

# **2024 Signal Processing: Algorithms, Architectures, Arrangements, and Applications (SPA 2024)**

**Poznan, Poland**  
**25-27 September 2024**



**IEEE Catalog Number:** CFP2407D-POD  
**ISBN:** 979-8-3503-7380-6

**Copyright © 2024, Division of Signal Processing and Electronic Systems, Poznan  
University of Technology  
All Rights Reserved**

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP2407D-POD
ISBN (Print-On-Demand):	979-8-3503-7380-6
ISBN (Online):	978-83-62065-48-6
ISSN:	2326-0262

**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  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# Table of Contents

Program summary .....	N/A
General information .....	7

## TUTORIALS:

I. Boguslaw Obara, Image Informatics: From Pixels to Insights .....	9
II. Ulrich H. Reimers, Broadcast to the SmartPhone .....	10
III. Wassim Alexan, Efficient Image Encryption Using Hyperchaos and Other Mathematical Constructs.....	11
IV. Malina Szychowska, Understanding human perception of objects and scenes .....	12
V. Adam Dąbrowski, Basis change, projection, and relative linear algebra tricks in signal and image processing .....	13

## SESSION 1: Image Processing I

1. Nick Petrovsky, Maxim Vashkevich, Quaternionic multilayer bottleneck autoencoder for color image compression .....	19
2. Ewelina Rosiak, Artur Klepaczko, Transfer learning in application to semantic segmentation of 3D indoor scenes scanned with a depth camera.....	24
3. Rana Lotfy, Mohamed Gabr, Eyad Mamdouh, Amr Aboshousha, Wassim Alexan, Dina El-Damak, Abdallah Fathy, Marvy Badr Monir Mansour, Image Encryption Based on Chen Chaotic System, OpenSSL S-Box and the Fibonacci Q-Matrix .....	30
4. Hubert Szolc, Karol Desnos, Tomasz Kryjak, Tangled Program Graphs as an alternative to DRLbased control algorithms for UAVs .....	36
5. Ivo Petráš, Mittag-Leffler Filter and Its Application in Bio-signals Processing .....	42

## SESSION 2: Applications of Neural Networks

6. Musa Karayıgit, Oğuzhan Erdem, Hüseyin Güdücüoğlu, Artificial Intelligence Based Antibiotic Zone Measurement For Disk Diffusion .....	48
7. Muhammad Farhan Safdar, Piotr Pałka, Ahmed Al Faresi, Robert Marek Nowak, Optimizing Electrocardiogram Signal Augmentation for Realistic Synthetic Data in Deep Learning Model .....	54
8. Muhammad Ahsan, Dariusz Bismor, Paweł Fabiś, Comparison of ANN and CNN models for misfire detection in vehicle engine at different RPMs with low-cost ADXL1002 accelerometer .....	60
9. Jakub Suder, Tomasz Marciniak, Foreign Object Debris detection at aerodromes using YOLOv5 .....	66

## SESSION 3: Image Processing II

10. Kacper Podbucki, Tomasz Marciniak, Camera-based light source localization for precise luminous intensity measurement of airport lamps .....	72
11. Jing Jie Tan, Anissa Mokraoui, Ban-Hoe Kwan, Danny Wee-Kiat Ng, Yan-Chai Hum, Siamese-Driven Optimization for Low-Resolution Image Latent Embedding in Image Captioning .....	79
12. Julian Balceruk, Paweł Pawłowski, Krzysztof Dolny, Julia Skotnicka, Automatic recognition of emergency vehicles in images from video recorders .....	85
13. Julian Balceruk, Paweł Pawłowski, Julia Cierpiszewska, Łukasz Kus, Piotr Zborowski, Automatic recognition of dangerous objects in front of the vehicle's windshield .....	91
14. Wiktor Nowacki, Dominik Gołemberski, Piotr Góral, Adam Dąbrowski, Prototype of mobile agrotechnical sorting robot with a vision system .....	97
15. Tomasz Marciniak, Agnieszka Stankiewicz, Influence of Histogram Equalization on Multi-Classification of Retinal Diseases in OCT B-scans .....	102

## SESSION 4: Biomedical Applications and Assistive Technologies

16. Bianca-Alexandra Zîrnă, Denis Mihailescu, Alin Alexandru Ţerban, Mădălin Corneliu Frunzete, Design of a Portable EMG and ECG Signal-Based System for Upper Limb Recovery Using Data Compression .....	109
17. Baran Atbaş, Efe Çalışkan, Oğuzhan Erdem, AI-Supported Pneumonia Diagnosis: Performance of Deep Learning Models and Synthetic Data Generation .....	115

<b>18.</b> Adnan Elahi, Danilo Comminiello, Sara Marceglia, Robust Framework for the detection of Alzheimer's Disease via analysis of Spontaneous Speech Signals .....	121
<b>19.</b> İlke Kurt, Sezer Ulukaya, Oğuzhan Erdem, Sibel Güler, Cem Uzun, Shannon Wavelet Entropy-based Machine Learning Applications in Parkinson's Disease Diagnosis with Videonystagmography .....	127
<b>20.</b> Bastián Estay Zamorano, Ali Dehghan Firoozabadi, Alessio Brutti, Pablo Adasme, David Zabala-Blanco, Pablo Palacios Játiva, Cesar A. Azurdia-Meza, Detection and Classification of Cardiovascular Diseases Using Neural Networks .....	132
<b>SESSION 5: Audio Processing</b>	
<b>21.</b> M. Szczodrak, J. Kotus, P. Szczuko, G. Szwoch, Leveraging Activation Maps for Improved Acoustic Events Detection and Classification .....	138
<b>22.</b> Merav Arogeti, Etan Fisher, Dima Bykhovsky, Sound Analysis of Drop Characteristics by Evaluation of Impact on Water Pool .....	144
<b>23.</b> Farah Hamed, Mohamed Gabr, Eyad Mamdouh, Amr Aboshousha, Wassim Alexan, Dina El-Damak, Abdallah Fathy, Marvy Badr Monir Mansour, Memristive Coupled Neural Network Based Audio Signal Encryption .....	149
<b>24.</b> Tomasz Grzywalski, Dick Botteldooren, Automatic re-labeling of Google AudioSet for improved quality of learned features and pre-training .....	155
<b>25.</b> Nur Banu Hancı, İlke Kurt, Sezer Ulukaya, Oğuzhan Erdem, Sibel Güler, Cem Uzun, Hybrid Voice Spectrogram-Chromogram Based Deep Learning (HVSC-DL) Model for the Detection of Parkinson's Disease .....	161
<b>26.</b> Tomasz Grzywalski, Dick Botteldooren, Yanjue Song, Nilesh Madhu, Salient sound extraction using deep neural networks predicting complex masks .....	166
<b>SESSION 6: DSP Theory and Implementation</b>	
<b>27.</b> Deepthi Kattula, P. Rajesh Kumar, Praveen B. Choppala, Multiple sampling with reduced resampling for particle filtering .....	172
<b>28.</b> Bianca-Alexandra Zîrnă, Denis Mihailovschi, Mădălin Corneliu Frunzete, EMG Signal Acquisition and Processing for Muscle Contraction Classification .....	177
<b>29.</b> Alin Alexandru Ţerban, Mădălin Frunzete, Traffic flow models and statistical analysis using compressed data from acquisition module .....	183
<b>30.</b> Solomon Habtamu Tessema, Daruissz Bismor, Roman Wyżgolik, Advanced Signal Processing Techniques for Plasma-MAG Welding Process .....	188
<b>31.</b> Karolina Brończyk, Michał Adamski, Agata Dąbrowska, Adam Konieczka, Adam Dąbrowski, Electrochemical determination of pollutants from various passenger car engines .....	194
<b>32.</b> Karolina Brończyk, Michał Adamski, Agata Dąbrowska, Adam Konieczka, Adam Dąbrowski, Accuracy and cross-sensitivity analysis of the PMS5003 formaldehyde sensor .....	200
<b>33.</b> Damian Jankowski, Sebastian Szwaczyk, Paweł Kaczmarek, Przemysław Ścibiorek, Zbigniew Piotrowski, Effective Application of the Big Data Techniques in the Internet Resource Processing System .....	205
Index of Authors .....	211