

# **14th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2021)**

Volume 4: BIOSIGNALS

Online  
11-13 February 2021

## **Editors:**

**Bethany Bracken  
Ana Fred  
Hugo Gamboa**

ISBN: 978-1-7138-4012-1

**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© (2021) by SCITEPRESS – Science and Technology Publications, Lda.  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2021)

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)

# BRIEF CONTENTS

---

INVITED SPEAKERS .....	IV
ORGANIZING COMMITTEES .....	V
PROGRAM COMMITTEE .....	VI
AUXILIARY REVIEWER .....	VII
SELECTED PAPERS BOOK .....	VII
FOREWORD .....	IX
CONTENTS .....	XIII

# CONTENTS

---

## INVITED SPEAKERS

### KEYNOTE SPEAKERS

- Capitalizing on Patient Reported Outcome Measures, Wearables, and Smartphones Towards Developing New Clinical Decision Support Tools for Frequent, Remote, Longitudinal Monitoring of Chronic Disorders 5  
*Athanasios Tsanas*
- Psychological Perspectives and Challenges towards Information Technology and Digital Health Interventions 7  
*Thomas Ostermann*
- ETERNITY: European Training Network on Electromagnetic Risks in Medical Technology 13  
*Mireya Fernández Chimeno*
- Democratizing Data-driven Healthcare 15  
*Tiago Guerreiro*

### PAPERS

#### FULL PAPERS

- Evaluation of Stair Climbing as an Approach for Estimating Heart Rate Recovery in Daily Activities 21  
*Daivas Sokas, Andrius Rapalis, Andrius Petrėnas, Saulius Daukantas and Vaidotas Marozas*
- Detection of Error Correlates in the Motor Cortex in a Long Term Clinical Trial of ECoG based Brain Computer Interface 26  
*Vincent Rouanne, Maciej Śliwowski, Thomas Costecalde, Alim Louis Benabid and Tetiana Aksenova*
- Chaotic Changes in Fingertip Pulse Waves during Autobiographical Memory Retrieval 35  
*Eri Shibayama and Taira Suzuki*
- Elliptical Fitting as an Alternative Approach to Complex Nonlinear Least Squares Regression for Modeling Electrochemical Impedance Spectroscopy 42  
*Norman Pfeiffer, Toni Wachter, Jürgen Frickel, Christian Hofmann, Abdelhamid Errachid and Albert Heuberger*
- Choosing the Appropriate QRS Detector 50  
*Justus Eilers, Jonas Chromik and Bert Arnrich*
- Characterization of Upper Limb Functionality Caused by Neuromuscular Disorders using Novel Motion Features from a Specialized Gaming Platform 60  
*A. Chytas, D. Fotopoulos, V. Kilintzis, E. Koutsiana, I. Ladakis, E. Kiana, T. Loizidis and I. Chouvarda*
- Estimation of Movement Speed in Monitoring Systems based on Sensors of Multiple Types 69  
*Jakub Wagner and Paweł Mazurek*
- Self-Similarity Matrix of Morphological Features for Motion Data Analysis in Manufacturing Scenarios 80  
*António Santos, João Rodrigues, Duarte Folgado, Sara Santos, Carlos Fujão and Hugo Gamboa*

Robust Anomaly Detection in Time Series through Variational AutoEncoders and a Local Similarity Score <i>Pedro Matias, Duarte Folgado, Hugo Gamboa and André V. Carreiro</i>	91
Machine Learning based Voice Analysis in Spasmodic Dysphonia: An Investigation of Most Relevant Features from Specific Vocal Tasks <i>Giovanni Costantini, Pietro Di Leo, Francesco Asci, Zakarya Zarezadeh, Luca Marsili, Vito Errico, Antonio Suppa and Giovanni Saggio</i>	103
Performance of Monosyllabic vs Multisyllabic Diadochokinetic Exercises in Evaluating Parkinson's Disease Hypokinetic Dysarthria from Fluency Distributions <i>Pedro Gómez-Vilda, Andrés Gómez-Rodellar, Daniel Palacios-Alonso and Athanasios Tsanas</i>	114
Assessing Parkinson's Disease Speech Signal Generalization of Clustering Results across Three Countries: Findings in the Parkinson's Voice Initiative Study <i>Athanasios Tsanas and Siddharth Arora</i>	124
<b>SHORT PAPERS</b>	
Deep Learning Solution for Pathological Voice Detection using LSTM-based Autoencoder Hybrid with Multi-Task Learning <i>Dávid Sztahó, Kiss Gábor and Tulics Miklós Gábor</i>	135
Wavelet Correlation of Non-stationary Bursts of EEG <i>S. V. Bozhokin and I. B. Suslova</i>	142
Cross-phase Emotion Recognition using Multiple Source Domain Adaptation <i>Ke-Ming Ding, Tsukasa Kimura, Ken-ichi Fukui and Masayuki Numao</i>	150
Clustering Pathologic Voice with Kohonen SOM and Hierarchical Clustering <i>Alessa Anjos de Oliveira, Maria Eugênia Dajer and João Paulo Teixeira</i>	158
Tragus based Vagus Nerve Stimulation for Stress Reduction <i>Surej Mouli, Ramaswamy Palaniappan, Jane Ollis, Ian McLoughlin, Rahul Kanegaonkar and Sunil Arora</i>	164
Convolutional Neural Networks for Quantitative Prediction of Different Organic Materials using Near-Infrared Spectrum <i>Tegegn Dagmawi Delelegn, Italo Francesco Zoppis, Sara Manzoni, Cezar Sas and Edoardo Lotti</i>	169
Feature Extraction for Stress Detection in Electrodermal Activity <i>Erika Lutin, Ryuga Hashimoto, Walter De Raedt and Chris Van Hoof</i>	177
Comparison of Convolutional and Recurrent Neural Networks for the P300 Detection <i>Lukáš Vařeka</i>	186
Surface EMG-based Profiling and Fatigue Analysis of the Biceps Brachii Muscle of Cricket Bowlers <i>Muhammad Usama Rizwan, Nadeem Ahmad Khan, Rushda Basir Ahmad and Muneeb Ijaz</i>	192
Mental Workload Estimation using Wireless EEG Signals <i>Quadri Adewale and George Panoutsos</i>	200
Noise-resilient Automatic Interpretation of Holter ECG Recordings <i>Egorov Konstantin, Sokolova Elena, Avetisian Manvel and Tuzhilin Alexander</i>	208
Feature Space Reduction for Human Activity Recognition based on Multi-channel Biosignals <i>Yale Hartmann, Hui Liu and Tanja Schultz</i>	215

Segmented ECG Bio Identification using Fréchet Mean Distance and Feature Matrices of Fiducial QRS Features <i>Abdullah Biran and Aleksandar Jeremic</i>	223
A Multi-spot Murmur Sound Detection Algorithm and Its Application to a Pediatric and Neonate Population <i>Marisa Oliveira, Jorge Oliveira, Rui Camacho and Carlos Ferreira</i>	228
Estimation of Affective State based on Keystroke and Typing Vibration during Computer-Mediated Communication <i>Kei Hasegawa, Hikaru Miyamoto, Yuki Ashida, Yuki Ban, Rui Fukui, Masahiro Inazawa and Shin'ichi Warisawa</i>	235
Classification of Myoelectric Surface Signals of Hand Movements using Supervised Learning Techniques <i>Marisol Cristel Galarza Flores, Cristian López del Álamo and Juan Felipe Miranda Medina</i>	243
Automatic Segmentation of Mammary Tissue using Computer Simulations of Breast Phantoms and Deep-learning Techniques <i>Lucca R. Peregrino, Jordy V. Gomes, Thaís G. do Rêgo, Yuri de A. M. Barbosa, Telmo de M. e Silva Filho, Andrew D. A. Maidment and Bruno Barufaldi</i>	252
Dispersion Entropy: A Measure of Electrohysterographic Complexity for Preterm Labor Discrimination <i>Félix Nieto-del-Amor, Yiyao Ye-Lin, Javier Garcia-Casado, A. Diaz-Martinez, María González Martínez, R. Monfort-Ortiz and Gema Prats-Boluda</i>	260
A Wavelet Scattering Convolutional Network for Magnetic Resonance Spectroscopy Signal Quantitation <i>Amirmohammad Shamaei, Jana Starčuková and Zenon Starčuk Jr.</i>	268
Eppur si muove: Formant Dynamics is Relevant for The Study of Speech Aging Effects <i>Luciana Albuquerque, Catarina Oliveira, António Teixeira and Daniela Figueiredo</i>	276
Separation Method of Atrial Fibrillation Classes with High Order Statistics and Classification using Machine Learning <i>Luís Fillype da Silva, Jonathan Araújo Queiroz, Caroline Vanessa, Allan Kardec Barros, Gean Carlos Lopes and Letícia Cabral</i>	284
Estimation of Chronic Stress by Measuring Sympathetic Sedation Time <i>Masahiro Inazawa, Yuki Ban, Naoki Tateyama and Shin'ichi Warisawa</i>	292
Prototype Reduction on sEMG Data for Instance-based Gesture Learning towards Real-time Prosthetic Control <i>Tim Sziburis, Markus Nowak and Davide Brunelli</i>	299
On the Optimal Strategy for Tackling Head Motion in fMRI Data <i>Júlia F. Soares, Rodolfo Abreu, Ana Cláudia Lima, Sónia Batista, Livia Sousa, Miguel Castelo-Branco and João Valente Duarte</i>	306
CIBA: Continuous Interruption-free Brain Authentication <i>Florian Gondesen and Dieter Gollmann</i>	314
FRADE: Pervasive Platform for Fall Risk Assessment, Prevention and Fall Detection <i>Joana Silva, Nuno Cardoso, Jorge Ribeiro, Alberto Carvalho, Mariana Pereira, Fernando Ricaldoni, Carlos Resende and João Oliveira</i>	320

Inertial-based Gait Analysis Applied to Patients with Parkinson Disease <i>Joana Sousa, Joana Silva, Ricardo Leonardo, Hugo Gamboa and Josefa Domingos</i>	327
Evaluating Synthetic Speech Workload with Oculo-motor Indices: Preliminary Observations for Japanese Speech <i>Mateusz Dubiel, Minoru Nakayama and Xin Wang</i>	335
Separating Local and Propagated Contributors to the Behnke-fried Microelectrode Recordings <i>P. Jurczynski, S. Le Cam, B. Rossion and R. Ranta</i>	343
Convolution-based Soma Counting Algorithm for Confocal Microscopy Image Stacks <i>Shih-Ting Huang, Yue Jiang and Hao-Chiang Shao</i>	351
Automatic Emotion Recognition from DEMoS Corpus by Machine Learning Analysis of Selected Vocal Features <i>Giovanni Costantini, E. Parada-Cabaleiro and Daniele Casali</i>	357
The Relationship between Psychological Workload and Oculomotor Indices under Visual Search Task Execution <i>Tomomi Okano and Minoru Nakayama</i>	365
AUTHOR INDEX	373

Santos, S. ....	80	Starčuk Jr., Z. ....	268	Van Hoof, C. ....	177
Sas, C. ....	169	Starčuková, J. ....	268	Vanessa, C. ....	284
Schultz, T. ....	215	Suppa, A. ....	103	Vářeka, L. ....	186
Shamaei, A. ....	268	Suslova, I. ....	142	Wachter, T. ....	42
Shao, H-C. ....	351	Suzuki, T. ....	35	Wagner, J. ....	69
Shibayama, E. ....	35	Sziburis, T. ....	299	Wang, X. ....	335
Silva, J. ....	320, 327	Sztahó, D. ....	135	Warisawa, S. ....	235, 292
Śliwowski, M. ....	26	Tateyama, N. ....	292	Ye-Lin, Y. ....	260
Soares, J. ....	306	Teixeira, A. ....	276	Zarezadeh, Z. ....	103
Sokas, D. ....	21	Teixeira, J. ....	158	Zoppis, I. ....	169
Sousa, J. ....	327	Tsanas, A. ....	5, 114, 124		
Sousa, L. ....	306				