



2017 Signal Processing Symposium (SPSympo)

## Conference Program

Jachranka Village, September 12 – 14 2017 Poland

2017 Signal Processing Symposium Program			
TIME	Poster Area	ROOM A	ROOM B
<b>Tuesday, September 12</b>			
10:00–11:00		<i>SPSympo opening</i>	
11:20–13:00		Plenary talks	
13:00–14:00		<i>Lunch</i>	
14:00–15:40		MAPIS special session	Medical signal processing
16:00–17:40		ISAR and SAR imaging	Medical applications
18:00–19:00		<b>Tutorial 1</b> - Progressive Classification and Learning	<b>Workshop</b> - 5G Toolset - The Easiest Way to Explain Signal Processing in Communications
<b>Wednesday, September 13</b>			
08:50–10:30		Radar signal processing	Stochastic Realization and Orthogonal Signal Processing - S. A
10:50–12:30		Space technology and applications	Stochastic Realization and Orthogonal Signal Processing - S. B
12:30–13:30		<i>Lunch</i>	
13:30–14:30	Poster session		<b>Tutorial 2</b> - Subspace Identification
15:00–16:40		Passive and noise radar	<b>Tutorial 3</b> - Signal analysis in biomedical applications
17:00–18:00		<b>Tutorial 4</b> - Imaging radar: an all weather all day e.m. camera	<b>Tutorial 5</b> - Measuring the Event Horizon Shadow of Sgr A* Super Massive Black Hole
<b>Thursday, September 14</b>			
09:20–11:00		Image processing	Localization techniques
11:20–13:00		Signal processing	Electromagnetic phenomena and microwave techniques
13:00–14:00		<i>Lunch</i>	
14:00–15:40		<i>SPSympo closing</i> <i>Young Scientist Contest - Award Ceremony</i>	

**SPSympo opening**

ROOM A 10:00 - 11:00 12.09.2017 TUESDAY

**Papers:**

1. SPSympo Welcome  
*Krzysztof Kulpa, Piotr Samczyński*
2. The Main Areas of Activity of the Polish Space Agency  
*Michał Marchewka*
3. Innovative Defence Technologies for the Modernization of Polish Armed Forces - the Role of I3TO  
*Slawomir Augustyn*
4. Digital Radar - Recent Developments at Fraunhofer FHR  
*Peter Knott*

**Plenary talks**

ROOM A 11:20 - 13:00 12.09.2017 TUESDAY

**Papers:**

1. Progressive Classification and Learning: From Analytics for Deep Neural Networks to Cortex-on-a-Chip  
*John S. Baras*
2. HF-Radar Signal Processing: From Ocean Remote Sensing to Real-Time Tsunami Alerting  
*Anna Dzvonnkovskaya*
3. Efficient Management of Radio Networks with Dynamic Spectrum Access  
*Jerzy Łopatka*
4. 'Quantum Radar' Concept Implemented by Means of Classical Radar Technologies: Comparison with Noise Radar Concept  
*Konstantin Lukin*

**MAPIS special session**

ROOM A 14:00 - 15:40 12.09.2017 TUESDAY

**Papers:**

1. Multichannel Passive ISAR Imaging for Military Applications (MAPIS) Project: An Overview *Fabrizio Berizzi, Michele Conti, Amerigo Capria*
2. Passive Bistatic ISAR Imaging *Fabrizio Berizzi, Elisa Giusti, Marco Martorella*
3. Feature-Based Target Detection and Classification in Passive ISAR Range-Crossrange Images *Levente A. Kovacs, Andrea Manno-Kovacs*
4. DVB-T Based Passive Radar for Maritime Surveillance *Annarita Di Lallo, Roberta Cardinali*
5. Measurement System for Multistatic Passive Radar *Bartosz Dzikowski, Marcin Bączyk, Piotr Samczyński, Adam Grabowski, Maciej Wielgo, Damian Gromek, Piotr Krysiak, Anna Kurowska, Jędrzej Drozdowicz*
6. Passive Radar Detection Schemes for Complex Radar Scenarios *Maria -Pilar Jarabo-Amores, David Mata-Moya, Pedro-Jose Gomez-del-Hoyo, Manuel Rosa, Nerea del Rey-Maestre*

**Medical signal processing**

ROOM B 14:00 - 15:40 12.09.2017 TUESDAY

**Papers:**

1. Linear Prediction and Discrete Wavelet Transform to Identify Pathology in Voice Signals *Everthon Fonseca, Rodrigo Capobianco Guido, Katia Paulo, Denis Mosconi, Luís Maschi*
2. Estimation of Time Domain Parameters for Camera-Based Respiration Monitoring *Oleh Bodilovskiy, Anton Popov*
3. Fetal ECG and Heart Rhythm Analyzing Using BabyCard *Oleh Viunytyskiy, Vyacheslav Shulgin*
4. Investigation of New Feature Vectors to Improve an Automatic Classification Accuracy of Granulocyte *Shinnosuke Tomiyama, Mamiko Sakata-Yanagimoto, Shigeru Chiba, Naoyuki Aikawa*
5. On the Possible Improvements of Pipeline A / D Converters Parameters *Konrad Jędrzejewski*

**ISAR and SAR imaging**

ROOM A 16:00 - 17:40 12.09.2017 TUESDAY

**Papers:**

1. Three-Dimensional Imaging of a Cooperative Target Using Bistatic Inverse Synthetic Aperture Radar *Jędrzej Drozdowicz, Piotr Samczyński, Marcin Bączyk*
2. Impact of Non-Compensated Rotational Motion on the Stability of ISAR Image Formation Using Sparse Signal Reconstruction *Witold Dyszyński, Piotr Samczyński*
3. Classification Results of ISAR Sea Targets Based on Their Two Features *Anna Kurowska, Janusz S. Kulpa, Elisa Giusti, Michele Conti*
4. Comparison of Non-Coherent Change Detection Methods in SAR Imagery *A. Gromek*

**Medical applications**

ROOM B 16:00 - 17:40 12.09.2017 TUESDAY

**Papers:**

1. Heart Beat-to-Beat Interval Classification for Epileptic Seizure Prediction *Anton Popov, Yaroslav Smirnov, Oleg Panichev, Volodymyr Kharytonov and Yevgeniy Karplyuk*
2. Epileptic Seizure Prediction Based on Singular Value Decomposition of Heart Rate Variability Features *Yaroslav Smirnov, Anton Popov, Oleg Panichev, Yevgeniy Karplyuk and Volodymyr Kharytonov*
3. Feature Ranking for Mild Cognitive Impairment and Alzheimer's Disease Diagnosis *Maksym Manko, Javier Ramirez, Anton Popov, Igor Krasheniyi, Dmytro Domashenko, Juan Górriz Sáez*
4. Eye Blink Detection for the Implantable System for Functional Restoration of Orbicularis Oculi Muscle *Danylo Batulin, Anton Popov, Andrii Bobrov*
5. A Sleep Spindle Detector Based on the Fujimori Method *Yuka Kawashima, Takashi Yoshida, Mitsuo Hayashi, Naoyuki Aikawa*

**TUTORIAL 1** **Progressive Classification and Learning Mathematical Foundations, Deep Neural Networks, Implementations**  
*John S. Baras*

ROOM A 18:00 - 19:00 12.09.2017 TUESDAY

<b>WORKSHOP</b>		
<b>5G Toolset – The Easiest Way to Explain Signal Processing in Communications</b> <i>Mateusz Ul, Łukasz Kwiatkowski, IS-Wireless</i>		
ROOM B	18:00 - 19:00	12.09.2017 TUESDAY
<b>Radar signal processing</b>		
ROOM A	08:50 - 10:30	13.09.2017 WEDNESDAY
<b>Papers:</b>		
1.	System for Adjustment of Angle Coordinates for Sea Surface Surveillance Radar	<i>Evgenii Vorobev, Alexander Bezuglov, Vladimir Veremyev, Vladimir Kutuzov</i>
2.	Multi-Polarization Approach to Liquid Hydrometeors' Vibration Discrimination in Presence of Turbulence	<i>Yuliya Averyanova</i>
3.	FMCW Radar Implemented in SDR Architecture Using a USRP Device	<i>Krzysztof Stasiak, Piotr Samczyński</i>
4.	Simultaneous Processing of Time-Shifted Orthogonal LFM CW Waveforms	<i>Sharef Neemat, Oleg Krasnov, Alexander Yarovoy</i>
<b>Stochastic Realization and Orthogonal Signal Processing - special session A</b>		
ROOM B	08:50 - 10:30	13.09.2017 WEDNESDAY
<b>Papers:</b>		
1.	Issues on Multidimensional Stochastic Realization	<i>Sankar Basu</i>
2.	Nonlinear Schur-Type Orthogonal Transformations of Higher-Order Stochastic Processes: An Overview of Current Topics	<i>Jan Zarzycki, Agnieszka Wielgus, Urszula Libal</i>
3.	Generalized Schur Parametrization and Orthogonal Modeling Algorithms for Second-Order Time Series	<i>Urszula Libal, Władysław Magiera, Agnieszka Wielgus</i>
4.	Nonlinear Orthogonal Parametrization and Modeling for Higher-Order Non-Gaussian Time-Series	<i>Agnieszka Wielgus, Urszula Libal, Władysław Magiera</i>
<b>Space technology and applications</b>		
ROOM A	10:50 - 12:30	13.09.2017 WEDNESDAY
<b>Papers:</b>		
1.	Concept of the Polish SSA System	<i>Joanna Modławska, Karolina Pieniowska, Krzysztof Samp, Edwin Wnuk</i>
2.	Detection of Objects on LEO Using Signals of Opportunity	<i>Dorota Mieczkowska, Martyna Zaborowska, Agnieszka Borucka, Jakub Wójcicki, Urszula Zielińska, Gabriela Moryc, Patrycja Szewczak, Jakub Kopyciński, Wioleta Rzęsa, Marek Kubel-Grabau, Paulina Woźniak, Bartłomiej Majerski, Viktor Szabó</i>
3.	Feasibility of Asteroid Detection Using Pulsar FSR-Network	<i>Hristo A. Kabakchiev, Vara Behar, Dorina Kabakchieva, Ivan Garvanov, Avgust Kabakchiev, Hermann Rohling, Mark J. Bentum, Jorge Fernandes</i>
4.	The Concept of SAR Satellite Data Use for Flood Risk Monitoring in Poland	<i>Joanna Pluto-Kossakowska, Katarzyna Osińska-Skotak, Helena Łoś and Beata Weintrit</i>
5.	The Use of Sentinel-1 Imagery in the Analysis of River Ice Phenomena on the Lower Vistula in the 2015-2016 Winter Season	<i>Helena Łoś, Bogusław Pawłowski</i>
<b>Stochastic Realization and Orthogonal Signal Processing - special session B</b>		
ROOM B	10:50 - 12:30	13.09.2017 WEDNESDAY
<b>Papers:</b>		
1.	Subspace Identification of Large-scale LTI Dynamical Systems	<i>Michel Verhaegen</i>
2.	Nonlinear Complexity Reduction: Sparsity of the Generalized Schur Coefficient Matrices and Frobenius Norm Criterion	<i>Agnieszka Wielgus, Urszula Libal, Władysław Magiera</i>
3.	FPGA-based Signal Correlators	<i>Michał Kniola, Waldemar Susek, Adam Kawalec</i>
4.	An Optimized Resource Allocation Algorithm in Cooperative Relay Cognitive Radio Networks	<i>Min Zhang, Guodong Zhang, Zhihua Bao, Shibing Zhang</i>
<b>Poster session</b>		
POSTER AREA	13:30 - 14:30	13.09.2017 WEDNESDAY
<b>Papers:</b>		
1.	Data Association with Evidence Theory	<i>Ahmed Dallil</i>
2.	For The Detection And Tracking Of The Ball And Players In Ball Sports	<i>Piotr Samczyński, Krzysztof S. Kulpa, Damian Gromek, Jacek Misiurewicz, Wiesław Klembowski, Marcin Botwicz</i>
3.	Moving Target Detection Method of the Ka FMCW SAR Based on DPCA	<i>Hui Wang, ZhanSheng Chen, Shichao Zheng, Man Jiang</i>
4.	A Simple Radar Based on USRP Software Defined Radio	<i>Bartłomiej Bleszyński</i>
5.	Noise Waveform Reflectometer Based on LED and Spectral Interferometry Technique	<i>Konstantin Alexandrovich Lukin, Dmytro Tatyanko, Oleg Zemlyaniy</i>
6.	Equivalent Simulation Method for Pulse Radar Countermeasure in RFS	<i>Xiaobin Liu, Jin Liu, Zhao Feng, Qihua Wu, Guoyu Wang, Jian'an Chen</i>
7.	Estimation of Time-Frequency Complex Phase-Based Speech Attributes Using Narrow Band Filter Banks	<i>Karol Abratkiewicz, Krzysztof Czarnecki, Dominique Fourer, Francois Auger</i>
8.	Assessing Frequency Response of Video Motion Magnification Techniques	<i>Mateusz Popek, Monika Danielewska, Daoud Iskander</i>
9.	Experimental Evaluation of Estimator Mean Square Error Curve for Cognitive Tracking Radar	<i>Michał Meller</i>
10.	Reliability Parameters Estimation for Radioelectronic Equipment in Case of Change-point	<i>Oleksandr Solomentsev, Maksym Zaliskyi, Olena Kozhokhina, Tetyana Herasymenko</i>
11.	Instrument Landing Systems' Control Processes Investigation	<i>Oleksii Zuiev</i>
12.	Combination of Periodic and Alias-free Non-uniform Signal Sampling for Wideband Signal Digitizing and Compressed Transmitting Based on Picosecond-resolution Event Timing	<i>Ivars Bilinskis, Eugene Boole, Kaspars Sudars</i>
13.	Real Time Processing of the Phase Shift and the Frequency by Voltage Signal Conversion into the Sequence of Rectangular Pulses	<i>Eskender Bekirov, Marlen Asanov, Svetlana Voskresenskaya, Ahmed Alkaata</i>
14.	High Resolution Range Profile Reconstruction for Rotating Targets Based on Random Stepped Frequency Signal	<i>Qihua Wu, Jin Liu, Feng Zhao, Xiaobin Liu, Shunping Xiao, Xiaofeng Ai</i>

<b>TUTORIAL 2</b>	<b>Subspace Identification</b> <i>Michel Verhaegen</i>	
ROOM B	13:30 - 14:30	13.09.2017 WEDNESDAY
<b>Passive and noise radar</b>		
ROOM A	15:00 - 16:40	13.09.2017 WEDNESDAY
<b>Papers:</b>		
1.	Comparative Analysis of Object Shadows Obtained by GPS and Sound Signals <i>Kalin Dimitrov, Ivan Garvanov, Vara Behar, Christo Kabakchiev</i>	
2.	Nondesired Effects in DVB-T Based Passive Radar Due to Sporadic Interference <i>Nerea del Rey-Maestre, Jose Luis Bárcena-Humanes, Javier Rosado-Sanz, Pedro-Jose Gomez-del-Hoyo, David Mata-Moya</i>	
3.	Study of the Ghost Target Phenomenon on a Real DVB-T Passive Radar Scenario <i>Pedro-Jose Gomez-del-Hoyo, Jose Luis Bárcena-Humanes, Nerea del Rey-Maestre, Javier Rosado-Sanz, Maria -Pilar Jarabo-Amores</i>	
4.	Novel Bispectrum-Based Wireless Vision Technique Using Disturbance of Electromagnetic Field by Human Gestures <i>Oleh Viunmyskiy, Alexander Totskiy</i>	
<b>TUTORIAL 3</b>	<b>Signal analysis in biomedical applications</b> <i>Anton Popov</i>	
ROOM B	15:00 - 16:40	13.09.2017 WEDNESDAY
<b>TUTORIAL 4</b>	<b>Imaging radar: an all weather all day e.m. camera</b> <i>Fabrizio Berizzi</i>	
ROOM A	17:00 - 18:00	13.09.2017 WEDNESDAY
<b>TUTORIAL 5</b>	<b>Measuring the Event Horizon Shadow of Sgr A* Super Massive Black Hole - Experiment Crucis of the 21st Century</b> <i>Konstantin Lukin</i>	
ROOM B	17:00 - 18:00	13.09.2017 WEDNESDAY
<b>Image processing</b>		
ROOM A	09:20 - 11:00	14.09.2017 THURSDAY
<b>Papers:</b>		
1.	Visual-Based Navigation System for Unmanned Aerial Vehicles <i>Piotr Kaniewski, Wojciech Grzywacz</i>	
2.	Advanced Image Tracking Approach for Augmented Reality Applications <i>Ievgen Gorovyi, Dmytro Sharapov</i>	
3.	Algorithm for Real-Time Finger Spelling Alphabet Recognition in Video Sequences <i>Filip Csóka, Jaroslav Polec</i>	
4.	Objects Detection and Recognition System Using Artificial Neural Networks and Drones <i>Dymitr Pietrow, Jan Matuszewski</i>	
5.	Superpixels Merging in Corrupted Color Images <i>Filip Csóka, Jaroslav Polec</i>	
<b>Localization techniques</b>		
ROOM B	09:20 - 11:00	14.09.2017 THURSDAY
<b>Papers:</b>		
1.	Detecting and Removing Repetitive Errors from PPP Time Series by Means of Adaptive Filter <i>Sefa Yalvac, Aydin Ustun, Mike Mustafa Berber</i>	
2.	A New Anchor Nodes Position Determination Method Supporting UWB Localization System Deployment <i>Vitomir Djaja-Josko</i>	
3.	Errors Analysis of Differential Single-Frequency Geo-Positioning Algorithm <i>Arkadiusz Niemiec, Bogusław Szlachetko</i>	
4.	Framework for Real-Time User Positioning in GPS Denied Environments <i>Ievgen Gorovyi, Aleksey Roenko, Alexander Pitertsev, Yevhen Chervoniak, Vitalii Vovk</i>	
5.	Utilizing Acceleration Measurements to Improve TDOA Based Localization <i>Marcin Kotakowski</i>	
<b>Signal processing</b>		
ROOM A	11:20 - 13:00	14.09.2017 THURSDAY
<b>Papers:</b>		
1.	Signal Processing in Passive Acoustic Location for Aircraft Detection <i>Yevhen Chervoniak, Rustem Sinitsyn, Felix J Yanovsky, Vitaliy Makarenko, Vadim Tokarev, Oleksandr Zaporozhets</i>	
2.	Data Hiding Method in Speech Using Echo Embedding and Voicing Correction <i>Zbigniew Piotrowski, Jaroslaw Wojtuń, Bartosz Tabara</i>	
3.	Estimation of Polynomial Frequency Modulation Law for FM Signals Based on Modified Extended Generalized Chirp Transform <i>Ewa Świercz</i>	
<b>Electromagnetic phenomena and microwave techniques</b>		
ROOM B	11:20 - 13:00	14.09.2017 THURSDAY
<b>Papers:</b>		
1.	Properties of High Directivity Microstrip Couplers <i>Arkadiusz Golaszewski, Adam Abramowicz</i>	
2.	The Antenna Array with Ring Elements <i>Olga Shcherbyna, Ludvig Ilnitskiy, Inna Mykhalchuk, Olena Kozhokhina</i>	
3.	Forward- And Backward-Scattering Profiles of Metallic Targets <i>Bartłomiej Salski, Piotr Samczyński, Paweł Kopyt, Krzysztof S. Kulpa</i>	
<b>SPSymposium closing</b>		
ROOM A	14:00 - 15:00	14.09.2017 THURSDAY
Closing Remarks		
Symposium Summary		
Award Ceremony		

Tuesday, September 12

**Tuesday, September 12, 10:00 - 11:00**

**SPSympo opening**  TOP

Room A

Chairs: Krzysztof S Kulpa, Peter Knott

**10:00 Welcome Speech**

Krzysztof S Kulpa and Piotr Samczynski

**10:20 The Main Areas of Activity of the Polish Space Agency**

Michał Marchewka

**10:30 Innovative Defence Technologies for the Modernization of Polish Armed Forces - The Role of I3TO**

Sławomir Augustyn

**10:45 Digital Radar - Recent Developments at Fraunhofer FHR**

Peter Knott

**Tuesday, September 12, 11:20 - 13:00**

**Plenary talks**  TOP

Room A

Chairs: Piotr Samczynski, Anna Dzvonkovskaya

**11:20 Progressive Classification and Learning: From Analytics for Deep Neural Networks to Cortex-on-a-Chip**

John S. Baras

**11:45 HF-Radar Signal Processing: From Ocean Remote Sensing to Real-Time Tsunami Alerting**

Anna Dzvonkovskaya

**12:10 Efficient Management of Radio Networks with Dynamic Spectrum Access**

Jerzy Lopatka

**12:35 'Quantum Radar' Concept Implemented by Means of Classical Radar Technologies: Comparison with Noise Radar Concept**

Konstantin Alexandrovich Lukin

**Tuesday, September 12, 14:00 - 15:40**

**MAPIS special session**  TOP

Room A

Chairs: Fabrizio Berizzi, Maria -Pilar Jarabo-Amores, Robert Łukawski

This session aims at presenting to the radar signal processing community the main novel scientific and technological results of the MAPIS project ( Multichannel passive ISAR imaging for military applications). MAPIS is a three years EDA (European Defence Agency) project aiming at studying, defining, analyzing a new system concept for implementing and demonstrating ISAR imaging capability in a plug-in multistatic array passive radar finalized to target recognition. The session is composed in several papers starting with an overview of the project, to the concept of passive bistatic ISAR imaging, the use ISAR images for classification, the DVB-T multichannel passive radar, the multistatic passive radar measurement system and finally to the detection signal processing complex chain. The results will show that imaging with passive radar is feasible with predictable performance.

**14:00 *Multichannel Passive ISAR Imaging for Military Applications (MAPIS) Project: An Overview***

Fabrizio Berizzi, Michele Conti and Amerigo Capria

**14:15 *Passive Bistatic ISAR Imaging***

Fabrizio Berizzi, Elisa Giusti and Marco Martorella

**14:30 *Feature-Based Target Detection and Classification in Passive ISAR Range-Crossrange Images***

Levente A. Kovacs and Andrea Manno-Kovacs

**14:45 *DVB-T Based Passive Radar for Maritime Surveillance***

Annarita Di Lallo and Roberta Cardinali

**15:00 *Measurement System for Multistatic Passive Radar***

Bartosz Dzikowski, Marcin Baczyk, Piotr Samczynski, Adam Grabowski, Maciej Wielgo, Damian Gromek, Piotr Krysik, Anna Kurowska and Jędrzej Drozdowicz

**15:15 *Passive Radar Detection Schemes for Complex Radar Scenarios***

Maria -Pilar Jarabo-Amores, David Mata-Moya, Pedro-Jose Gomez-del-Hoyo, Manuel Rosa and Nerea del Rey-Maestre



**Medical signal processing**

Room B

Chairs: Anton Popov, Boguslaw Szlachetko

**14:00 *Linear Prediction and Discrete Wavelet Transform to Identify Pathology in Voice Signals***

Everthon Fonseca, Rodrigo Capobianco Guido, Katia Paulo, Denis Mosconi and Luís Maschi

**14:20 *Estimation of Time Domain Parameters for Camera-Based Respiration Monitoring***

Oleh Bodilovskyi and Anton Popov

**14:40 *Fetal ECG and Heart Rhythm Analyzing Using BabyCard***

Oleh Viunytskyi and Vyacheslav Shulgin

**15:00 *Investigation of New Feature Vectors to Improve an Automatic Classification Accuracy of Granulocyte***

Shinnosuke Tomiyama, Mamiko Sakata-Yanagimoto, Shigeru Chiba and Naoyuki Aikawa

**15:20 *On the Possible Improvements of Pipeline A / D Converters Parameters***

Konrad Jędrzejewski

**Tuesday, September 12, 16:00 - 17:40**



**ISAR and SAR imaging**

Room A

Chairs: Maria -Pilar Jarabo-Amores, Jacek Misiurewicz

**16:00 *Three-Dimensional Imaging of a Rotating Airborne Target Using Bistatic Inverse Synthetic Aperture Radar***

Jędrzej Drozdowicz, Piotr Samczynski and Marcin Baczyk

**16:20 *Impact of Non-Compensated Rotational Motion on the Stability of ISAR Image Formation Using Sparse Signal Reconstruction***

Witold Dyszyński and Piotr Samczynski

**16:40 *Classification Results of ISAR Sea Targets Based on Their Two Features***

Anna Kurowska, Janusz S. Kulpa, Elisa Giusti and Michele Conti

## 17:00 *Comparison of Non-Coherent Change Detection Methods in SAR Imagery*

A. Gromek

### Medical applications



Room B

Chair: Konrad Jędrzejewski

#### 16:00 *Heart Beat-to-Beat Interval Classification for Epileptic Seizure Prediction*

Anton Popov, Yaroslav Smirnov, Oleg Panichev, Volodymyr Kharytonov and Yevgeniy Karplyuk

#### 16:20 *Epileptic Seizure Prediction Based on Singular Value Decomposition of Heart Rate Variability Features*

Yaroslav Smirnov, Anton Popov, Oleg Panichev, Yevgeniy Karplyuk and Volodymyr Kharytonov

#### 16:40 *Feature Ranking for Mild Cognitive Impairment and Alzheimer's Disease Diagnosis*

Maksym Manko, Javier Ramirez, Anton Popov, Igor Krashenyi, Dmytro Domashenko and Juan Manuel Górriz Sáez

#### 17:00 *Eye Blink Detection for the Implantable System for Functional Restoration of Orbicularis Oculi Muscle*

Danylo Batulin, Anton Popov, Andrii Bobrov and Albina Tretiakova

#### 17:20 *A Sleep Spindle Detector Based on the Fujimori Method*

Yuka Kawashima, Takashi Yoshida, Mitsuo Hayashi and Naoyuki Aikawa

## Tuesday, September 12, 18:00 - 19:00

### Tutorial 1 - Progressive Classification and Learning



Mathematical Foundations, Deep Neural Networks, Implementations

**Prof. John S. Baras**

Room A

We describe various applications in sensing and associated signal processing, cognition and reasoning, as motivation and justification for multi-resolution analysis. We also include abstractions of the cortex architectures for sound and vision in ferrets, mice, and humans. These considerations inspire the class of generic architectures we propose. We next describe a rigorous mathematical framework we have developed that provides a hierarchical architecture for learning and cognition. The resulting architecture combines a wavelet preprocessor, a group invariant feature extractor and an aligned hierarchical (layered) learning algorithm. There are two feedback loops one back from the learning output to the feature extractor and one all the way back to the wavelet preprocessor. We show that the scheme can incorporate all metric differences but also non-metric dissimilarity measures like Bregman divergences. The learning module incorporates two universal learning algorithms in their hierarchical tree-structured form, both due to Kohonen. Learning Vector Quantization (LVQ) for supervised learning and Self-Organizing Map (SOM) for unsupervised learning. We demonstrate convergence of the resulting algorithms. We demonstrate the superior performance of the resulting algorithms and architecture on a variety of practical problems including: speaker and sound identification, simultaneous direction of arrival speaker ID and vowel ID, radar classification, ISAR classification, face recognition based on photographs. We describe how the resulting architecture and analytics capture the architecture abstractions of the cortex of higher-level animals and humans w.r.t. sound and vision sensing and understanding. We describe multi-resolution aspect graphs and their use in understanding and explaining the framework, and associated descriptions and importance of group invariance and representation of sound and vision objects that are non-traditional, including and emerging framework for shape recognition. We provide an interpretation of the algorithms as data-driven multi-resolution partition based classifiers and associated geometric constructions. We describe the implications on complexity reduction, and why these results explain known performance in higher-level animals and humans. We demonstrate how the underlying mathematics can be used to provide systematic models for design, analysis and evaluation of deep neural networks. We describe how the underlying mathematical framework is related to recent work by Mallat and others on a mathematical foundation for deep convolutional neural networks and learning. We close with a description of current work and future plans on mixed signal (digital and analog) micro-electronic implementations that exploit known architectural abstractions of the cortex of higher-level animals and humans w.r.t. to sound and vision sensing and cognition. We call the resulting chip class "Cortex-on-a-Chip".

### Workshop - 5G Toolset - The Easiest Way to Explain Signal Processing in Communications



IS Wireless

**Mateusz Ul, Łukasz Kwiatkowski**

Room B

Decoding of LTE signal captured from the air.

Practical approach towards education on 4G and 5G - MATLAB laboratory cases.

Deployment of real-time LTE base station with the use of configurator for open-source protocol stack.

**Wednesday, September 13**

**Wednesday, September 13, 08:50 - 10:30**

**Radar signal processing**  TOP

Room A

Chairs: Yuliya Averyanova, Piotr Kaniewski

**08:50 *System for Adjustment of Angle Coordinates for Sea Surface Surveillance Radar***  
Evgenii Vorobev, Alexander Bezuglov, Vladimir Veremyev and Vladimir Kutuzov

**09:10 *Multi-Polarization Approach to Liquid Hydrometeors' Vibration Discrimination in Presence of Turbulence***  
Yuliya Averyanova

**09:30 *FMCW Radar Implemented in SDR Architecture Using a USRP Device***  
Krzysztof Stasiak and Piotr Samczynski

**09:50 *Simultaneous Processing of Time-Shifted Orthogonal LFM CW Waveforms***  
Sharef Neemat, Oleg Krasnov and Alexander Yarovoy

**Stochastic Realization and Orthogonal Signal Processing - special session A**  TOP

Room B

Chairs: Sankar Basu, Jan Zarzycki

**08:50 *Issues on Multidimensional Stochastic Realization***  
Sankar Basu

**09:10 *Nonlinear Schur-Type Orthogonal Transformations of Higher-Order Stochastic Processes: An Overview of Current Topics***  
Jan Zarzycki, Agnieszka Wielgus and Urszula Libal

**09:30 *Generalized Schur Parametrization and Orthogonal Modeling Algorithms for Second-Order Time Series***  
Urszula Libal, Władysław Magiera and Agnieszka Wielgus

**09:50 *Nonlinear Orthogonal Parametrization and Modeling for Higher-Order Non-Gaussian Time-Series***  
Agnieszka Wielgus, Urszula Libal and Władysław Magiera

**Wednesday, September 13, 10:50 - 12:30**

**Space technology and applications**  TOP

Room A

Chairs: Christo Kabakchiev, Manuel Rosa



**10:50 *Concept of the Polish SSA System***

Joanna Modławska, Karolina Pieniowska, Krzysztof Samp and Edwin Wnuk

**11:10 *Detection of Objects on LEO Using Signals of Opportunity***

Dorota Mieczkowska, Martyna Zaborowska, Agnieszka Borucka, Jakub Wójcicki, Urszula Zielińska, Gabriela Moryc, Patrycja Szewczak, Jakub Kopyciński, Wioleta Rzęsa, Marek Kubel-Grabau, Paulina Woźniak, Bartłomiej Majerski and Viktor Szabó

**11:30 *Feasibility of Asteroid Detection Using Pulsar FSR-Network***

Hristo A. Kabakchiev, Vara Behar, Dorina Kabakchieva, Ivan Garvanov, Avgust Kabakchiev, Hermann Rohling, Mark J. Bentum and Jorge Fernandes

**11:50 *The Concept of SAR Satellite Data Use for Flood Risk Monitoring in Poland***

Joanna Pluto-Kossakowska, Katarzyna Osińska-Skotak, Helena Łoś and Beata Weintrit

**12:10 *The Use of Sentinel-1 Imagery in the Analysis of River Ice Phenomena on the Lower Vistula in the 2015-2016 Winter Season***

Helena Łoś and Bogusław Pawłowski



**Stochastic Realization and Orthogonal Signal Processing - special session B**

Room B

Chairs: Michel Verhaegen, Agnieszka Wielgus

**10:50 *Subspace Identification of Large-scale LTI Dynamical Systems***

Michel Verhaegen

**11:10 *Nonlinear Complexity Reduction: Sparsity of the Generalized Schur Coefficient Matrices and Frobenius Norm Criterion***

Agnieszka Wielgus, Urszula Libal and Władysław Magiera

**11:30 *FPGA-based Signal Correlators***

Michał Kniota, Waldemar Susek and Adam Kawalec

**11:50 *An Optimized Resource Allocation Algorithm in Cooperative Relay Cognitive Radio Networks***

Min Zhang, Guodong Zhang, Zhihua Bao and Shibing Zhang

**Wednesday, September 13, 13:30 - 14:30**



Poster session

Room: Poster area

Chair: Łukasz Maślikowski

***Data Association with Evidence Theory***

Ahmed Dallil

***The Concept of RF System for Detection and Tracking of Ball and Players in Sport Ball Games***

Piotr Samczynski, Krzysztof S Kulpa, Damian Gromek, Jacek Misiurewicz, Wiesław Klemkowski and Marcin Botwicz

***Moving Target Detection Method of the Ka FMCW SAR Based on DPCA***

Hui Wang, ZhanSheng Chen, Shichao Zheng and Man Jiang

***A Simple Radar Based on USRP Software Defined Radio***

Bartłomiej Błeszyński

***Equivalent Simulation Method for Pulse Radar Countermeasure in RFS***

Xiaobin Liu, Jin Liu, Zhao Feng, Qihua Wu, Guoyu Wang and Jian'an Chen

***Estimation of Time-Frequency Complex Phase-Based Speech Attributes Using Narrow Band Filter Banks***

Karol Abratkiewicz, Krzysztof Czarnecki, Dominique Fourer and Francois Auger

***Assessing Frequency Response of Video Motion Magnification Techniques***

Mateusz Popek, Monika Danielewska and Daoud Iskander

***Experimental Evaluation of Estimator Mean Square Error Curve for Cognitive Tracking Radar***

Michał Meller

***Reliability Parameters Estimation for Radioelectronic Equipment in Case of Change-point***

Oleksandr Solomentsev, Maksym Zaliskyi, Olena Kozhokhina and Tetyana Herasymenko

***Instrument Landing Systems' Control Processes Investigation***

Oleksii Zuiev

***Combination of Periodic and Alias-free Non-uniform Signal Sampling for Wideband Signal Digitizing and Compressed Transmitting Based on Picosecond-resolution Event Timing***

Ivars Bilinskis, Eugene Boole and Kaspars Sudars

***Real Time Processing of the Phase Shift and the Frequency by Voltage Signal Conversion into the Sequence of Rectangular Pulses***

Eskender Bekirov, Marlen Asanov, Svetlana Voskresenskaya and Ahmed Alkaata

***High Resolution Range Profile Reconstruction for Rotating Targets Based on Random Stepped Frequency Signal***

Qihua Wu, Jin Liu, Feng Zhao, Xiaobin Liu, Shunping Xiao and Xiaofeng Ai



**Tutorial 2 - Subspace Identification**

**Michel Verhaegen (TU Delft)**

Room B

In this tutorial Subspace Techniques (ST) for identifying linear time invariant state space models from input-output data are revised. ST do not require a parametrization of the system matrices and therefore are less prone to problems related to local minima that often hamper successful application of parametric optimization based identification methods. The overview follows the historic line of development. It starts from Kroneckers result on the representation of an infinite power series by a rational function and then addresses respectively the deterministic realization problem, its stochastic variant and finally the identification of a state space model given in innovation form. The tutorial summarizes the fundamental algorithmic principles of key methods over 3 decades of research in this field and gives a glimpse on potential future research directions.

**Wednesday, September 13, 15:00 - 16:40**



**Passive and noise radar**

Room A

Chair: Mateusz Malanowski

**15:00 *Comparative Analysis of Object Shadows Obtained by GPS and Sound Signals***

Kalin Dimitrov, Ivan Garvanov, Vara Behar and Christo Kabakchiev

**15:20 *Nondesired Effects in DVB-T Based Passive Radar Due to Sporadic Interference***

Nerea del Rey-Maestre, Jose Luis Bárcena-Humanes, Javier Rosado-Sanz, Pedro-Jose Gomez-del-Hoyo and David Mata-Moya

**15:40 *Study of the Ghost Target Phenomenon on a Real DVB-T Passive Radar Scenario***

Pedro-Jose Gomez-del-Hoyo, Jose Luis Bárcena-Humanes, Nerea del Rey-Maestre, Javier Rosado-Sanz and Maria -Pilar Jarabo-Amores

**16:00 *Novel Bispectrum-Based Wireless Vision Technique Using Disturbance of Electromagnetic Field by Human Gestures***

Oleh Viunytskyi and Alexander Totskiy

## 16:20 **Noise Waveform Reflectometer Based on LED and Spectral Interferometry Technique**

Konstantin Alexandrovich Lukin, Dmytro Tatyanko and Oleg Zemlyaniy



### Tutorial 3 - Signal analysis in biomedical applications

**Dr. Anton Popov**

Room B

A constant interest growth is observed in the area of exploring the data from human body. Wide range of tools is available for registering biosignal in various modalities, thus analyzing such data using various mathematical techniques is of great importance. In the tutorial, the general overview of the biomedical systems and signal types will be presented, with emphasize on the origin and characteristics of each particular signal and the concepts of biosignal treatment in the medical IoT framework. The overview of mathematical tools used for biosignal analysis will be presented. Four classes of methods, i.e. linear, nonlinear, uni- and multivariate techniques will be discussed with examples. Applications of biosignal analysis will be presented. Among the topics, analysis of brain electrical activity, epileptic seizure prediction using machine learning, development of fuzzy inference system for early diagnostics of Alzheimer's Disease, and contactless registration of human respiration from video in visible range will be described in details.

- Biosignals in medical IoT ecosystem
- Mathematics behind biosignal analysis
- Applications of biosignal analysis
- Analysis of brain electrical activity, Epileptic seizure detection, prediction and control
- Fuzzy logic for Alzheimer Disease diagnostics
- Respiration data analysis
- Heart rate variability analysis
- Muscle synergies analysis

**Wednesday, September 13, 17:00 - 18:00**



### Tutorial 4 - Imaging radar: an all weather all day e.m. camera

**Prof. Fabrizio Berizzi**

Room A

Radar system allows detection and tracking of non-cooperative target making use of ElectroMagnetic (e.m.) reflection of target illuminated by the transmitted signal. In the last 20 years, the radar has shown rapidly technological progresses and a consequent improvement of the performance. Current wide band radars are now able to reconstruct microwave images of the targets thanks to their high spatial resolution capabilities. The tutorial focuses on fundamentals of radar imaging aiming at demonstrating that the radar behaves as a camera producing e.m. image in any meteo and day and night conditions. The main common Range-Doppler technique will be explained and some critical aspects related to image focusing and cross-range scaling mentioned. Which are the differences between an ElectroOptical camera and imaging radar? Answer to this simple question will be addressed. The tutorial will conclude with an excursus of the advanced and recent imaging techniques with application to real data.

Topics:

- Fundamental of coherent radar: principles, radar signal, architecture
- Basic concept of radar imaging
- Signal model
- Range Doppler technique
- Spatial resolution
- Image Autofocusing and cross-scaling algorithms
- Experimental results
- Advanced techniques and their applications



### Tutorial 5 - Measuring the Event Horizon Shadow of Sgr A\* Super Massive Black Hole

Experimentum Crucis of the 21st Century

**Prof. Konstantin Lukin**

## Room B

Super Massive Black Hole (SMBH) in the center of Milky Way galaxy (Sgr A) is the closest one to the Earth. A unique feature of any black hole is the existence of an Event Horizon (EH). The EH represents the boundary of a space-time domain from which nothing, not even photons, may ever leave and reach an external observer. At the same time, accreting matter produces electromagnetic radiation in a wide frequency range which may be readily detected with nowadays radio receiving technology, which gives a chance to estimate experimentally the EH shadow. The presently available angular resolution allows us to measure even the shape of the shadow of the EH of the Sgr A SMBH. Implementation of such an experiment will be Experimentum Crucis for proving the validity of General Relativity. These experiments are based on the use of multi-position Interferometers with a Very Large Base (VLBI). Our lecture briefly describes the above and related issues, such as: formation of the EH; existing Projects on the EH measuring; Event Horizon Telescope (EHT) Project, and, in some more detail, a new Project on 'Event Horizon Imaging Experiment' (EHIE) suggested and elaborated recently by European Space Agency (ESA) - M.Martin-Neira, Vololimir Kudryashev, et al. The concept of the horizon plays an increasing role not only in gravitation, but also in physics in general. The existence of the event horizon manifests itself both at macro and micro scales. In the latter case, the event horizon, generating a minimum length, may determine the discrete structure of space.

Thursday, September 14

Thursday, September 14, 09:20 - 11:00

### Image processing TOP

Room A

Chair: Michał Meller

**09:20 *Visual-Based Navigation System for Unmanned Aerial Vehicles***

Piotr Kaniewski and Wojciech Grzywacz

**09:40 *Advanced Image Tracking Approach for Augmented Reality Applications***

Ievgen Gorovyi and Dmytro Sharapov

**10:00 *Algorithm for Real-Time Finger Spelling Alphabet Recognition in Video Sequences***

Filip Csóka and Jaroslav Polec

**10:20 *Objects Detection and Recognition System Using Artificial Neural Networks and Drones***

Dymitr Pietrow and Jan Matuszewski

**10:40 *Superpixels Merging in Corrupted Color Images***

Filip Csóka and Jaroslav Polec

### Localization techniques TOP

Room B

Chairs: Ethan Lin, Jerzy Pietrasinski

**09:20 *Detecting and Removing Repetitive Errors from PPP Time Series by Means of Adaptive Filter***

Sefa Yalvac, Aydin Ustun and Mike Mustafa Berber

**09:40 *A New Anchor Nodes Position Determination Method Supporting UWB Localization System Deployment***

Vitomir Djaja-Josko

**10:00 *Errors Analysis of Differential Single-Frequency Geo-Positioning Algorithm***

Arkadiusz Niemiec and Boguslaw Szlachetko

**10:20 *Utilizing Acceleration Measurements to Improve TDOA Based Localization***

Marcin Kolakowski

**10:40 *Framework for Real-Time User Positioning in GPS Denied Environments***

Ievgen Gorovyi, Aleksey Roenko, Alexander Pitertsev, Yevhen Chervoniak and Vitalii Vovk

**Thursday, September 14, 11:20 - 13:00**

**Signal processing**  TOP

Room A

Chairs: Ewa Swiercz, Ievgen Gorovyi

**11:20 *Signal Processing in Passive Acoustic Location for Aircraft Detection***

Yevhen Chervoniak, Rustem Sinitsyn, Felix J Yanovsky, Vitaliy Makarenko, Vadim Tokarev and Oleksandr Zaporozhets

**11:40 *Data Hiding Method in Speech Using Echo Embedding and Voicing Correction***

Zbigniew Piotrowski, Jarosław Wojtuń and Bartosz Tabara

**12:00 *Estimation of Polynomial Frequency Modulation Law for FM Signals Based on Modified Extended Generalized Chirp Transform***

Ewa Swiercz

**Electromagnetic phenomena and microwave techniques**  TOP

Room B

Chair: Bartłomiej Salski

**11:20 *Properties of High Directivity Microstrip Couplers***

Arkadiusz Golaszewski and Adam Abramowicz

**11:40 *The Antenna Array with Ring Elements***

Olga Shcherbyna, Ludvig Ilnitskyi, Inna Mykhalchuk and Olena Kozhokhina

**12:00 *Forward- And Backward-Scattering Profiles of Metallic Targets***

Bartłomiej Salski, Piotr Samczynski, Pawel Kopyt and Krzysztof S Kulpa

**Thursday, September 14, 14:00 - 15:40**

**SPSympo closing**  TOP

Room A

Chairs: Krzysztof S Kulpa, Piotr Samczynski