

19th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2026)

Volume 1: BIOSIGNALS

Marbella, Spain
2-4 March 2026

ISBN: 979-8-3313-3335-5

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© (2026) by SCITEPRESS – Science and Technology Publications, Lda.
All rights reserved.

Printed with permission by Curran Associates, Inc. (2026)

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

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
Web: www.proceedings.com

CONTENTS

INVITED SPEAKERS

KEYNOTE SPEAKERS

From Signals to Meaning: Biosignals as a Language for Health, Emotion, and Connection <i>Antonio Lanatà</i>	3
Extended Reality in Healthcare <i>Kavitha Anandan, S. Pravin Kumar, B. Divya, S. Saranya and S. Raja Lakshmi</i>	5
AI in Medicine: Progress, Perils, and Perspectives <i>Tim Hahn</i>	17
Neuro-Acoustic Intelligence: A Unified Phonation-Encephalography Framework for Multi-Disorder Monitoring via Explainable AI <i>Pedro Gómez Vilda</i>	19

PAPERS

FULL PAPERS

Associations between Circadian Sleep Alignment, Sleep Regularity, and Wellbeing: Evidence from Wearable Device Data <i>Swathi Senthil, Szymon Fedor, Boyu Zhang, Viswam Nathan, Robert Stickgold and Rosalind W. Picard</i>	25
Phonation Encephalographic Bands in Parkinson's Disease <i>Pedro Gómez-Vilda, Andrés Gómez-Rodellar, Jiří Mekyska and Daniel Palacios-Alonso</i>	35
Benchmarking and Enhancing PPG-Based Cuffless Blood Pressure Estimation Methods <i>Neville Mathew, Yidan Shen, Renjie Hu, Maham Rahimi and George Zouridakis</i>	45
Real-Time Predetermination of Excitation Frequencies for Optimizing Electrochemical Impedance Spectroscopy <i>Norman Pfeiffer, Toni Wachter, Joan Bausells, Abdelhamid Errachid and Albert Heuberger</i>	56
Evaluating the Vector Based Selection Algorithm for Sample Entropy Estimation on FHR Time Series with Missing Data <i>Athanasios Georvassilis, Dimitrios Platakis and George Manis</i>	65
A Cross-Modality Comparison between Structural and Functional Brain Connectivity and Individual Differences in Intelligence <i>Sue Si-Qi Gao, Tong Liang, Zhe Sun, Cesar F. Caiafa and Jordi Solé-Casals</i>	71
Improving Feature Extraction for Spike Sorting Using a Custom Loss Function for an Autoencoder <i>Elizaveta Kompaniets, Steven Le Cam and Radu Ranta</i>	80
CAAM-Net: A Chrono-Acoustic Attention MobileNet for Snore-Based Sleep Apnea Screening <i>Himanshu Sharma and Pradip K. Das</i>	87
Differential Contributions of Physiological Features across Early, Mid and Late Sleep Phases to Next Morning Cognitive Performance <i>Chijing Wang, Ryota Nitto, Yuki Ban, Miki Nakai, Jun'ichi Shimizu, Tomoyoshi Ashikaga and Shin'ichi Warisawa</i>	94

Supervised Human Activity Recognition in Office Environments Using Trapezius-Mounted Accelerometers	107
<i>Gonalo Barros, Sara Santos, Phillip Probst and Hugo Gamboa</i>	
QT Interval Estimation by Denoising Electrocardiogram Signals	119
<i>Francisco Javier Maldonado Carrascosa, Jos� Enrique Mu�oz Exp�sito, Sebasti�n Garc�a Gal�n, Francisco Jes�s Ca�adas Quesada, Adam Marchewka and Jos� Ranilla Pastor</i>	
Probabilistic Detection of Interictal Epileptiform Discharges	129
<i>In�s A. Gonalves, In�s Silveira, Sem Hoogteijling, Irene Heijink, Maeike Zijlmans, Lu�s Silva and Hugo Gamboa</i>	
Controlled Large Scale Synthetic Motion Dataset Generation Leveraging Text-to-Motion and Sample-Wise Quality Assurance	140
<i>Loureno Abrunhosa Rodrigues, Markus Wenzel and Felix Putze</i>	
Detecting Infant Cries in Noisy NICU Recordings: A Study on SSL Models	151
<i>�kos Antal, P�ter F�ldesy and P�ter Mihajlik</i>	
Stress Detection from Consumer-Grade ECG Device Using GA Optimization and Segment-Wise Analysis	160
<i>Abu Saleh Khan, Areen Ramesh Patil, Nipun Verma, Prakrititz Borah and Sakshi Arora</i>	
Multimodal Estimation of Chronic Stress Using Physiological Signals and Cognitive Task Performance	172
<i>Jiayi Hu, Yuki Ban and Shin'ichi Warisawa</i>	
A Comparative Study of Deep Learning Approaches for Leishmania Detection in Microscopic Images	184
<i>Eduardo Monteiro, Marcelo Nogueira and Elsa Ferreira Gomes</i>	
Modular Framework for Comparative Analysis of EMG Detection Methods: Application to Wearable Interfaces for Persons with Motor Neuron Diseases	192
<i>Carolina Amante, Catarina Consolado, Gabriel Pires, Ana Rita Londral and Cl�udia Quaresma</i>	
Fall Risk Classification in Older Adults Using Wearable IMU Data: A Comparative Study of Validation Strategies and Model Complexity	201
<i>Judith Urbina-C�rdoba, Shuning Han, Zhe Sun, Ryutaro Himeno, David Arcos and Jordi Sol�-Casals</i>	
SHORT PAPERS	
Consensus Ranking via Entropy-Based Multi-Objective Optimization: Application of Selection of Biomarker Candidates	215
<i>J.-P. Conge, V. Vigneron, H. Maaref and L. T. Duarte</i>	
Possibilities to Improve Dementia Classification through Data Balancing Using Augmentation by Synonym Replacement	223
<i>Attila Zolt�n Jenei, D�vid Sztah� and G�bor Kiss</i>	
Wavelet Analysis of non-Stationary Heart Rate Variability During Functional Tests	231
<i>S. V. Bozhokin and I. B. Suslova</i>	
SIMUS-Based Modeling for Radial Artery Ultrasound Characterization	239
<i>Aur�lia Leandri, Louis Lecrosnier, Adel Ghazel and Bastien Faure</i>	
Predicting Signs of Problematic Internet Use to Analyze Children's Health Using Machine Learning	247
<i>Fahad Layth Malallah and Kamran Iqbal</i>	

A Two-Stage Cascaded Ensemble Based on CRNN and Markov Chain for Sleep Apnea Detection Using ECG <i>Faustine Faccin, El-Hadi Djermoune, Pauline Guyot and Laurent Bougrain</i>	255
Tensor Decomposition-Driven Variational Autoencoder: Biomarker-Aware OCT Classification <i>A. H. Ahamada, A. Hazan, H. Maaref, T. Q. Syed and V. Vigneron</i>	263
Fully Convolutional Denoising Autoencoder with Skip Connections for Noise Reduction in (Simulated) Respiratory RIP Signals <i>Redona Brahimetaj, Sofia Yfantidou, Maarten Gijssel, Vangelis Lympouridis, Silvia Zaccardi and Bart Jansen</i>	271
Temporal Dynamics of Functional Connectivity During Neuroaesthetic Experience: Effects of Art Expertise and Psychological Traits <i>Pietro Tarchi, Lorenzo Frassinetti, Lucrezia Bigagli, Valeria Pitterà and Antonio Lanatà</i>	281
Auto-Encoder Powered Genetic Algorithm-Based Dimensionality Reduction and Classification of in Situ Mid-Infrared Markers for Strawberry Maturity <i>Mageda A. A. Sharafeddin, Adam Abdel Karim, Nour Harajli, Marwa Zeineddine and Abbass Rammal</i>	289
Waveform Similarity Analysis of the Pupil Light Reflex for Detecting Dementia Symptoms <i>Minoru Nakayama, Wioletta Nowak and Anna Żarowska</i>	298
Counting without Seeing: Toward Acoustic Population Estimation from Unsupervised Audio Features <i>Aysenur Arslan-Dogan and Aki Härmä</i>	305
Fully Automated Recanalization Prediction in Ischemic Stroke Patients Using Multimodal MRI <i>Rafia Ahsan, Sofia Vargas-Ibarra, Vincent Vigneron, Hichem Maaref and Sonia Garcia-Salicetti</i>	312
Feasibility Study of Spirometric Parameter Estimation from Exhaled Breath Sounds Using Time–Frequency Representations and Deep Learning <i>A. Salvador-Navarro, J. De la Torre-Cruz, A. Muñoz-Montoro, P. Revuelta-Sanz, J. M. Cruz-Molina, R. P. Paiva and F. J. Canadas-Quesada</i>	320
Formal Grammar Based Syntactic Analysis of Heart Sounds <i>George Manis</i>	330
Investigating the Applicability of ECG Signals for Neonatal Seizure Detection Using ECG Spectrograms and CNN-ViT <i>Kimia Rezaei, Sean R. Mathieson, Gordon Lightbody, Geraldine B. Boylan and William P. Marnane</i>	338
Detecting Cardiac and Respiratory Rhythms in Few-Second Auscultation Audio with Group Monte Carlo Singular Spectrum Analysis <i>Sandra Ranilla-Cortina, Luciano Sánchez, José Ranilla, Alejandro Salvador-Navarro and Jose R. Gutierrez</i>	347
Validation of an Imagined Speech Stimulation Protocol and EEG Investigation of Neurophysiological Differences between Rest and Imagined Speech <i>Francesco Iacomì, Alessandro Elia, Gabriele Furnari, Harman Kaur, Andrea Farabbi, Riccardo Barbieri and Luca Mainardi</i>	355
Assessing Stimuli Detectability and Pleasantness for Auditory BCI <i>Lenaïg Guého, Laurent Bougrain, Cyril Plapous, Patrick Hénaff and Rozenn Nicol</i>	363

Influence of Multi-Wavelength Sensor Array Design on Signal Stability and Application in Blood Pressure Detection <i>Yuke Zheng, Long Yu, Ruishi Zhou, Yuchen Hu, Hongwei Wang, Hui Liu, Xuesong Ye and Congcong Zhou</i>	371
Open-Source Control PCB for Automated Behavioral Biomarker Acquisition <i>Saumari Negrón-Santos, Charlie Montes-Rivera, Juan González-Sánchez and Keven J. Laboy-Juárez</i>	376
DA-NN: A ResNet-Based Architecture with Domain Adaptation for Automatic EEG Artifact Identification <i>Emmanuel de Jesús Velásquez-Martínez and Miguel Ángel Porta-García</i>	383
Automated Diagnosis of Respiratory Diseases from Respiratory Sounds: A Reproducibility Case Study <i>Diogo Pessoa, João Garcia, Juan De La Torre-Cruz, Francisco Cañadas-Quesada and Rui Pedro Paiva</i>	392
Neuro-Acoustic Fusion: EEG Biomarkers and Deep Audio Embeddings for Music-Evoked Emotion Recognition <i>Amulya J. Naik, Anagha Madhusoodhana, Anagha Vyakarnam, Aritro Maiti and Gowri Srinivasa</i>	398
Quantitative EEG Biomarkers for Cognitive Decline: A Comparative Study of Frontotemporal Dementia and Alzheimer's Disease <i>Aisa Sadat Takyar and Beren Semiz</i>	406
Gender- and Channel-Specific Electroencephalography Markers for Attention Deficit Hyperactivity Disorder Assessment <i>Muhammet Aksakal and Beren Semiz</i>	414
Comparative Evaluation of Rule-Based and Machine Learning Models for EEG-Based Psychological Stress Detection <i>Elvin Güngör and Beren Semiz</i>	421
Multi-Method Signal Decomposition Reveals Neural Network Disruption in Claustrophobia: A Multi-Scale Connectivity Analysis <i>Seyed Amir Tabatabaei Hosseini, Dunya Moradi and Beren Semiz</i>	427
Differentiating between Multiple Sclerosis and Neuromyelitis Optica Spectrum Disorder Using IMU-Measured Spatiotemporal Gait Characteristics <i>Dunya Moradi, Kardelen Akar, Hussein Youssef, Ayse Altintas, Atay Vural and Beren Semiz</i>	435
Opportunistic Teacher Forcing: Training RNNs on Wearable Signals with Inherent Missing Data <i>Sutashu Tomonaga, Andres Hernandez-Matamoros, Haruo Mizutani and Kenji Doya</i>	444
Anomaly Detection in cECG Data Using Unsupervised Learning <i>Lavinia Goldermann, Pascal Raabe, Markus Lüken, Steffen Leonhardt and André Stollenwerk</i>	452
Anomaly Detection in Intensive Care Unit Data: A Comparative Analysis <i>Simon Fonck, Lavinia Goldermann, Sebastian Fritsch, Lena Olivier and André Stollenwerk</i>	457
Multimodal Analysis of Human Movement Patterns Using a Smart Wearable T-Shirt and Force Platform <i>Laura Valente, Cláudia Quaresma and Carla Quintão</i>	465
Differentiating Pre-REM and Post-REM N2 Sleep Stage Using Machine Learning Models <i>Miriam Allalouf, Tali Bitan, Lior Ketz, Eva Kimel, Safa Natsheh and Ilana S. Hairston</i>	473

Comparison of the Accuracy and Reliability of Artificial Intelligence and Human Assessment in the Diagnosis of Flatfoot in the Younger Population <i>Jovana Kuzmanovic Pficer, Zorana Bukvic, Lazar Krstic, Filip Milanovic and Dejan Nikolic</i>	482
A Machine Learning-Based System for Human Movement Analysis <i>Mauro Aloisio Smaniotto, Fabio Kurt Schneider and Heitor Silvério Lopes</i>	490
Image-Based Evaluation System for Paraná State Military Physical Fitness Test: Pull-Ups <i>Andrio Ramos dos Santos, Mauro Aloisio Smaniotto and Fabio Kurt Schneider</i>	499
Image-Based Evaluation System for Paraná State Military Physical Fitness Test: Push-Ups <i>Tarcisio Maico Goncalves Da Silva, Lucas Daniel Ortiz Arias, Mauro Aloisio Smaniotto and Fabio Kurt Schneider</i>	507
Gender and Age Modulate the Diving Reflex: Quantifying Bradycardia Dynamics and Autonomic Shifts via HRV and Exponential Modeling <i>O. Barquero-Pérez, R. Goya-Esteban, A. Luque-Casado, D. Grassi and F. Suárez</i>	515
Estimating Brain Activity of Neonates Using Physics Informed Networks <i>Aleksandar Jeremic, D. Nikolic, G. Djuricic, N. Milcanovic and Z. Jokovic</i>	520
A Comparative Evaluation of Open-Source Gait Event Detection Methods Using a Single Sacrum-Mounted IMU <i>Elena Botti, Redona Brahimetaj, Eva Swinnen and Bart Jansen</i>	525
An Exploratory Study on SVM-Based Fall-Risk Classification Using Hybrid IMU-Derived and Clinical Features <i>Judith Urbina-Córdoba, Shuning Han, Zhe Sun, Ryutaro Himeno, David Arcos and Jordi Solé-Casals</i>	537
Resting Surface Electromyography as an Indicator of Motor State in Parkinson's Disease <i>Ester Muñoz del Campo, Carlos Pérez-López, Jordi Solé-Casals, Miriam Grande Gordon, Irene Gonzalo Asenjo, Lúa Márquez López, Marta Montesinos Terceño and Patricia Rodríguez Sánchez</i>	545
SPECIAL SESSION ON DESIGN AND EVALUATION OF MONITORING SYSTEMS	
FULL PAPERS	
User-Centred Design of a Cost-Efficient, Mobile, Machine Learning Based Seizure Detection Device <i>Anna Katharina Hardenbicker, Gabriele Bleser-Taetz and Dorian Mora-Sanchez</i>	557
Calibration-Enhanced Multimodal Framework for Non-Invasive Glucose Monitoring: An In-Vivo Validation <i>El Arbi Belfarsi, Henry Flores, Maria Valero, Luisa Valentina Nino and Katherine Ingram</i>	566
OPAT@Home: A Patient-Centered Digital Tool to Support Confident IV Treatment at Home <i>Harald F. Franck, Emma Milford, Jacob Justad, Beata Jahangiri, Sogeta Al-Bazi and Eunji Lee</i>	578
Multi-Protocol Redundancy and Adaptive Sampling for Safety-Critical IoT Communication Using Clinical ECG Monitoring as Case Study <i>Nina Pearl Doe and Christian Herglotz</i>	588

WORKSHOP ON ADVANCING DIGITAL WOMEN'S HEALTH

FULL PAPERS

- Scaling Gender-Responsive Digital Health in the European Union: A Policy Commentary
Laura Wagon 603
- From Workaround to Centerpiece: Translating Lived Experience into Perimenopause-Focused Menstrual Health Technologies
Marinja Principe, Stefanie Krohmann, Tobias Kowatsch and Marcia Nifßen 614
- From Menstrual Cycle Tracking to Menstrual Cycle Syncing: A Scoping Review of Cycle Phase Effects on Lifestyle Behaviors
Marcia Nifßen, Maren Mauerhofer, Davinny Sou and Tobias Kowatsch 629
- Enhancing Menstrual Health Research through User-Centred Digital Data Structures: Findings from a Researcher Needs Study
Gian Senpinar, Larissa Shuyin Moser-Chee and Marcia Nifßen 645
- When the User Is Female but the Design Is not: A Systematic Review of Gender Alignment in Digital Eating Disorder Interventions
Rebecca Scheel 656
- Menstrual Cycle Tracking at Scale: Scientific Evidence behind the Top 15 Funded Digital Menstrual Tracking Companies
Lavinia Moretti, Sophie Paci, Davinny Sou, Tobias Kowatsch and Marcia Nifßen 668

SHORT PAPERS

- An Ethical Approach to Co-Designing Scalable Digital Health Interventions for Vulnerable Populations
Rasita Vinay and Tobias Kowatsch 683
- Barriers to Implementing and Scaling Wearable Technologies in Women's Health: Perspectives from a Gynaecologist in Switzerland
Alina Liebich, Lucia Mauz and Tobias Kowatsch 691

SPECIAL SESSION ON THE EMERGING DUAL-IMAGING SYSTEMS (PET/MRI, PET/CT, MR/CT) IN HEALTHCARE, ADVANTAGES, CHALLENGES, AND FUTURE APPLICATION

FULL PAPERS

- Towards Prediction of Brain Tumour Responses after Intervention Based on 3D MR T2 Images
Xiaohong W. Gao, Chia-Hui Chien, Guan-Lin Liu and Amja Manullang 703
- Attenuation Correction in Preclinical PET/MRI Imaging Using Denoising Diffusion Probabilistic Models with Multi-Loss Optimization
Kishore Krish, Sivakumar Duraisamy and Jyh-Cheng Chen 709

SHORT PAPER

Generative Augmentation of Anatomical-Functional Imaging for Rare Lung Cancer Subtype Classification 719

Rumeth Payagalage and Prasan Yapa

SPECIAL SESSION ON RESPONSIBLE AI IN HEALTHCARE INFORMATION SYSTEMS AND TECHNOLOGY

FULL PAPERS

Chronic Wound Assessment Solution with Secure Communication and Explainability as Key Enablers 729

Andreea Ancuta Corici, Kalpana Chaudhary, Benny Häusler, Martin Hocquel-Hans, Nils Lahmann, Hemant Zope, Marius Corici, Mareike Tabea Jansen and Simone Kuntz

Using Responsible AI for Prediction Applied to a Brazilian Dataset on Sepsis 739

Thiago Q. Oliveira, Leandro A. Carvalho, Flávio R. C. Sousa and João B. F. Filho

SHORT PAPERS

Semantic Web Knowledge Graphs for Patient-Centred Healthcare: A Systematic Review and Design Framework 751

Chenyang Ding and João Ponciano

Assessing the Trustworthiness of AI-Generated Online Health Information: Toward a Socio-Technical Framework and System 761

Tahir Hameed, Andrew Tollison and Lisa Perks

Designing Guardrails to Align LLM-Generated Social Scenarios with the Needs of Autistic Learners 771

Mahmoud Elbattah and Federica Cilia

A Systematic Literature Review of Generative AI Approaches for Synthetic Clinical Data Generation: Balancing Realism and Privacy 778

Daniel Bhola and Syed Ahmad Chan Bukhari

SPECIAL SESSION ON FEDERATED AND TRUSTWORTHY AI SOLUTIONS FOR PREDICTING CLINICAL OUTCOMES: FROM THEORY TO REAL-WORLD CLINICAL IMPACT

FULL PAPERS

How Interpretable Are LLMs? A Multi-Metric Framework for Evaluating Synthetic Explanations in Digital Mental Health 791

Prasan Yapa, Ashala Senanayake and Zilu Liang

Towards Federated Breast Microcalcification Analysis: Validating Segmentation Stability on Kaapana Using Synthetic Phantoms 803

Shqipe Salii, Mennan Selimi and Markus Graf

Explainable AI for Post-Stroke Recurrence Prediction: A Random Forest Dashboard for Personalized Risk Profiles 810

Luis Marte, Oier Segura, Judith Recober, Laura Rivera-Sanchez, Carlos A. Molina and Carolina Migliorelli

Federated Transformer-GNN for Privacy-Preserving Brain Tumor Localization with Modality-Level Explainability 820

Andrea Protani, Riccardo Taiello, Marc Molina Van Den Bosch and Luigi Serio

A Study on the Security Risks of Model Sharing in Federated Learning Systems <i>Francesco Pastore, Marco Di Gennaro, Stefano Zanero and Michele Carminati</i>	829
AUTHOR INDEX	839