic Activity Index	293
Salvador Carrasco-Sosa, Alejandra Guillén-Mandujano	
Sleep Stage Classification in Children using Photoplethysmogram Pulse Rate Variability	297
Parastoo Dehkordi, Ainara Garde, Walter Karlen, David Wensley, J Mark Ansermino, Guy A Dumont	
Changes in Short-Term Blood Pressure Regulation in Adolescents with Type-I Diabetes Mellitus and Essential Hypertension	301
Eva Zavodna, Zuzana Novakova, Magdalena Rohanova, Jana Stastna, Natasa Honzikova, Hana Hrstkova	
Dynamics of Arterial Pressure Components in a Sheep Model of Hemorrhage	305
Christopher G Scully, George C Kramer, David G Strauss	
5-3: Cardiovascular Ultrasound	Chairs Nico Bruining T Syeda-Mahmood
<hr/>	
CAPSU: a Completely Automated Method for Carotid Plaques Segmentation in Ultrasound Images	309
Francesca Galluzzo, Cristiana Corsi, Carmela Morizzo, Luca De Marchi, Nicola Testoni, Nicolò Speciale, Guido Masetti	

Near-Automated Quantification of Prenatal Aortic Intima-Media Thickness from Ultrasound Images	313
G Tarroni, S Visentin, E Cosmi, E Grisan	
Anatomical Structure Labeling in Apical Four-Chamber View Echocardiogram Images	317
Yu Cao, Colin B Compas, Hongzhi Wang, Tanveer F Syeda-Mahmood	
Necrotic Tissue Distribution Analysis: Preliminary Investigation for Reducing Necrosis Overestimation in Intravascular Ultrasound Virtual Histology Images	321
Fernando JR Sales, Breno AA Falcao, Joao LAA Falcao, Sergio S Furuie, Pedro A Lemos	

6-1: ECG Methods I

Optimized Modelling of Maternal ECG Beats using the Stationary Wavelet Transform	325
Fernando Andreotti, Joachim Behar, Julien Oster, Gari D Clifford, Hagen Malberg, Sebastian Zaunseder	
Estimation of Atrial Fibrillatory Frequency by Spectral Subtraction of Wavelet Denoised ECG in Patients with Atrial Fibrillation	329
Jonathan Goodfellow, Omar J Escalona, Philip R Walsh, Vivek Kodoth, Ganesh Manoharan	
Morphology-based QT Interval Measurement using Frame-based Representation of ECG Signal	333
Alireza Ghodrati, Abbas Babajani-Feremi	
Wave Sequence Based Identification of Sinus Rhythm Beats on a Microcontroller	337
Alexander Noack, Rüdiger Poll, Wolf-Joachim Fischer	
A Signal Decomposition Approach to Morphological Modeling of P-wave	341
Ebadollah Kheirati Roonizi, Roberto Sassi	
Reducing ECG Alarm Fatigue Based on SQI Analysis	345
Zehui Sun, Jianwei Su, Chaocheng Xie, Jiao Yu, Wenyu Ye, Shen Luo	
Classification of Supraventricular and Ventricular Beats by QRS Template Matching and Decision Tree	349
Vessela Krasteva, Remo Leber, Irena Jekova, Ramun Schmid, Roger Abächerli	
Respiratory Rate Estimation from Multi-Lead ECGs using an Adaptive Frequency Tracking Algorithm	353
Leila Mirmohamadsadeghi, Jean-Marc Vesin	
QRS Detectors Performance Comparison in Public Databases	357
Mariano Llamedo, Juan Pablo Martínez	
An Algorithm for the Detection of ST Segment Elevation Relating to Induced Ischemia in Body Surface Potential Maps	361
Dewar D Finlay, Daniel Guldenring, Raymond R Bond, Michael J Daly	

Trend Strips: a New Tool to Analyze RR Time Series	365
Antônio Carlos da Silva Filho, Fátima Maria HHSP da Silva, Júlio Cesar Crescêncio, Lourenço Gallo Júnior	
Morphological Analysis on Single Lead Contactless ECG Monitoring Based on a Beat-TemplateDevelopment	369
Jesús Hernández-Ortega, Francisco-Javier Gimeno-Blanes, José-Luis Rojo-Álvarez, José-Antonio Flores-Yepes, Andrés Lorenzo Bleda-Tomás, Rafael Maestre-Ferriz, José-María López-Ayala, Juan-Ramón Gimeno-Blanes, Arcadio García-Alberola	
Internet based ST Map Software: A Web Service, a Decision Support System and an Educational Tool	373
Raymond R Bond, Dewar D Finlay, Daniel Guldenring	

6-2: ECG Repolarization

Normal Ventricular Repolarization Dispersion Range with Abrupt Heart Rate Changes	377
Pablo D Cruces, María P Bonomini, Marcos J Teperino, Ana Mincholé, Pablo Laguna, Pedro D Arini	
Repolarization Effects of Sertindole Manifest as T-wave Flatness on the ECG	381
Tanveer A Bhuiyan, Claus Graff, Jørgen K Kanters, Jimmi Nielsen, Johannes J Struijk	
Changes in the ST- and Ventricular Gradient Vectors over a Period of 25 Years	385
Marjolein De Jongh, C Cato Ter Haar, Sumche Man, Maurits FJ Van der Heide, Roderick W Treskes, Arie C Maan, Martin J Schalij, Cees A Swenne	
Specificity of the Moving Average Method for Detecting Alternans	389
David W Mortara	
The Accuracy of the EASI-Derived Spatial QRS-T Angle	393
Daniel Guldenring, Dewar D Finlay, Raymond R Bond, Alan Kennedy, James McLaughlin	

6-3: Clinical Aspects of ECG

Electrocardiographic Abnormalities in Hypertrophic Cardiomyopathy	397
A Mincholé, R Ariga, S Neubauer, H Watkins, B Rodriguez	
Low Level and High Frequency Fragmentation of the QRS Changes during Acute Myocardial Ischemia in Patients with and without Prior Myocardial Infarction	401
Pedro Gomis, Pere Caminal	
Assessing the Accuracy of Limited Lead Recordings for the Detection of Atrial Fibrillation	405
Kerri M Griffiths, Elaine N Clark, Brian Devine, Peter W Macfarlane	

QRS and T Loops Area Changes During Haemodialysis	409
I Simova, I Christov, L Kambova, G Bortolan, Tz Katova	
The Loss of Multifractality as Evidence of Impaired Left Ventricular Ejection Fraction in Patients after Acute Myocardial Infarction	413
Fátima MHSP da Silva, Antonio Carlos da Silva Filho, Julio Cesar Crescencio, Valéria Papa, Lourenço Gallo Júnior	
 6-4: Nonlinear Analysis of Heart Rate Variability	
<hr/>	
Extended Parabolic Phase Space Mapping (EPPSM): Novel Quadratic Function for Representation of Heart Rate Variability Signal	417
Sadaf Moharreri, Shahab Rezaei, Nader Jafarnia Dabanloo, Saman Parvaneh	
HRV Spectral and Fractal Analysis in Heart Failure Patients with Different Aetiologies	421
Elisa Fornasa, Agostino Accardo, Martino Cinquetti, Marco Merlo, Gianfranco Sinagra	
The Analysis of Human Heart Rate for Healthy and Ill Patients using the Recently Published Method Multiscale Multifractal Analysis	425
Dorota Kokosińska, Jan Jakub Gierałtowski	
Time-domain, Frequency Domain and Non-linear Measurements in Neonates' Heart Rate Variability with Clinical Sepsis	429
E Godoy, J López, L Bermúdez, A Ferrer, N García, C García Vicent, EF Lurbe, J Saiz	
Nonlinear Features of Neonatal Heart Rate Dynamics	433
Barbora Czippelova, Lenka Chladekova, Zuzana Turianikova, Ingrid Tonhajzerova, Kamil Javorka, Zuzana Uhrikova, Mirko Zibolen, Michal Javorka	
Comparison of Attractor Reconstruction and HRV Methods for Analysing Blood Pressure Data	437
Philip J Aston, Manasi Nandi, Mark I Christie, Ying H Huang	
Investigating Maternal-Fetal Heart Rate Coupling with High Resolution Joint Symbolic Dynamics	441
Ahsan H Khandoker, Steffen Schulz, Yoshitaka Kimura, Marimuthu Palaniswami, Andreas Voss	
Recurrence Quantification Analysis of Heart Rate and Blood Pressure Variability in Obese Children and Adolescents	445
Zuzana Turianikova, Ingrid Tonhajzerova, Barbora Czippelova, Kamil Javorka, Zuzana Lazarova, Michal Javorka	
Multiscale Cardiovascular Autonomic Modulation Following Treatment in Patients with Anorexia Nervosa	449
HF Jelinek, DJ Cornforth, SP Lam, J Russell, I Spence	

6-5: Informatics

Design and Optimization of an ECG / Holter Hybrid System for Mobile Systems based on DSPic	453
Flavio M Pineda-López, Andrés Martínez-Fernández, José Luis Rojo-Álvarez, Manuel Blanco-Velasco	
Exploratory Analysis of Heart Rate Changes in Newborns to Investigate the Effectiveness of Bag-Mask Ventilation	457
Huyen Vu, Trygve Eftestøl, Kjersti Engan, Joar Eilevstjønn, Jørgen Linde, Hege Ersdal	
Proof of Concept for an International Long-Time Preservation ECG Format	461
Roberto Sassi, Luca Sparagino, Norman L Stockbridge, Juan M Guadiana, Fabio Badilini	
Encoding the Electrocardiogram Details in the Host Record's Bandgap for Authorization-Dependent ECG Quality	465
Piotr Augustyniak	
Telemedical Human Activity Monitoring System based on a Wearable Sensors Network	469
Eliasz Kańtoch	
Effect of Telehealth on Self-Care Behavior of Heart Failure Patients	473
Carolina Varon, Morenikeji Alao, Jan Minter, Michelle Stapleton, Stuart Thomson, Siegfried Jaecques, Hans-Peter Brunner-La-Rocca, Sabine Van Huffel	
Optimization of Shifts and On-Call Coverage of Cardiologists Working in a Hospital Complex Structure by using Free Software	477
Eugenio Cervesato, Giovanni Righini, Gian L Rellini, Matteo Cassin, Rita Piazza, Gian L Nicolosi	
European Patient Summary Guideline and Continuity of Care Document: A Comparison	481
Ana Estelrich, Harold Solbrig, Giorgio Cangioli, Marcello Melgara, Catherine Chronaki	
Automated Measurement of Fetal Isovolumic Contraction Time from Doppler Ultrasound Signal without using Fetal Electrocardiography	485
Faezeh Marzbanrad, Yoshitaka Kimura, Miyuki Endo, Marimuthu Palaniswami, Ahsan H Khandoker	
Assessment of Dynamic Autonomic Changes with Posture using Instantaneous Entropy Measures	489
Gaetano Valenza, Luca Citi, Enzo Pasquale Scilingo, Riccardo Barbieri	
Heart Murmur Detection using Ensemble Empirical Mode Decomposition and Derivations of the Mel-Frequency Cepstral Coefficients on 4-Area Phonocardiographic Signals	493
Joe A Jimenez, Miguel A Becerra, Edilson Delgado-Trejos	

Towards Semantic Interoperability for Cardiovascular Risk Stratification into the Electronic Health Records Using Archetypes and SNOMED-CT	497
---	------------

Alfonso Sánchez-Cano, Cristina Soguero-Ruiz, Inmaculada Mora-Jiménez, Luis Lechuga, Javier Ramos-López, Arcadio García-Alberola, Pablo Serrano-Balazote, José Luis Rojo-Álvarez

6-6: Tools for Simulation and Modeling

Spatial Refinement of a New Algorithm to Identify Focus of Atrial Ectopic Activity from 64-lead ECGs	501
Erick A Perez Alday, Michael A Colman, Philip Langley, Henggui Zhang	
Huge Reduction of Defibrillation Thresholds using Four Electrode Defibrillators	505
Ana Simic, Inma R Cantalapiedra, Jorge Elorza, Jean Bragard	
Quantitative Insights into the Closed-loop Cardiovascular System using an Electrical Lumped Element Physiological Model	509
Athanasis Tsanas, Gari D Clifford, Vassiliki Vartela, Petros Sfirakis	
Modeling of the Human Heart Rate Variability Enhanced using Stochastic Sleep Architecture Properties	513
Mateusz Soliński, Jan Gierałtowski, Jan Janeck Zebrowski	
A Simple 2D Whole Heart Model for Simulating Electrocardiogram	517
Minimol Balakrishnan, Srinivasa Chakravarthy, Soma Guhathakurta	
Parameter Sensitivity Analysis of a Human Atrial Cell Model using Multivariate Regression	521
Eugene TY Chang, Richard H Clayton	
Detection of Abnormal Cardiac Activity using Principal Component Analysis	525
Ariel Greisas, Sharon Zlochiver	
A Bayesian Approach to Quantifying Uncertainty in Tikhonov Solutions for the Inverse Problem of Electrocardiography	529
Jessie J France, Yaniv Gur, Robert M Kirby, Chris R Johnson	
How Accurately can Cardiac Conductivity Values be Determined from Heart Potential Measurements?	533
Barbara M Johnston, Peter R Johnston	
Accuracy of Inverse Solution Computation of Dominant Frequencies and Phases during Atrial Fibrillation	537
J Pedrón-Torrecilla, AM Climent, A Liberos, M Rodrigo, E Pérez-David, J Millet, F Fernández-Avilés, O Berenfeld, F Atienza, MS Guillen	

fecgsyngui: A GUI Interface to fecgsynfor the Simulation of Maternal-Foetal Activity Mixtures on Abdominal Electrocardiogram Recordings	541
Mohsan S Alvi, Fernando Andreotti, Julien Oster, Sebastian Zaunseder, Gari D Clifford, Joachim Behar	
Correlation Dimension as a Measure of the Atrial Fibrillation Capture during Atrial Septal Pacing	545
Adrian Luca, Jean-Marc Vesin	
<hr/>	
7-1: Challenge II	Chairs
	Franc Jager Ikaro Silva
<hr/>	
Robust Detection of Heart Beats in Multimodal Data: The PhysioNet/Computing in Cardiology Challenge 2014	549
George Moody, Benjamin Moody, Ikaro Silva	
Hidden Semi-Markov Model-Based Heartbeat Detection Using Multimodal data and Signal Quality Indices	553
Marco AF Pimentel, Mauro D Santos, David B Springer, Gari D Clifford	
Robust Multichannel QRS Detection	557
Filip Plesinger, Juraj Jurco, Pavel Jurak, Josef Halamek	
Heart Beat Detection Method with Estimation of Regular Intervals between ECG and Blood Pressure	561
Jongmin Yu, Taegyun Jeon, Moongu Jeon	
Robust Identification of Heartbeats with Blood Pressure Signals and Noise Detection	565
Bo Yang, Soo-Kng Teo, Bart Hoeben, Christopher Monterola, Yi Su	
Robust Detection of Heart Beats using Dynamic Thresholds and Moving Windows	569
Marcus Vollmer	
<hr/>	
7-2: ECG Waveform Quality and Detection I	Chairs
	Shen Luo Raymond Bond
<hr/>	
Lead Quality Monitoring for Detection of the Optimal Snapshot Time to Record Resting ECG	573
Irena Jekova, Remo Leber, Vessela Krasteva, Ramun Schmid, Roger Abächerli	
Study of ECG Quality using Self Learning Techniques	577
Gianfranco Toninelli, Alfonso Gerevini, Ivan Serina, Martino Vaglio, Fabio Badilini	
ECG Recording Sites for Improving Signal-to-Noise Ratio during Atrial Depolarisation	581
Alan Kennedy, Dewar D Finlay, Daniel Guldenring, James McLaughlin	

Automatic J-point Location in Subjects with Electrocardiographic Early Repolarization	585
Jacob Melgaard, Johannes J Struijk, Jørgen K Kanters, Samuel E Schmidt, Ask S Jensen, John Hansen, Tanveer A Bhuiyan, Claus Graff	
Automatic Real-Time Quality Assessment of a 12-Lead ECG Recording	589
Reza Firoozabadi, Richard E Gregg, Beth Zengo, Saeed Babaeizadeh	
<hr/>	
7-3: Nonlinear Analysis of Heart Rate Variability	Chairs
	Olivier Meste Pablo Laguna
<hr/>	
Analysis of Non-linear Respiratory Influences on Sleep Apnea Classification	593
Alexander Caicedo, Carolina Varon, Sabine Van Huffel	
Rank-based Multi-Scale Entropy Analysis of Heart Rate Variability	597
Luca Citi, Giulia Guffanti, Luca Mainardi	
A Methodological Assessment of Phase-Rectified Signal Averaging through Simulated Beat-to-Beat Interval Time Series	601
Roberto Sassi, Tamara Stampalija, Daniela Casati, Enrico Ferrazzi, Axel Bauer, Massimo W Rivolta	
QT Interval Adaptation to Changes in Autonomic Balance	605
Ehimwenma Nosakhare, George C Verghese, Robert C Tasker, Thomas Heldt	
Separating Respiratory Influences from the Tachogram: Methods and their Sensitivity to the Type of Respiratory Signal	609
D Widjaja, C Varon, D Testelmans, B Buyse, L Faes, Sabine Van Huffel	
<hr/>	
7-4: Classification of CV Signals	Chairs
	Philip Warrick Piotr Augustyniak
<hr/>	
Robust Heart Rate Estimation from Noisy Phonocardiograms	613
David B Springer, Thomas Brennan, Jens Hitzeroth, Bongani M Mayosi, Lionel Tarassenko, Gari D Clifford	
Subject-Optimized Feature Selection for Accurate Classification of Cardiac Beats	617
Piotr Augustyniak	
Evaluation of Fetal Heart Rate Recordings Based on Clustering	621
Tereza Janíčková, Václav Chudáček, Jiří Spilka	
Support Vector Machine Hidden Semi-Markov Model-based Heart Sound Segmentation	625
David B Springer, Lionel Tarassenko, Gari D Clifford	

8-1: Ischemia and InfarctionChairs Cees Swenne
Goran Krstacic

Detection of Acute Ischemia Episodes from QRS Angles Changes using a Laplacian Noise Model	629
Daniel Romero, Juan Pablo Martínez, Pablo Laguna, Esther Pueyo	
Reproducibility of ST and Ventricular Gradient Vectors	633
Roderick W Treskes, C Cato Ter Haar, Sumche Man, Marjolein C DeJongh, Maurits FJ Van Der Heide, Arie C Maan, Martin J Schalij, Cees A Swenne	
Improving Automatic Detection of Acute Myocardial Infarction in the Presence of Confounders	637
Richard E Gregg, Saeed Babaeizadeh	
A Real-time ST-segment Monitoring Algorithm Based on a Multi-channel Waveform-Length-TransformMethod for Q-onset and J-point Detection	641
Wei Zong, Scott Kresge, Haisheng Lu, John Wang	
Wavelet Based Method for Localization of Myocardial Infarction using the Electrocardiogram	645
Azadeh Nooriyan, Nader Jafarnia Dabanloo, Saman Parvaneh	

8-2: Fibrillation and TachyarrhythmiaChairs Guy Carrault
José Alvarez

A Platform to guide Catheter Ablation of Persistent Atrial Fibrillation using Dominant Frequency Mapping	649
Xin Li, João L Salinet, Tiago P Almeida, Frederique J Vanheusden, Gavin S Chu, G André Ng, Fernando S Schlindwein	
Spatiotemporal Behaviour of High Dominant Frequency during Persistent Atrial Fibrillation	653
Nawshin Dastagir, Joao Salinet, Frederique J Vanheusden, Tiago P Almeida, Xin Li, Gavin S Chu, G André Ng, Fernando S Schlindwein	
Distinctive Patterns of Dominant Frequency Trajectory Behaviour in Persistent Atrial Fibrillation: Spatio-temporal Characterisation	657
JL Salinet, J Tuan, ASM Salinet, X Li, P Stafford, GA Ng, FS Schlindwein	
Pulse Harmonic Strength of Facial Video Signal for the Detection of Atrial Fibrillation	661
Jean-Philippe Couderc, Survi Kyal, Lalit K Mestha, Beilei Xu, Derick R Peterson, Xiaojuan Xia, Burr Hall	
Towards Impedance Optimised Transcutaneous Atrial Defibrillation	665
PR Walsh, PA Rodrigues, J Goodfellow, N Watermann, D McEneaney, OJ Escalona	

Specific Patterns of Premature Beats Tend to Initiate Ventricular Tachyarrhythmias in Human Patients	669
---	------------

Anna RM Gelzer, Robert F Gilmour Jr, Niels F Otani

8-3: Ventricular Modeling

Chairs Flavio Fenton
 Henggui Zhang

A Computational Investigation into the Effect of Infarction on Clinical Human Electrophysiology Biomarkers	673
---	------------

Louie Cardone-Noott, Alfonso Bueno-Orovio, Ana Mincholé, Kevin Burrage,
Mikael Wallman, Nejib Zemzemi, Erica Dall'Armellina, Blanca Rodriguez

Inverse Estimation of Left Ventricular Purkinje Tree Pathways from Sequence of Depolarization	677
--	------------

Ruben Cardenes, Rafael Sebastian, Antonio Beruezo, Oscar Camara

Sensitivity Study of Fiber Orientation on Stroke Volume in the Human Left Ventricle	681
--	------------

Lukas Baron, Thomas Fritz, Gunnar Seemann, Olaf Dössel

Modeling the Take-off Voltage of the Action Potential during Fast Pacing	685
---	------------

Diandian Diana Chen, Richard A Gray, Flavio H Fenton

Verification of a Defibrillation Simulation Using Internal Electric Fields in a Human Shaped Phantom	689
---	------------

Jess Tate, Thomas Pilcher, Kedar Aras, Brett Burton, Rob MacLeod

Quantitative Analysis of Rate-Dependent of Human Heart Failure Action Potential Model on Alternans Onset and Arrhythmias	693
---	------------

MM Elshrif, P Shi, EM Cherry

8-4: 3D Imaging

Chairs Rob MacLeod
 Cristiana Corsi

Automatic Extraction of Arterial Centerline from Whole-body Computed Tomography Angiographic Datasets	697
--	------------

Xinpei Gao, Shengxian Tu, Michiel A de Graaf, Liang Xu, Pieter Kitslaar,
Arthur JHA Scholte, Bo Xu, Johan HC Reiber

Fusion Imaging of Computed Tomography and 3D Echocardiography: Combined Assessment of Coronary Anatomy and Myocardial Function	701
---	------------

Francesco Maffessanti, Karima Addetia, Gillian Murtagh, Lynn Weinert, Amit R Patel,
Roberto M Lang, Victor Mor-Avi

Automatic Correction of Motion Artifacts in 4D Left Ventricle Model Reconstructed from MRI	705
Yi Su, May-Ling Tan, Chi-Wan Lim, Soo-Kng Teo, Senthil Kumar Selvaraj, Min Wan, Liang Zhong, Ru-San Tan	
3D Echocardiographic Quantification of Ejection Fraction and Cardio-toxicity Onset	709
Cinzia Lorenzini, Michele Aquilina, Claudio Lamberti, Cristiana Corsi	
Temporal Sparse Promoting Three Dimensional Imaging of Cardiac Activation	713
Long Yu, Zhaoye Zhou, Bin He	
An Iterative Method for Solving the Inverse Problem in Electrocardiography Imaging: From Body Surface to Heart Potential	717
Nejib Zemzemi, Hamed Bourenane, Hubert Cochet	
9-1: ECG Waveform Quality and Detection II	Chairs Eric Helfenbein Ivaylo Christov
<hr/>	
A Pattern-Recognition Approach for Lead-Selection in Heartbeat Detection	721
Mariano Llamedo, Juan Pablo Martínez, Pablo Laguna	
Adaptive Mathematical Morphology for QRS Fiducial Points Detection in the ECG	725
Sasan Yazdani, Jean-Marc Vesin	
Heartbeat Classification System using Adaptive Learning form Selected Beats	729
Philip de Chazal	
A real-time QRS detector based on higher-order statistics for ECG gated cardiac MRI	733
Marcus Schmidt, Johannes W Krug, Andreas Gierstorfer, Georg Rose	
QRS Detection Optimization in Stress Test Recordings using Evolutionary Algorithms	737
David Hernando, Raquel Bailón, Rute Almeida, Alfredo Hernández	
Vector-based Pacemaker Pulse Detection Algorithm for the Surface ECG	741
Simon C Chien, Po-Cheng Chang, Hong-Ta Wo, Chun-Chieh Wang, Ming-Shien Wen, Eric D Helfenbein	
9-2: Atrial Fibrillation Modeling	Chairs G Seemann Adriaan van Oosterom
<hr/>	
Optimization of Pharmacotherapy for Familial Atrial Fibrillation in a Numerical Model of Human Atrial Electrophysiology	745
Axel Loewe, Yannick Lutz, Mathias Wilhelms, Eberhard P Scholz, Olaf Dössel, Gunnar Seemann	

Atrial Spiral Wave Drifting Under Applied Spatial Temperature Gradients	749
Guy Malki, Sharon Zlochiver	
A Simulation Study of Electrotonic Coupling between Human Atrial Myocytes and Mechanosensitive Fibroblasts	753
Honglian Su, Heqing Zhan, Yinglan Gong, Dingchang Zheng, Ling Xia	
Accurate Characterization of Rotor Activity during Atrial Fibrillation Depends on the Properties of the Multielectrode Grid	757
Laura Martínez, Lucía Romero, Catalina Tobón, José M Ferrero, José Jalife, Omer Berenfeld, Javier Saiz	
Constructing Human Atrial Electrophysiological Models Mimicking a Patient-Specific Cell Group	761
A Muszkiewicz, A Bueno-Orovio, X Liu, B Casadei, B Rodriguez	
Evaluating Effects of Fibrosis in Atrial Arrhythmogenesis using 3D Computational Modelling	765
Ross Morgan, Michael Colman, Martin Kruger, Gunnar Seemann, Kawal Rhode, Oleg Aslanidi	

9-3: Pathology of Heart Rate Variability	Chair	Andreas Voss
Causality of Heart Rate – Blood Pressure Interactions during Mental and Orthostatic Stress	769	
Michal Javorka, Barbora Czippelova, Lenka Chladekova, Zuzana Turianikova, Zuzana Visnovcova, Zuzana Lazarova, Kamil Javorka, Ingrid Tonhajzerova		
Heart Rate Variability Associated with Different Modes of Lower Abdominal Muscle Tension during Zen Meditation	773	
Masaki Hoshiyama, Asagi Hoshiyama		
Impacts of First and Second Labour Stages on Hurst Parameter based Intrapartum Fetal Heart Rate Analysis	777	
Jiří Spilka, Patrice Abry, Paulo Goncalves, Muriel Doret		
Three Independent Forms of Cardio-Respiratory Coupling: Transitions across Sleep Stages	781	
Ronny P Bartsch, Kang KL Liu, Qianli DY Ma, Plamen CH Ivanov		
Time-Domain and Spectral Analysis of Heart Rate Variability in Rats Challenged with Hypoxia	785	
Stanislaw Zajaczkowski, Maria Smolińska, Piotr Badtke, Tomasz H Wierzba		

9-4: Miscellaneous Medical InformaticsChairs Gary Clifford
 Peter Szolovits

CrowdLabel: A Crowdsourcing Platform for Electrophysiology	789
Tingting Zhu, Joachim Behar, Tasos Papastylianou, Gari D Clifford	
Increasing the Dynamic Range of a Pulse Oximeter using Heart Rate Characteristics	793
Chris J Brouse, Ron Gatzke, Dan Freeman, Yu Chen	
Noise and Spatial-resolution Effect of Electrode Array on Rotor Tip Location during Atrial Fibrillation: A Simulation Study	797
Miguel A Becerra, Juan Murillo-Escobar, Laura C Palacio, Catalina Tobón Zuluaga	
Risk Assessment of Atrial Fibrillation: a Failure Prediction Approach	801
Jelena Milosevic, Andreas Dittrich, Alberto Ferrante, Miroslaw Malek, Camilo Rojas Quiros, Rubén Braojos, Giovanni Ansaloni, David Atienza	
Multimodal Sensor Fusion of Cardiac Signals via Blind Deconvolution: A Source-Filter Approach	805
Christoph Hoog Antink, Christoph Brüser, Steffen Leonhardt	

10-1: Atrial Fibrillation IChairs José Millet
 Leif Sörnmo

Altered Nonlinear Dynamics of Atrial Fibrillation Detected After Ablation	809
Kevin Sunderland, Adam E Berman, Autumn M Schumacher	
A Novel P-wave Duration Estimation Method to Assess the Impact of the Hybrid Procedure for Atrial Fibrillation Ablation	813
Pietro Bonizzi, Narendra Kumar, Stef Zeemering, Ralf LM Peeters, Laurent Pison	
Atrial Fibrillation Type Characterization and Catheter Ablation Acute Outcome Prediction: Comparative Analysis of Spectral and Nonlinear Indices from Right Atrium Electrograms	817
Luigi Yuri Di Marco, Daniel Raine, John P Bourke, Philip Langley	
Modification of Atrioventricular Node Conduction Increases RR Variability but not RR Irregularity in Atrial Fibrillation Patients	821
Valentina DA Corino, Sara R Ulimoen, Steve Enger, Luca T Mainardi, Arnljot Tveit, Pyotr G Platonov	

10-2: Inverse ProblemChairs Dewar Finlay
 Peter van Dam

Using a new Time-Independent Average Method for Non-Invasive Cardiac Potential Imaging of Endocardial Pacing with Imprecise Thorax Geometry	825
Jaume Coll-Font, Burak Erem, Petr Štovíček, Dana H Brooks	
Localization of Three-Dimensional Sources in Cardiac Tissue Using Optical Mapping	829
Gwladys Ravon, Yves Coudière, Angelo Iollo, Olivier Bernus, Richard D Walton	
Noninvasive Identification of Three-dimensional Myocardial Infarctions from Inversely Reconstructed Equivalent Current Density	833
Zhaoye Zhou, Chengzong Han, Bin He	
Local Regularization of Endocardial and Epicardial Surfaces for better Localization of Ectopic Beats in the Inverse Problem of ECG	837
Danila Potyagaylo, Walther HW Schulze, Olaf Dössel	

10-3: Blood Pressure and Peripheral PulseChairs Dingchang
 Zhang
 Brian Anthony

Validation of a Blood Pressure Simulator that Regenerates Oscillometric Cuff Pressure Waveforms	841
Dingchang Zheng, Chengyu Liu, John Amoore, Stephan Mieke, Alan Murray	
Validation of a Smartphone-based Photoplethysmographic Beat Detection Algorithm for Normal and Ectopic Complexes	845
Lenn Drijkoningen, Frederic Lenaerts, Jo Van der Auwera, Kobe Leysen, Dieter Nuyens, Pieter Vandervoort, Lars Grieten	
Oscillometric Waveform Difference between Cuff Inflation and Deflation during Blood Pressure Measurement	849
Chengyu Liu, Dingchang Zheng, Clive Griffiths, Alan Murray	
Estimation of Respiratory Information from the Built-In Pressure Sensors of a Dialysis Machine	853
Frida Sandberg, Mattias Holmer, Bo Olde, Kristian Solem	

10-4: Ionic Modeling in Ventricular ArrhythmiaChairs Javier Saiz
 José Ferrero

Pro-arrhythmic Effects of Increased Late Sodium Current in Failing Human Heart	857
Jieyun Bai, Kuanquan Wang, Xiangyun Bai, Yongfeng Yuan, Henggui Zhang	

Late Sodium Current Inhibition Counteracts Pro-arrhythmic Mechanisms in Human Hypertrophic Cardiomyopathy	861
Elisa Passini, Blanca Rodriguez, Ana Mincholé, Raffaele Coppini, Elisabetta Cerbai, Stefano Severi, Alfonso Bueno-Orovio	
Theoretical Study of the Role of Funny Current (If) and the Background Inward Current (Ib) in Atrioventricular Nodal Conduction	865
Jue Li, Ian Temple, Mark R Boyett	
Effect of Inter-Subject Variability in Determining Response to IKr Block in Human Ventricular Myocytes	869
Oliver J Britton, Alfonso Bueno-Orovio, Laszlo Virag, Andras Varro, Blanca Rodriguez	
<hr/>	
11-1: Ischemic Modeling	Chairs Stefan Nelwan Daniel Guldenring
Ischemia Alters Sensitivity of Action Potential to the Sodium-Potassium Pump	873
Sanjay Kharche, Edward Vigmond, Haibo Ni, Michael Colman, Henggui Zhang	
Dynamic Computational Simulations of Alternans in Acute Myocardial Ischemia	877
Antonio Felix de Castro, Adriano Giovanni, Jose F Rodrigues, Jose M Ferrero	
Effects of Acute Myocardial Ischemia in Mathematical Models of Heterogeneous Myocardium	881
Anastasia Vasilyeva, Nathalie Vikulova, Olga Solovyova, Vladimir S Markhasin	
Metabolic but not Hypoxic Stimuli are Related to the Apparent Recruitment of Capillaries in the Muscle	885
Vito Starc	
<hr/>	
11-2: Atrial Fibrillation II	Chairs Marianna Meo Philip Langley
Non-invasive Evaluation of the Effect of Metoprolol on the Atrioventricular Node during Permanent Atrial Fibrillation	889
Valentina DA Corino, Frida Sandberg, Luca T Mainardi, Sara R Ulimoen, Steve Enger, Arnljot Tveit, Pyotr G Platonov, Leif Sörnmo	
Principal Component Analysis of Body Surface Potential Mapping in Atrial Fibrillation Patients Suggests Additional ECG Lead Locations	893
Stef Zeemering, Theo AR Lankveld, Pietro Bonizzi, Harry Crijns, Ulrich Schotten	
Is it Possible to Detect Atrial Fibrillation by Simply using RR Intervals?	897
Sándor Hargittai	

Joint Entropy for Spatial Information Retrieval from Orthogonal Heart Planes Improves Catheter Ablation Outcome Prediction in Persistent Atrial Fibrillation	901
Marianna Meo, Vicente Zarzoso, Olivier Meste, Decebal G Latcu, Nadir Saoudi	

11-3: Apnea Detection and Cardio-respiratory Interactions	Chairs Ary Goldberger Carolina Varon
--	---

An approach to the Enhancement of Sleep Apnea Detection by means of Detrended Fluctuation Analysis of RR intervals	905
---	------------

AG Ravelo-García, U Casanova-Blancas, S Martín-González, E Hernández-Pérez, I Guerra-Moreno, P Quintana-Morales, Niels Wessel, JL Navarro-Mesa

Automated Detection of Obstructive Sleep Apnoea by Single-lead ECG through ELM Classification	909
--	------------

Nadi Sadr, Philip de Chazal

Development of Analytical Approach for an Automated Analysis of Continuous Long-Term Single Lead ECG for Diagnosis of Paroxysmal Atrioventricular Block	913
--	------------

Muammar M Kabir, Larisa G Tereshchenko

Transient Behavior of Cardiorespiratory Interactions towards the Onset of Epileptic Seizures	917
---	------------

Carolina Varon, Katrien Jansen, Lieven Lagae, Luca Faes, Sabine Van Huffel

12-1: Imaging

In Vivo T2-mapping and Segmentation of Carotid Artery Plaque Components Using Magnetic Resonance Imaging at 1.5T	921
---	------------

Bartosz Proniewski, Tomasz Miszalski-Jamka, Przemysław Jaźwiec

Fusion of Edge Enhancing Algorithms for Atherosclerotic Carotid Wall Contour Detection in Computed Tomography Angiography	925
--	------------

Florentino Luciano Caetano dos Santos, Atte Joutsen, Juha Salenius, Hannu Eskola

Myocardium Segmentation Improvement with Anisotropic Anomalous Diffusion Filter Applied to Cardiac Magnetic Resonance Imaging	929
--	------------

Antonio Carlos da S Senra Filho, Gustavo C Barizon, Luiz O Murta Junior

Automated Algorithm for Computing Left Ventricle Volume Changes from Cine-MR Images	933
--	------------

Soo-Kng Teo, Wan Min, Chi-Wan Lim, Liang Zhong, Ru-San Tan, Yi Su

A Local Phase-Based Algorithm for Registration of CMR Scans from Multiple Visits	937
---	------------

Christopher Kelly, Stefan Neubauer, Robin Choudhury, Erica Dall'Armellina, Vicente Grau

Defining Angular and Radial Positions and Parameters for Myocardial Pixels in Cardiac MR Images	941
Kjersti Engan, Leik Woie, Trygve Eftestøl	
Tissue Characterization from Myocardial Perfusion and Autonomic Innervation using MRI and SPECT images in Chagas Disease	945
Gustavo C Barizon, Antonio Carlos da S Senra Filho, Marcus Vinicius Simões, André Schmidt, Leonardo P Gadioli, Luiz O Murta Junior	
Variance Stabilizing Transformations in the Reduction of Poisson noise in 3D Nuclear Medicine Images	949
Edward Flórez Pacheco, Sergio Shiguemi Furui	
Optical Ballistocardiography for Gating and Patient Monitoring during MRI: An Initial Study	953
Johannes W Krug, Falk Lüsebrink, Oliver Speck, Georg Rose	
Automatic Segmentation of Intravascular Ultrasound Images based on Temporal Texture Analysis	957
Chi Hau Chen, Adithya G Gangidi	
A New Method for Intraoperative Quantification of Mitral Leaflet Segment Prolapse	961
Sandy Engelhardt, Raffaele De Simone, Norbert Zimmermann, Matthias Karck, Hans-Peter Meinzer, Diana Nabers, Ivo Wolf	
Ambulatory Impedance Pneumography Device for Quantitative Monitoring of Volumetric Parameters in Respiratory and Cardiac Applications	965
Marcel C Młyńczak, Wiktor Niewiadomski, Marek Zyliński, Gerard P Cybulski	
The Use of Different Measures of Signal Shape for Automatic Identification of Artifacts in Impedance Cardiography	969
Gerard Cybulski, Piotr Piskulak	

12-2: System Studies

Antipsychotic Medication Influences Cardiovascular Coupling in Patients Suffering from Acute Schizophrenia	973
Steffen Schulz, Jens Haueisen, Karl-Jürgen Bär, Andreas Voss	
Study of Induced Emotion by Color Stimuli: Power Spectrum Analysis of Heart Rate Variability	977
Sadaf Moharreri, Shahab Rezaei, Nader Jafarnia Dabanloo, Saman Parvaneh	
In-vivo and Isolated Heart HRV Analysis by Hidden Markov Model	981
Oto Janoušek, Marina Ronzhina, Jana Kolářová, Ivo Provazník, Marie Nováková, Peter Scheer	

Detection of Electrocardiographic and Respiratory Signals from Transthoracic Bioimpedance Spectroscopy Measurements with a Wearable Monitor for Improved Home-Based Disease Management in Congestive Heart Failure	985
Silviu Dovancescu, Attila Para, Jarno Riistama	
Heart Rate Variability Analysis of Pre and Post Awakening of 10 Year Old Children	989
Taher A Biala, Syamil Muhammad, Fernando S Schlindwein, Michael Wailoo	
Global Optimization Approaches for Parameter Tuning in Biomedical Signal Processing: A Focus of Multi-scale Entropy	993
Mohammad Ghassemi, Li-Wei Lehman, Jasper Snoek, Shamim Nemati	
Heart Rate Variability in Ultra-Trail Runners	997
Umberto Melia, Montserrat Vallverdu, Emma Roca, Daniel Brotons, Alfredo Iruria, Joan A Cadefau, Pere Caminal, Alexandre Perera	
Discrimination of Normal and At-Risk Populations from Fetal Heart Rate Variability	1001
Philip A Warrick, Emily F Hamilton	
Investigation of Baroreflex Autonomic Control by Spectral Coherence of fMRI Independent Components and Neck Suction Stimulation Signal	1005
Matteo Mancini, Eugenio Mattei, Federica Censi, Barbara Basile, Marco Bozzali, Giovanni Calcagnini	
Influence of Psychological Stress on QT Interval	1009
Chandan Karmakar, Mohammad Hasan Imam, Ahsan Khandoker, Marimuthu Palaniswami	
Cardiac Autonomic Innervation Following Coronary Artery Bypass Grafting Evaluated by High Resolution Heart Rate Variability	1013
D Simov, M Matveev, M Milanova, V Krasteva, I Christov	

12-3: Simulation

Linking a Novel Mutation to its Short QT Phenotype through Multiscale Computational Modelling	1017
Chiara Bartolucci, Cristina Moreno, Alicia de la Cruz, Pier Lambiase, Stefano Severi, Carmen Valenzuela	
Ionic Mechanisms of Triggered Activity in Atrial Cell Models	1021
Marta Varela, Ross Morgan, Nooshin Ghavami, Stuart James, Oleg Aslanidi	
The Effect of Low Potassium in Brugada Syndrome. A Simulation Study	1025
K Cardona, JF Gómez, J Saiz, W Giles, B Trenor	
Simple Ablation Guided by ApEn Mapping in a 2D Model during Permanent Atrial Fibrillation	1029
Catalina Tobón, Laura C Palacio, Juan E Duque, Esteban A Cardona, Juan P Ugarte, Andrés Orozco-Duque, Miguel A Becerra, Javier Saiz, John Bustamante	

The Modified Bidomain Model with Periodic Diffusive Inclusions	1033
Yves Coudière, Andjela Davidović, Clair Poignard	
Myocardial Electrophysiological, Contractile and Metabolic Properties of Hypertrophic Cardiomyopathy: Insights from Modelling	1037
Ismail Adeniran, David H MacLver, Henggui Zhang	
Role of Fiber Orientation in Atrial Arrhythmogenesis	1041
Sanjay Kharche, Simon Castro, Belvin Thomas, Michael Colman, Jonathan Jarvis, Bruce Smail, Henggui Zhang, Robert Stephenson, Jichao Zhao	
Propagation Malfunctions due to Gap Junction Dysregulation	1045
Inma R Cantalapiedra, Angelina Peñaranda, Blas Echebarria	
Simulation of an Electro-Mechanical Resuscitation Device for Cardiopulmonary Resuscitation	1049
Alejandro Mendoza Garcia, Stefan Eichhorn, Marcin Polski, Alois Knoll	
Action Potential Abnormalities due to Loss- or Gain-of-Function Mutations in KCNJ2	1053
Ronald Wilders	

12-4: ECG Methods II

Robust Derivative-Based Method to Determine Filtered QRS Limits in High Resolution Electrocardiography	1057
Olivassé Nasario-Junior, Paulo R Benchimol-Barbosa, Jurandir Nadal	
Assessment of Electrocardiograms with Pretraining and Shallow Networks	1061
Vicent J Ribas Ripoll, Anna Wojdel, Pablo Ramos, Enrique Romero, Josep Brugada	
Variability of the Maximal Amplitudes of Impedance Cardiogram and of its First Derivative during Supine, Standing, Paced Breathing, and Exercise Maneuvers	1065
Salvador Carrasco-Sosa, Alejandra Guillén-Mandujano	
Post Extrasystolic T Wave Change in Subjects With Structural Healthy Ventricles - Measurement and Simulation	1069
Gustavo Lenis, Yannik Lutz, Gunnar Seemann, Arcadio García-Alberola, José Luis Rojo-Álvarez, Óscar Baquero-Pérez, Eduardo Gil, Olaf Doessel	
Comparative Study of Signal Decomposition Methods for Enhancement of the Accuracy of T-wave End Localisation	1073
I Christov, VN Batchvarov, I Simova, N Dimitrov, ER Behr	
A Portable Device for a Modular System of Patient ECG Monitoring	1077
Daniel Campillo, Hector Torres, Rene Gonzalez, Katia Valdes, Rolando Lopez	

Personalised System-on-chip and Mobile-App for Standard 12-lead Reconstruction from the Reduced 3-lead System Targeting Remote Health Care	1081
Utkalika Panda, Sidharth Maheshwari, Gayathri Padma, Murugaiyan Thendral, Agathya Jagirdar, Venkateswara Chowdary, Naresh Vemishetty, Amit Acharyya, Paolo Emilio Puddu, Michele Schiariti	
QRS Complex Detection in Experimental Orthogonal Electrograms of Isolated Rabbit Hearts	1085
Jiří Kozumplík, Marina Ronzhina, Oto Janoušek, Jana Kolářová, Marie Nováková, Ivo Provazník	
Dynamic Filtration of High-Frequency Noise in ECG Signal	1089
Giovanni Bortolan, Ivaylo Christov	

12-5: Clinical Aspects of ECG II

High Resolution ECG Differences between Hospital Survivors and Non-survivors of Out-of-Hospital Cardiac Arrest during Mild Therapeutic Hypothermia	1093
Martin Rauber, Dušan Štajer, Marko Noč, Todd T Schlegel, Vito Starc	
Susceptibility of Isolated Rabbit Hearts with Various Left Ventricular Mass to Short Ischemic Periods	1097
Veronika Olejníčková, Marina Ronzhina, Hana Paulová, Miroslava Hlaváčová, Tibor Stračina, Marie Nováková	

12-6: Cardiac Mechanics

Comparison of Time and Frequency Domain Methods for the Feedback on Chest Compression Rate	1101
Digna M González-Otero, Erik Alonso, Jesús Ruiz, Sofía Ruiz deGauna, Elisabete Aramendi, Unai Ayala, James K Russel, Mohamud Daya	
Three-Dimensional Apex-Seismocardiography	1105
Samuel E Schmidt, Ask S Jensen, Jacob Melgaard, Claus Graff, John Hansen, Tanveer A Bhuiyan, Johannes J Struijk	
Filtering Chest Compression Artifacts Improves the Performance of VF-detection Parameters.	1109
Unai Ayala, Unai Irusta, Jesús Ruiz, Felipe Alonso-Atienza, Erik Alonso, Digna González-Otero, Jo Kramer-Johansen, Henning Naas, Trygve Eftestøl	
Feasibility of Non-invasive Blood Pressure Estimation Based on Pulse Arrival Time: a MIMIC Database Study	1113
Braiam Escobar, Robinson Torres	

Measurement of Pulse Wave Velocity during Valsalva and Mueller Maneuvers by Whole Body Impedance Monitor	1117
Magdalena Matejkova, Vlastimil Vondra, Josef Halamek, Ladislav Soukup, Filip Plesinger, Ivo Viscor, Pavel Jurak	

12-7: Electrophysiology Modeling

Analysis of Electrogram Complexity during Atrial Fibrillation for Ablation Duration Assessment	1121
Katarzyna Kośna, Piotr Podziemski, Lauren Wilson, Simon Stolzman, Prashanthan Sanders, Jan Gierałtowski, Jan J Zebrowski, Paweł Kuklik	
Frequency Spectrum Correlation along Atria to Study Atrial Fibrillation Recurrence	1125
Raquel Cervigón, Javier Moreno, Jorge García-Quintanilla, Julián Pérez-Villacastín, José Millet, Francisco Castells	
Loss of Transverse-Tubules Promotes the Development of Ectopic Activity in Guinea-pig Ventricles	1129
Michael A Colman, Sanjay Kharche, Henggui Zhang	
The Effect of Scar Tissue on Complexity of Activation Patterns in Simulated Human Ventricular Fibrillation	1133
Sathyavani Malyala, Richard H Clayton	
Motion Analysis Method for Determining Cardiomyocyte Beating Properties Based on Digital Image Correlation and Templates	1137
Antti Ahola, Paruthi Pradhan, Eeva Laurila, Katriina Aalto-Setälä, Jari Hyttinen	

13-1: Plenary	Chairs	Roger Mark
		Olivier Meste

Uncovering Clinical Significance of Vital Sign Dynamics in Critical Care	1141
Li-wei H Lehman, Shamim Nemati, George B Moody, Thomas Heldt, Roger G Mark	
Ethnic Variation in Prevalence of End QRS Notching and Slurring in Apparently Healthy Populations	1145
Elaine N Clark, Peter W Macfarlane	
Bidomain Simulations of Subendocardial Ischemia: The Forward and Inverse Problems	1149
Marius Lysaker, Bjørn Fredrik Nielsen, Samuel Wall	