

# **15th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2022)**

Volume 4: BIOSIGNALS

Online

9 - 11 February 2022

**Editors:**

**Athanasios Tsanas**

**Ana Fred**

**Hugo Gamboa**

ISBN: 978-1-7138-5306-0

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2022) by SCITEPRESS – Science and Technology Publications, Lda.  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2022)

For permission requests, please contact SCITEPRESS – Science and Technology Publications, Lda.  
at the address below.

SCITEPRESS – Science and Technology Publications, Lda.  
Avenida de S. Francisco Xavier, Lote 7 Cv. C,  
2900-616 Setúbal, Portugal

Phone: +351 265 520 185  
Fax: +351 265520 186

[info@scitepress.org](mailto:info@scitepress.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# CONTENTS

---

## INVITED SPEAKERS

### KEYNOTE SPEAKERS

- Wirewalking over Two Medical AI Chasms: Results and Open Problems in Making "Valid AI" Also Useful in Medical Practice 5  
*Federico Cabitza*
- On Trust and Trustworthiness of Interpretable AI Methods for Decision Support in Radiology 7  
*Katja Bühler*
- Value-based Healthcare: Contributions from Biomedical Engineering 9  
*Ana Rita Londral*

### PAPERS

#### FULL PAPERS

- Data Compression for Wireless ECG Devices 15  
*Elena Merdjanovska, Miha Mohorčič, Matjaž Depolli, Aleksandra Rashkovska and Tomaž Javornik*
- AroNap: A Scent-based Nap Promotion System 22  
*Mayo Iizuka, Anna Yokokubo and Guillaume Lopez*
- Classification of Volatile Compounds with Morphological Analysis of e-nose Response 31  
*Rita Alves, João Rodrigues, Efthymia Ramou, Susana I. C. J. Palma, Ana C. A. Roque and Hugo Gamboa*
- Interpretable High-level Features for Human Activity Recognition 40  
*Yale Hartmann, Hui Liu, Steffen Lahrberg and Tanja Schultz*
- Evaluation of Fall Detection Approaches based on Virtual Devices: Leveraging on Motion Capture Data in Unity environments 50  
*Eduarda Vaz, Heitor Cardoso and Plinio Moreno*
- Hypoxic-Ischaemic Encephalopathy Prognosis using Susceptibility Weighted Image Analysis based on Histogram Orientation Gradient 57  
*Zhen Tang, Sasan Mahmoodi, Angela Darekar and Brigitte Vollmer*
- Wavelet based Method of Mapping the Brain Activity Waves Travelling over the Cerebral Cortex 63  
*Bozhokin Sergey, Suslova Irina and Tarakanov Daniil*
- Bone Conduction Eating Activity Detection based on YAMNet Transfer Learning and LSTM Networks 74  
*Wei Chen, Haruka Kamachi, Anna Yokokubo and Guillaume Lopez*
- Paroxysmal Atrial Fibrillation Detection by Combined Recurrent Neural Network and Feature Extraction on ECG Signals 85  
*Xinqi Bao, Fenghe Hu, Yujia Xu, Mohamed Trabelsi and Ernest Kamavuako*
- Adaptive Control of Cardio-respiratory Training in a Virtual Reality Hiking Simulation: A Feasibility Study 91  
*Rodrigo Lima, Muhammad Asif, Honorato Sousa and Sergi Bermúdez i Badia*

## SHORT PAPERS

A New Method of Dimensionality Reduction for Large Time Series Applied to Accelerometer Wristbands' Signals <i>Alihuén García-Pavioni and Beatriz López</i>	103
Contactless Heart Rate Measurement using Image Processing <i>Gaganjot Kaur and Jeff Kilby</i>	111
Exploiting EEG-extracted Eye Movements for a Hybrid SSVEP Home Automation System <i>Tracey Camilleri, Jeanluc Mangion and Kenneth Camilleri</i>	117
The Usage of Data Augmentation Strategies on the Detection of Murmur Waves in a PCG Signal <i>José Torres, Jorge Oliveira and Elsa Ferreira Gomes</i>	128
12-Lead ECG Reconstruction via Combinatoric Inclusion of Fewer Standard ECG Leads with Implications for Lead Information and Significance <i>Utkars Jain, Adam A. Butchy, Michael T. Leasure, Veronica A. Covalesky, Daniel McCormick and Gary S. Mintz</i>	133
Prediction of Personal Characteristics and Emotional State based on Voice Signals using Machine Learning Techniques <i>Marta Babel Guerreiro, Catia Cepeda, Joana Sousa, Carolina Maio, João Ferreira and Hugo Gamboa</i>	142
Contactless Measurement of Respiratory Volumes: A Calibration Free Method based on Depth Information <i>Felix Wichum, Jacqueline Hassel, Christian Wiede and Karsten Seidl</i>	150
Biomedical Text Mining: Applicability of Machine Learning-based Natural Language Processing in Medical Database <i>Nafiseh Mollaei, Catia Cepeda, Joao Rodrigues and Hugo Gamboa</i>	159
Optimization of Tracer Dose for Scintigraphic Imagery <i>C. Bousnah, S. Anebajagane, O. Monsarrat, J.-Ph. Conge, H. Maaref and V. Vigneron</i>	167
Iris Segmentation based on an Optimized U-Net <i>Sabry Abdalla M., Lubos Omelina, Jan Cornelis and Bart Jansen</i>	176
RoSe: Robot Sentinel as an Alternative for Medicinal or Physical Fixation and for Human Sitting Vigils <i>Robert Erzgräber, Falko Lischke, Frank Bahrmann and Hans-Joachim Böhme</i>	184
Denoising of Dynamic Contrast-enhanced Ultrasound Sequences: A Multilinear Approach <i>Metin Calis, Massimo Mischi, Alle-Jan Van Der Veen and Borbála Hunyadi</i>	192
The Comparison of Various Correlation Network Models in Studying Mobility Data for the Analysis of Depression Episodes <i>Rama Krishna Thelagathoti and Hesham H. Ali</i>	200
A Calibration-free Blood Pressure Measurement on a Scale: Concept and Challenges <i>Christian Wiede, Carolin Wuerich and Anton Grabmaier</i>	208
Cross-lingual Detection of Dysphonic Speech for Dutch and Hungarian Datasets <i>Dávid Sztahó, Miklós Gábor Tulics, Jinzi Qi, Hugo Van Hamme and Klára Vicsi</i>	215

A New Method to Determine Systolic Blood Pressure Indirectly Aided by Parallel Recording of ECG and PPG <i>Péter Nagy and Ákos Jobbágy</i>	221
Discovery of Effective Spectrum for Classifying iPS Cells Taken with CARS Microscope <i>Ryouichi Furukawa, Yohei Hayashi, Hideaki Kano, Junichi Matsumoto, Shoichi Honda and Kazuhiro Hotta</i>	228
Heart Rate Estimation based on Optical Flow: Enabling Smooth Angle Changes in Ultrasound Simulation <i>Henning Schäfer, Hendrik Damm and Christoph M. Friedrich</i>	236
Personalized Evaluation of Life-threatening Conditions in Chronic Kidney Disease Patients: The Concept of Wearable Technology and Case Analysis <i>Analysis Ana Santos Rodrigues, Birutė Paliakaitė, Saulius Daukantas, Andrius Sološenko, Andrius Petrėnas and Vaidotas Marozas</i>	244
Generalized Poincaré Plots Analysis of Cardiac Interbeat Intervals in Heart Failure <i>Mirjana M. Platiša, Nikola N. Radovanović, Aleksandar Kalauzi and Siniša Pavlović</i>	251
A Subset of Acoustic Features for Machine Learning-based and Statistical Approaches in Speech Emotion Recognition <i>Giovanni Costantini, Valerio Cesarini and Daniele Casali</i>	257
Machine Learning-based Study of Dysphonic Voices for the Identification and Differentiation of Vocal Cord Paralysis and Vocal Nodules <i>Valerio Cesarini, Carlo Robotti, Ylenia Piromalli, Francesco Mozzanica, Antonio Schindler, Giovanni Saggio and Giovanni Costantini</i>	265
Survival Status Prediction for Non-small Cell Lung Cancer Patients using Machine Learning <i>Aishwarya Mohan and Aleksandar Jeremic</i>	273
Preliminary Results on the Use of Classification Trees to Predict Non-suicidal Self-injury with Data Collected through a Mobile App <i>Chiara Capra, Pere Marti-Puig, Daniel Vega Moreno, Laia Llunas, Stella Nicolaou, Carlos Schmidt and Jordi Solé-Casals</i>	278
Spectral Classification of Microplastics using Neural Networks: Pilot Feasibility Study <i>Petr Dolezel, Jiri Rolecek, Daniel Honc, Dominik Stursa and Bruno Baruque Zanon</i>	283
Wavelet based Machine Learning Approaches towards Precision Medicine in Diabetes Mellitus <i>Adeethya Shankar, Stephanie Chang, Xiaodi Wang and Yongzhong Zhao</i>	290
Exploring Classification in Open and Closed Eyes EEG Data for People with Cognitive Disorders <i>Ioanna Chouvarda, Lampros Mpaltadoros, Ioanna Boutziona, George Nikolaos Tsakonas, Magda Tsolaki and Konstantinos Diamantaras</i>	298

**SPECIAL SESSION ON DIAGNOSTIC, PROGNOSTIC, AND PHENOTYPING MODELS  
FROM MINED ADMINISTRATIVE HEALTHCARE DATA**

**FULL PAPERS**

Estimating Use of Short-term Asthma Reliever Inhalers from Electronic Prescription Records <i>Holly Tibble, Aziz Sheikh and Athanasios Tsanas</i>	311
Comparative Analysis of Patient Distress in Opioid Treatment Programs using Natural Language Processing <i>Fatemeh Shah-Mohammadi, Wanting Cui, Keren Bachi, Yasmin Hurd and Joseph Finkelstein</i>	319
Exploring Feature Selection and Feature Transformation Techniques to Improve Telephone-based Biomedical Speech Signal Processing towards Parkinson's Assessment <i>Athanasios Tsanas and Siddharth Arora</i>	327
<b>AUTHOR INDEX</b>	<b>335</b>