

# **2020 54th Asilomar Conference on Signals, Systems, and Computers**

**Pacific Grove, California, USA  
1 – 5 November 2020**

**Pages 1-783**



**IEEE Catalog Number: CFP20431-POD  
ISBN: 978-1-6654-4707-2**

**Copyright © 2020 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. 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:	CFP20431-POD
ISBN (Print-On-Demand):	978-1-6654-4707-2
ISBN (Online):	978-0-7381-3126-9
ISSN:	1058-6393

**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

---

Student Paper Contest.....	xxvii
Foreword.....	xxviii

## MO1-1: Waveform Design

MO1-1.1: Uncoded Binary Signaling through Modulo AWGN Channel.....	1
<i>Gizem Tabak, Andrew Singer, University of Illinois at Urbana-Champaign, United States</i>	
MO1-1.2: A decision theoretic approach for waveform design in joint radar communications applications .....	6
<i>Shammi A Doly, Shankarachary Ragi, South Dakota School of Mines &amp; Technology, United States; Alex Chiriyath, School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ 85287, United States; Hans D. Mittelmann, Arizona State University, United States; Daniel W. Bliss, Mathematical and Statistical Sciences, Arizona State University, Tempe, AZ 85287, United States</i>	
MO1-1.3: Predistortion of OFDM Waveforms using Guard-band Subcarriers.....	12
<i>Chance Tarver, Rice University, United States; Alexios Balatsoukas-Stimming, Eindhoven University of Technology, United States; Joseph Cavallaro, Rice University, United States</i>	
MO1-1.4: Continuous Phase Modulation With Faster-than-Nyquist Signaling for Channels With 1-bit Quantization and Oversampling at the Receiver .....	17
<i>Rodrigo de Alencar, Lukas Landau, Pontifical Catholic University of Rio de Janeiro, Brazil</i>	

## MO1-2: Machine Learning for Advanced Wireless Communications

MO1-2.2: Learning with Knowledge of Structure: A Neural Network-Based Approach for MIMO-OFDM Detection .....	22
<i>Zhou Zhou, Shashank Jere, Virginia Tech, United States; Lizhong Zheng, Massachusetts Institute of Technology, United States; Lingjia Liu, Virginia Tech, United States</i>	
MO1-2.3: Downlink Channel Feedback in FDD Massive MIMO Systems via Tensor Compression and Sampling .....	27
<i>Mohamed Salah Ibrahim, University of Virginia, United States; Charilaos Kanatsoulis, University of Minnesota, United States; Nicholas D. Sidiropoulos, University of Virginia, United States</i>	
MO1-2.4: Thresholded Wirtinger Flow for Fast Millimeter Wave Beam Alignment.....	32
<i>Chao Gan, Jing Yang, The Pennsylvania State University, United States; Cong Shen, University of Virginia, United States</i>	

## MO1-3: Decentralized Learning and Optimization

MO1-3.1: Learning-based Adaptive Quantization for Communication-efficient Distributed Optimization with ADMM .....	37
<i>Truong Nghiem, Northern Arizona University, United States; Aldo Duarte, Shuangqing Wei, Louisiana State University, United States</i>	
MO1-3.2: Privacy-Preserving Distributed Learning with NonSmooth Objective Functions .....	42
<i>François Gauthier, Cristiano Gratton, Naveen Venkategowda, Stefan Werner, Norwegian University of Science and Technology, Norway</i>	
MO1-3.3: Distributed Prediction-Correction ADMM for Time-Varying Convex Optimization .....	47
<i>Nicola Bastianello, University of Padova, Italy; Andrea Simonetto, IBM Research Ireland, Ireland; Ruggero Carli, University of Padova, Italy</i>	
MO1-3.4: Conservative Multi-agent Online Kernel Learning in Heterogeneous Networks.....	53
<i>Hrusiksha Pradhan, Indian Institute of Technology Kanpur, India; Amrit Singh Bedi, Alec Koppel, US Army Research Laboratory, Adelphi, United States; Ketan Rajawat, Indian Institute of Technology Kanpur, India</i>	

## **MO1-4: Applications of Deep Learning I**

- MO1-4.1: Spatiotemporal Convolutional LSTM for Radar Echo Extrapolation ..... 58  
*Shuxin Zhong, Xianxin Zeng, Qing Ling, Sun Yat-Sen University, China; Qiushi Wen, Weiguang Meng, Yerong Feng, Guangzhou Institute of Tropical and Marine Meteorology, China*
- MO1-4.2: A novel distance-based algorithm for multi-user classification in keystroke dynamics ..... 63  
*Chinmay Sahu, Mahesh Banavar, Stephanie Schuckers, Clarkson University, United States*
- MO1-4.3: FuSSI-Net: Fusion of Spatio-temporal Skeletons for Intention Prediction ..... 68  
Network  
*Francesco Piccoli, Rajarathnam Balakrishnan, Maria Jesus Perez, Moraldeepsingh Sachdeo, Carlos Nuñez, Matthew Tang, University of California, Berkeley, United States; Kajsa Andreasson, Kalle Bjurek, Ria Dass Raj, Ebba Davidsson, Colin Eriksson, Victor Hagman, Jonas Sjöberg, Chalmers University of Technology, Sweden; Ying Li, Volvo Cars Technology, United States; L. Srikar Muppirisetty, Volvo Cars Corporation, Sweden; Sohini Roychowdhury, Volvo Cars Technology, United States*
- MO1-4.4: Disentangling high energy chorus elements against structured background interference ..... 73  
in the Van Allen radiation belts using braid manifolds  
*Ananya Sen Gupta, Ryan McCarthy, Craig Kletzing, Kawther Rouabhi, Ivar Christopher, University of Iowa, United States*

## **MO1-5: Sparse Array Processing in MIMO Systems**

- MO1-5.1: Sequential sparse Bayesian learning for DOA ..... 78  
*YONGSUNG PARK, FLORIAN MEYER, PETER GERSTOFT, University of California, San Diego, United States*
- MO1-5.2: Sparse MIMO synthetic aperture sonar processing with distributed optimization ..... 82  
*Angeliki Xenaki, Yan Pailhas, Roberto Sabatini, Centre for Maritime Research and Experimentation, Italy*
- MO1-5.4: Sparse Approximation of an Outdoor-to-Indoor Massive MIMO Channel ..... 88  
Measurement  
*Herbert Groll, Daniel Schützenöfer, Stefan Pratschner, TU Wien, Austria; Peter Gerstoft, University of California San Diego, United States; Christoph F. Mecklenbräuker, TU Wien, Austria*

## **MO1-6: Network-Level Analysis and Modeling of Neural Data**

- MO1-6.1: Inferring neural dynamics during burst-suppression using a neurophysiology-inspired ..... 92  
switching state-space model  
*Sourish Chakravarty, Gabriel Schamberg, Taylor Baum, Emery Brown, Massachusetts Institute of Technology, United States*
- MO1-6.2: The population map of changes in the spatiotemporal sensitivity of visual neurons ..... 97  
across saccadic eye movements  
*Manish Roy, Amir Akbarian, Behrad Noudoost, Neda Nategh, University of Utah, United States*
- MO1-6.3: Adaptive Frequency-domain Granger Causal Inference from Neuronal Ensemble Data ..... 101  
*Anuththara Rupasinghe, Shoutik Mukherjee, Behdash Babadi, University of Maryland, United States*
- MO1-6.4: Time-varying graph analysis comparing speech perception in healthy and aphasic ..... 106  
brains  
*Sudha Yellapantula, Colin Noe, Simon Fischer-Baum, Behnaam Aazhang, Rice University, United States*

## **MO1-7: Architectures for Machine Learning**

- MO1-7.1: Low-complexity Neural Network-based MIMO Detector using Permuted Diagonal ..... 111  
Matrix  
*Siyu Liao, Chunhua Deng, Yi Xie, Rutgers University, United States; Lingjia Liu, Virginia Tech, United States; Bo Yuan, Rutgers University, United States*

MO1-7.2: FPGA Implementation of Q-RTS for Real-Time Swarm Intelligence Systems .....	116
<i>Gian Carlo Cardarilli, Luca Di Nunzio, Rocco Fazzolari, Daniele Giardino, Marco Matta, University of Rome Tor Vergata, Italy; Alberto Nannarelli, Technical University of Denmark, Denmark; Marco Re, Sergio Spanò, University of Rome Tor Vergata, Italy</i>	
MO1-7.3: VLSI Hardware Architecture for Gaussian Process .....	121
<i>Chunhua Deng, Yongbin Gong, Feng Han, Siyu Liao, Jingang Yi, Bo Yuan, Rutgers University, China</i>	
MO1-7.4: A Neural Network Engine for Resource Constrained Embedded Systems.....	125
<i>Zuzana Jelčicová, Demant A/S; Technical University of Denmark (DTU), Denmark; Adrian Mardari, Oskar Andersson, Evangelia Kasapaki, Demant A/S, Denmark; Jens Sparsø, Technical University of Denmark (DTU), Denmark</i>	
<b>MO1-8: Signal and Image Processing for Visual Cultural Heritage</b>	
MO1-8.1: Steerable Pyramid for Texture Classification of Photographic Paper .....	132
<i>Nicholas Rogers, Damon Crockett, Paul Messier, IPCH Lens Media Lab, United States</i>	
MO1-8.2: Multiscale anisotropic analysis for assessment of similarity between papers in a large Matisse print dataset .....	137
<i>Patrice ABRY, Stephane ROUX, CNRS - ENS Lyon, France; Paul MESSIER, Institute for the Preservation of Cultural Heritage, Yale University, United States; Margaret HOLBEN, Stephane JAFFARD, Institute of Fine Arts, New York University, United States</i>	
MO1-8.3: Semi-Supervised Convolutional Triplet Neural Networks for Assessing Paper Texture Similarity .....	142
<i>Leah Lackey, Arick Grootveld, Andrew Klein, Western Washington University, United States</i>	
<b>MO2-1: Modulation</b>	
MO2-1.1: Spectral Correlation for LEO Satellite Signal Presence Detection and Doppler Estimation .....	147
<i>Jonas Hofmann, Andreas Knopp, Bundeswehr University Munich, Germany; Chad Spooner, North West Research Associates, United States; Giovanni Minelli, James Newman, Naval Postgraduate School, United States</i>	
MO2-1.2: Optimizing Convolutional Neural Networks to Identify Distorted M-ary CPFSK Signals with RRC Pulse Shaped Instantaneous Frequency .....	153
<i>Ambaw Ambaw, George Washington University, United States; Mohammad Bari, T-Mobile, Headquarters, United States; Milos Doroslovacki, George Washington University, United States</i>	
MO2-1.3: OVER THE AIR PERFORMANCE OF DEEP LEARNING FOR MODULATION CLASSIFICATION ACROSS CHANNEL CONDITIONS .....	157
<i>Venkatesh Sathyanarayanan, Mark Wagner, Peter Gerstoft, UCSD, United States</i>	
MO2-1.4: Enhanced Automatic Modulation Classification using Deep Convolutional Latent Space Pooling .....	162
<i>Clayton Harper, Lauren Lyons, Mitchell Thornton, Eric Larson, Darwin Deason Institute, United States</i>	
<b>MO2-2: Machine Learning for Communication Systems</b>	
MO2-2.1: End-to-End Learning of Neuromorphic Wireless Systems for Low-Power Edge Artificial Intelligence .....	166
<i>Nicolas Skatchkovsky, Hyeryung Jang, Osvaldo Simeone, King's College London, United Kingdom</i>	
MO2-2.2: Vision Aided URLL Communications: Proactive Service Identification and Coexistence .....	174
<i>Muhammad Alrabeiah, Umut Demirhan, Andrew Hredzak, Ahmed Alkhateeb, Arizona State University, United States</i>	
MO2-2.4: Learning on a Grassmann Manifold: CSI Quantization for Massive MIMO Systems .....	179
<i>Keerthana Bhogi, Chiranjib Saha, Harpreet S. Dhillon, Virginia Tech, United States</i>	

<b>MO2-3: Tensor Methods for Signal, Data, and Network Analytics</b>	
MO2-3.2: C <sup>3</sup> APTION: Constraint Coupled CP And PARAFAC2 Tensor Decomposition.....	187
<i>Ekta Gujral, University of California, Riverside, United States; Georgios Theocharous, Adobe Inc, United States; Evangelos E. Papalexakis, University of California, Riverside, United States</i>	
MO2-3.3: Multi-Area Model-Free State Estimation via Distributed Tensor Decomposition.....	191
<i>Yajing Liu, Ahmed S. Zamzam, Andrey Bernstein, National Renewable Energy Laboratory, United States</i>	
MO2-3.4: Supervised Learning via Ensemble Tensor Completion.....	196
<i>Nikos Kargas, University of Minnesota, United States; Nicholas D. Sidiropoulos, University of Virginia, United States</i>	
<b>MO2-4: Applications of Deep Learning II</b>	
MO2-4.1: A Deep Learning-Aided Approach to Portfolio Design for Financial Index Tracking .....	200
<i>Zepeng Zhang, Ziping Zhao, Shanghaitech University, China</i>	
MO2-4.2: UPR: A Model-Driven Architecture for Deep Phase Retrieval.....	205
<i>Naveed Naimipour, Shahin Khobahi, Mojtaba Soltanalian, University of Illinois at Chicago, United States</i>	
MO2-4.3: Complexity Analysis and u-net Based Segmentation of Meningeal Lymphatic Vessels .....	210
<i>Nazia Tabassum, Michael Ferguson, Jasmin Herz, Scott Acton, University of Virginia, United States</i>	
MO2-4.4: Detecting Adversarial Images via Texture Analysis .....	215
<i>Weiheng Chai, Senem Velipasalar, Syracuse University, United States</i>	
<b>MO2-5: Robust Techniques for Effective Direction of Arrival Estimation</b>	
MO2-5.1: A Fast Group Sparsity Based Phase Retrieval Algorithm for Non-Coherent DOA .....	220
Estimation <i>Zhengyu Wan, Wei Liu, University of Sheffield, United Kingdom</i>	
MO2-5.2: Non-Redundant Sparse Array with Flexible Aperture.....	225
<i>Ammar Ahmed, Yimin D. Zhang, Temple University, United States</i>	
MO2-5.3: Co-Array MUSIC under Angle-Independent Nonidealities.....	230
<i>Robin Rajamäki, Visa Koivunen, Aalto University, Finland</i>	
MO2-5.4: Robust DOA and Subspace Estimation for Hybrid Channel Sensing .....	236
<i>Pulak Sarangi, Sina Shahsavari, Piya Pal, University of California, San Diego, United States</i>	
<b>MO2-6: Signal Processing for Neural and Medical Imaging</b>	
MO2-6.1: Graph Laplacian-based Tumor Segmentation and Denoising in Brain Magnetic .....	241
Resonance Imaging <i>Adnan Hanif, Milos Doroslovacki, The George Washington University, United States</i>	
MO2-6.2: Joint Estimation of Hemodynamic Response and Stimulus Function in Functional .....	246
Ultrasound Using Convolutional Mixtures <i>Aybüke Erol, Delft University of Technology, Netherlands; Simon Van Eyndhoven, Katholieke Universiteit Leuven, Belgium; Sebastiaan Koekkoek, Pieter Kruizinga, Erasmus Medical Center, Netherlands; Borbala Hunyadi, Delft University of Technology, Netherlands</i>	
MO2-6.3: Hieroglyph: Hierarchical Glia Graph Skeletonization and Matching .....	251
<i>Tiffany Ly, Tamal Batabyal, Jeremy Thompson, Tajie Harris, Daniel Weller, Scott Acton, University of Virginia, United States</i>	
MO2-6.4: VBET: VESSELNESS AND BLOB ENHANCEMENT TECHNIQUE .....	256
FOR 2D AND 3D MICROSCOPY IMAGES OF MICROGLIA <i>Tanjin Taher Toma, Kanchan Bisht, Ukpong Eyo, Daniel Weller, University of Virginia, United States</i>	
<b>MO2-7: Energy-Efficient solutions for neural networks and applications</b>	
MO2-7.1: Hierarchical Approximate Memory for Deep Neural Network Applications.....	261
<i>Minho Ha, Pohang University of Science and Technology, Republic of Korea; Seokha Hwang, Samsung Electronics, Republic of Korea; Jeonghun Kim, Youngjoo Lee, Sunggu Lee, Pohang University of Science and Technology, Republic of Korea</i>	

MO2-7.2: Deep Learning Based MIMO Channel Prediction: An Initial Proof of Concept Prototype	267
<i>Jayden Booth, Ahmed Ewaisha, Andreas Spanias, Ahmed Alkhateeb, Arizona State University, United States</i>	
MO2-7.3: An Energy-Efficient Deep Neural Network Accelerator Design	272
<i>Joeeun Jung, Kyuho Lee, UNIST, Republic of Korea</i>	
MO2-7.4: A REVIEW OF ON-DEVICE FULLY NEURAL END-TO-END AUTOMATIC SPEECH RECOGNITION ALGORITHMS	277
<i>Chanwoo Kim, Kwangyoun Kim, Dhananjaya Gowda, Jiyeon Kim, Changwoo Han, Dongsoo Lee, Samsung Research, Republic of Korea</i>	
<b>MO2-8: Generative Modeling of Images and Video: Challenges, Trends, and Applications</b>	
MO2-8.2: Treeview and Disentangled Representations for Explaining Deep Neural Networks Decisions	284
<i>Prasanna Sattigeri, IBM Research, United States; Jayaraman Thiagarajan, LLNL, United States</i>	
MO2-8.3: Partial Domain Adaptation Using Selective Representation Learning For Class-Weight Computation	289
<i>Sandipan Choudhuri, Riti Paul, Arunabha Sen, Baoxin Li, Hemanth Venkateswara, Arizona State University, United States</i>	
<b>MO3-1: Machine Learning for Wireless Resource Allocation</b>	
MO3-1.2: Importance- and Channel-Aware Scheduling in Cellular Federated Edge Learning	294
<i>Jinke Ren, Yinghui He, Zhejiang University, China; Dingzhu Wen, The University of Hong Kong, China; Guanding Yu, Zhejiang University, China; Kaibin Huang, The University of Hong Kong, China; Dongning Guo, Northwestern University, United States</i>	
MO3-1.3: Decentralized Wireless Resource Allocation with Graph Neural Networks	299
<i>Zhiyang Wang, University of Pennsylvania, United States; Mark Eisen, Intel Corporation, United States; Alejandro Ribeiro, University of Pennsylvania, United States</i>	
MO3-1.4: A Combinatorial Bandit Approach to UAV-aided Edge Computing	304
<i>Bochun Wu, Fudan University, China; Tianyi Chen, Rensselaer Polytechnic Institute, United States; Xin Wang, Fudan University, China</i>	
<b>MO3-2: Millimeter Wave Architectures and Baseband Algorithms</b>	
MO3-2.1: Millimeter-Wave Massive MIMO Testbed with Hybrid Beamforming	309
<i>MinKeun Chung, Liang Liu, Andreas Johansson, Martin Nilsson, Lund University, Sweden; Olof Zander, Zhinong Ying, Sony Research Center, Sweden; Fredrik Tufvesson, Ove Edfors, Lund University, Sweden</i>	
MO3-2.2: Frequency Synchronization for Low Resolution Millimeter-Wave	314
<i>Ryan Dreifuerst, Robert Heath, University of Texas at Austin, United States; Mandar Kulkarni, Jianzhong (Charlie) Zhang, Samsung Research America, United States</i>	
MO3-2.3: Distributed Massive MIMO via all-Digital Radio Over Fiber	319
<i>Lise Aabel, Ericsson, Sweden; Ibrahim Can Sezgin, Sven Jacobsson, Giuseppe Durisi, Christian Fager, Chalmers, Sweden</i>	
MO3-2.4: Power Efficient Multi-Carrier Baseband Processing for 5G and 6G Wireless	324
<i>Panagiotis Skrimponis, NYU Tandon School of Engineering, United States; Seyed Hadi Mirfarshbafan, Christoph Studer, Cornell Tech, United States; Sundeep Rangan, NYU Tandon School of Engineering, United States</i>	
<b>MO3-3: Nonconvex Methods for High-Dimensional Estimation</b>	
<b>MO3-4: Robustness and Efficiency in Machine Learning</b>	
MO3-4.1: Block-LMS and RLS adaptive filters using in-memory architectures	331
<i>Chandrasekhar Radhakrishnan, Sujana Gonugondla, University of Illinois, Urbana-Champaign, United States</i>	

MO3-4.2: Memory-Rate Tradeoff for Caching with Uncoded Placement under Nonuniform File Popularity <i>Yong Deng, Min Dong, Ontario Tech University, Canada</i>	336
MO3-4.3: Robustifying FISTA via the infinity norm of its smooth component's gradient <i>Paul Rodriguez, PUCP, Peru</i>	341
MO3-4.4: Unsupervised Mode Extraction and Group Velocity Estimation for Ultrasonic Guided Waves Propagating in Dispersive Material <i>Javaid Ikram, Intel Corporation, United States; Aditi Chattopadhyay, Antonia Papandreou-Suppappola, Arizona State University, United States</i>	343
<b>MO3-5: Tensor-Based Array Signal Processing</b>	
MO3-5.2: Low-Complexity Massive MIMO Tensor Precoding <i>Lucas Nogueira Ribeiro, TU Ilmenau, Germany; Stefan Schwarz, TU Wien, Austria; André Lima Férrer de Almeida, Federal University of Ceará, Brazil; Martin Haardt, TU Ilmenau, Germany</i>	348
MO3-5.3: Recovering Joint PMF from Pairwise Marginals <i>Shahana Ibrahim, Xiao Fu, Oregon State University, United States</i>	356
MO3-5.4: Learning Polynomial Neural Networks via Low Rank Tensor Recovery <i>Mehmet Can Hucumenoglu, Piya Pal, University of California, San Diego, United States</i>	361
<b>MO3-6: Neuro-Rehabilitation and Assistive Technologies</b>	
MO3-6.1: Compensating for electrode contact failures in chronic selective nerve cuff recordings: A simulation study <i>Stephen Sammut, University of Toronto, Canada; José Zariffa, Toronto Rehabilitation Institute - University Health Network, Canada</i>	366
MO3-6.2: Hybrid Deep Neural Networks for Sparse Surface EMG-Based Hand Gesture Recognition <i>Elahe Rahimian, Soheil Zabihi, Amir Asif, Arash Mohammadi, Concordia University, Canada</i>	371
MO3-6.3: Decoding neural activity to anticipate eye movements <i>Neda Nategh, University of Utah, United States</i>	375
<b>MO3-7: Low-Resolution Sampling and Modulation</b>	
MO3-7.1: Spatial Sigma-Delta Massive MIMO: Improved Channel Estimation and Achievable Rates <i>Shilpa Rao, Hessam Pirzadeh, University of California, Irvine, United States; Gonzalo Seco-Granados, Universitat Autònoma de Barcelona, Spain; A. Lee Swindlehurst, University of California, Irvine, United States</i>	379
MO3-7.2: Comparator Network Aided Detection for MIMO Receivers with 1-Bit Quantization <i>Ana Beatriz L. B. Fernandes, Zhichao Shao, Lukas T. N. Landau, Rodrigo C. de Lamare, Pontifical Catholic University of Rio de Janeiro, Brazil</i>	384
MO3-7.3: Hardware-Friendly Two-Stage Spatial Equalization for All-Digital mmWave Massive MU-MIMO <i>Oscar Castañeda, Cornell Tech, United States; Sven Jacobsson, Ericsson Research, Sweden; Giuseppe Durisi, Chalmers University of Technology, Sweden; Tom Goldstein, University of Maryland, College Park, United States; Christoph Studer, Cornell Tech, United States</i>	388
MO3-7.4: Learning a Low-Complexity Channel Estimator for One-Bit Quantization <i>Benedikt Fesl, Michael Koller, Nurettin Turan, Wolfgang Utschick, Technische Universität München, Germany</i>	393
<b>MO3-8: Reinforcement Learning and Bandits for Communication Systems</b>	
MO3-8.1: Deep Actor-Critic Learning for Distributed Power Control in Wireless Mobile Networks <i>Yasar Sinan Nasir, Dongning Guo, Northwestern University, United States</i>	398
MO3-8.2: MIMO Receive Antenna Selection via Deep Learning and Greedy Adaptation <i>Cong Shen, University of Virginia, United States; Donghao Li, University of Science and Technology of China, China; Jing Yang, Pennsylvania State University, United States</i>	403

MO3-8.3: Cooperative perception in Vehicular Networks using Multi-Agent Reinforcement Learning .....	408
<i>Mohamed K. Abdel-Aziz, Sumudu Samarakoon, University of Oulu, Finland; Cristina Perfecto, University of the Basque Country, Spain; Mehdi Bennis, University of Oulu, Finland</i>	
MO3-8.4: Network Performance Adaptation in Wireless Control with Reinforcement Learning.....	413
<i>Mark Eisen, Arjun KG, Amit S. Baxi, Dave Cavalcanti, Intel Corporation, United States</i>	
<b>TU1-1: Information Theory</b>	
TU1-1.1: Timely Updates in Distributed Computation Systems with Stragglers.....	418
<i>Baturalp Buyukates, Sennur Ulukus, University of Maryland, United States</i>	
TU1-1.2: Maximizing Information Freshness in Caching Systems with Limited Cache Storage .....	423
Capacity <i>Melih Bastopcu, Sennur Ulukus, University of Maryland, United States</i>	
TU1-1.3: Non-asymptotic Bounds via Causal Coding on Scalar-Valued Gauss-Markov Sources .....	428
with MSE Distortion and CaSI <i>Photios Stavrou, Mikael Skoglund, KTH Royal Institute of Technology, Sweden</i>	
TU1-1.4: Increasing the Raw Key Rate in Energy-Time Entanglement Based Quantum Key .....	433
Distribution <i>Esmail Karimi, Texas A&amp;M University, United States; Emina Soljanin, Rutgers University, United States; Philip Whiting, Macquarie University, Australia</i>	
<b>TU1-2: Millimeter Wave and Beyond</b>	
TU1-2.2: Energy-Efficient Analog Beamforming with Short Packets in Millimeter-Wave .....	439
MIMO Systems <i>Jordi Borras, Francesc Molina, Technical University of Catalonia, Spain; Roberto Lopez-Valcarce, AtlanTTic Research Center, University of Vigo, Spain; Josep Sala-Alvarez, Technical University of Catalonia, Spain</i>	
TU1-2.3: Reinforcement Learning for Beam Pattern Design in Millimeter Wave and .....	445
Massive MIMO Systems <i>Yu Zhang, Muhammad Alrabeiah, Ahmed Alkhateeb, Arizona State University, United States</i>	
TU1-2.4: Antenna Selection for Upper Millimeter Wave and THz Bands .....	450
<i>Vasanthan Raghavan, Tao Luo, Ozge Koymen, Junyi Li, Qualcomm, United States</i>	
<b>TU1-3: Signals on Graphs: Filtering, Evolution, and Convergence</b>	
TU1-3.1: Finite-time in-network computation of linear transforms .....	455
<i>Soumya Kar, Carnegie Mellon University, United States; Markus Püschel, ETH Zürich, Switzerland; José Moura, Carnegie Mellon University, United States</i>	
TU1-3.2: Node-Asynchronous Implementation of Filter Banks on Graphs .....	460
<i>Oguzhan Teke, P. P. Vaidyanathan, California Institute of Technology, United States</i>	
TU1-3.3: Blind Estimation of Eigenvector Centrality from Graph Signals: Beyond Low-pass .....	465
Filtering <i>T. Mitchell Roddenberry, Santiago Segarra, Rice University, United States</i>	
TU1-3.4: Graph-aided Online Learning with Expert Advice .....	470
<i>Pouya M. Ghari, Yanning Shen, University of California, Irvine, United States</i>	
<b>TU1-4: Generative Models in Computational Imaging</b>	
TU1-4.3: Image reconstruction for MRI using deep CNN priors trained without groundtruth .....	475
<i>Weijie Gan, Cihat Eldeniz, Jiaming Liu, Shihao Chen, Hongyu An, Ulugbek Kamilov, Washington University in St. Louis, United States</i>	
<b>TU1-5: Beamforming</b>	
TU1-5.1: Joint Precoding and Scheduling Optimization in Downlink Multicell Satellite .....	480
Communications <i>Yimin Zhang, Temple University, United States; Khanh Pham, Air Force Research Laboratory, United States</i>	

TU1-5.2: A Nonlinear Relay Scheme Resilient to Interference with Unknown CSI .....	485
<i>Rui Wang, Yi Jiang, Fudan University, China</i>	
TU1-5.3: Random Matrix Theory Analysis of the Dominant Mode Rejection Beamformer .....	490
White Noise Gain with Overestimated Rank	
<i>Christopher Hulbert, Kathleen Wage, George Mason University, United States</i>	
TU1-5.4: ITERATIVE MMSE SPACE-TIME ZERO-CROSSING PRECODING .....	496
FOR CHANNELS WITH 1-BIT QUANTIZATION AND OVERSAMPLING	
<i>Diana M. V. Melo, Lukas T. N. Landau, Pontifical Catholic University of Rio de Janeiro, Brazil;</i>	
<i>Lucas N. Ribeiro, Martin Haardt, Ilmenau University of Technology, Germany</i>	
<b>TU1-6: Signal Processing for Computational Genomics</b>	
TU1-6.1: Network-Based RNA Structural Alignment Through Optimal Local Neighborhood .....	501
Matching	
<i>Hyun-Myung Woo, Byung-Jun Yoon, Texas A&amp;M University, United States</i>	
TU1-6.2: Visualizing and Annotating Protein Sequences using A Deep Neural Network.....	506
<i>Zhengqiao Zhao, Gail Rosen, Drexel University, United States</i>	
TU1-6.3: Detecting novel genomic structural variants through negative binomial optimization.....	511
<i>Mario Banelos, California State University, Fresno, United States; Suzanne Sindi, Roummel</i>	
<i>Marcia, University of California, Merced, United States</i>	
TU1-6.4: Spatiotemporal Tracking of SARS-CoV-2 Variants using informative subtype .....	516
markers and association graphs	
<i>Ananya Sen Gupta, University of Iowa, United States; Gail Rosen, Drexel University, United</i>	
<i>States</i>	
<b>TU1-7: Architectures and Arithmetic for Autonomous Sensor Modules</b>	
TU1-7.1: A Local LoRa Based Network Protocol with Low Power Redundant Base Stations .....	520
Enabling Remote Environmental Monitoring	
<i>Stijn Wielandt, Baptiste Dafflon, Lawrence Berkeley National Laboratory, United States</i>	
TU1-7.2: On Reducing Module Activities in Online Arithmetic Operations .....	524
<i>Milos Ercegovac, Cmptr Sci, United States</i>	
TU1-7.3: An Architecture for Improving Variable Radix Real and Complex Division Using .....	529
Recurrence Division	
<i>Brett Mathis, James Stine, Oklahoma State University, United States; Miloš Ercegovac,</i>	
<i>University of California, Los Angeles, United States; Jean-Michel Muller, CNRS-Laboratoire</i>	
<i>LIP, France</i>	
<b>TU1-8: Computational Methods for Audio Processing and Enhancement</b>	
TU1-8.2: Probabilistic Optimization for Source Separation .....	534
<i>Gerald Schuller, Oleg Golokolenko, Ilmenau University of Technology, Germany</i>	
<b>TU2-1: mm-Wave Communication</b>	
TU2-1.1: A Stochastic Optimization Framework for Distributed Beam Scheduling in 5G .....	539
mm-Wave Networks over non-cooperative Operators	
<i>Xiang Zhang, Shamik Sarkar, University of Utah, United States; Arupjyoti Bhuyan, Idaho</i>	
<i>National Laboratory, United States; Sneha Kasera, Mingyue Ji, University of Utah, United States</i>	
TU2-1.2: Enabling Uncoordinated Spectrum Sharing in Millimeter Wave Networks Using .....	544
Carrier Sensing	
<i>Shamik Sarkar, Xiang Zhang, University of Utah, United States; Arupjyoti Bhuyan, Idaho</i>	
<i>National Labs, United States; Mingyue Ji, Sneha Kasera, University of Utah, United States</i>	
TU2-1.3: Multi-user Beam Alignment for Millimeter Wave Systems in Multi-path .....	549
Environments	
<i>Mohammad A. (Amir) Khojastepour, NEC Laboratories America, Inc., United States; Shahram</i>	
<i>Shahsavari, University of Waterloo, United States; Abbas Khalili, Elza Erkip, New York</i>	
<i>University, United States</i>	

<b>TU2-2: MIMO Communication Beyond 5G</b>	
TU2-2.1: Parallel Interference Cancellation for Cell-Free C-RANs .....	554
<i>Reza Mosayebi, Mohammad Mojahedian, Angel Lozano, Univ. Pompeu Fabra, Spain</i>	
TU2-2.2: Physics-based Modeling of Large Intelligent Reflecting Surfaces for Scalable Optimization .....	559
<i>Marzieh Najafi, Vahid Jamali, Robert Schober, Friedrich-Alexander University Erlangen-Nuremberg, Germany; H. Vincent Poor, Princeton University, United States</i>	
TU2-2.3: Near- and Far-Field Communications with Large Intelligent Surfaces .....	564
<i>Andrea De Jesus Torres, Luca Sanguinetti, University of Pisa, Italy; Emil Björnson, Linköping University, Sweden</i>	
TU2-2.4: The Impact of Terminal Mobility on the Performance of a Panel-Based Large Intelligent Surface .....	569
<i>Andreia Pereira, University of Coimbra (Instituto de Telecomunicações), Portugal; Fredrik Rusek, Lund University, Sweden; Marco Gomes, University of Coimbra (Instituto de Telecomunicações), Portugal; Rui Dinis, FCT-UNL (Instituto de Telecomunicações), Portugal</i>	
<b>TU2-3: Statistical Signal Processing Over Networks</b>	
TU2-3.1: Learning from Networks of Distributions .....	574
<i>Antonios Valkanas, Florence Regol, Mark Coates, McGill University, Canada</i>	
TU2-3.2: Distributed Hybrid Kalman Temporal Differences for Reinforcement Learning .....	579
<i>Mohammad Salimibeni, Parvin Malekzadeh, Concordia University, Canada; Konstantinos N. Plataniotis, University of Toronto, Canada; Arash Mohammadi, Concordia University, Canada</i>	
TU2-3.3: Asymptotic Performance In Heterogeneous Human-machine Inference Networks .....	584
<i>Chen Quan, Baocheng Geng, Pramod Varshney, Syracuse University, United States</i>	
<b>TU2-4: Nonlinear Estimation</b>	
TU2-4.1: Consistency of Sparse-Group Lasso Graphical Model Selection for Time Series .....	589
<i>Jitendra Tugnait, Auburn University, United States</i>	
TU2-4.2: A Novel Framework for Deep Learning from Pairwise Constraints .....	594
<i>Wubin Sheng, John Lipor, Portland State University, United States</i>	
TU2-4.3: Estimating Vector Fields from Noisy Time Series .....	599
<i>Harish S. Bhat, Majerle Reeves, University of California, Merced, United States; Ramin Raziperchikolaei, Rakuten, United States</i>	
TU2-4.4: Non-linear Manifold Clustering based on Conformity Index .....	607
<i>Mahlagha Sedghi, George Atia, Michael Georgiopoulos, UCF, United States</i>	
<b>TU2-5: Radar</b>	
TU2-5.1: A Cramer-Rao Bound Analysis for mmWave PMCW MIMO Radar with Quantized Observations .....	612
<i>Chao-Yi Wu, Jian Li, Tan F. Wong, University of Florida, United States</i>	
TU2-5.2: Moving Target Detection using Distributed MIMO Radar in Non-Homogeneous Clutter with Limited Training Data .....	617
<i>Jared Smith, Arnab Shaw, Wright State University, United States</i>	
TU2-5.3: ESTIMATING ABSOLUTE HUMIDITY USING LATENCY MEASUREMENTS OVER CMLs: CHALLENGES, OPPORTUNITIES AND ERROR ANALYSIS .....	623
<i>Gal Leibovitz, Hagit Messer, Tel-Aviv University, Israel</i>	
<b>TU2-6: Algorithms, Learning, and Theory for Computational Imaging</b>	
TU2-6.2: Ultra-Sparse View Reconstruction for Flash X-Ray Imaging using Consensus Equilibrium .....	631
<i>Maliha Hossain, Shane Paulson, Purdue University, United States; Hangjie Liao, Lam Research, United States; Weinong Chen, Charles Bouman, Purdue University, United States</i>	
TU2-6.3: Optimizing Optical Compressed Sensing for Multispectral DNN-Based Image Segmentation .....	636
<i>Yuqi Li, Yoram Bresler, University of Illinois at Urbana-Champaign, United States</i>	

<b>TU2-7: Positioning Energy Constraint Devices</b>	
TU2-7.1: ToF-based Indoor Positioning for Low-power IoT Nodes .....	641
<i>Daniel Neunteufel, TU Wien, Austria; Andreas Fuchs, Graz University of Technology, Austria; Holger Arthaber, TU Wien, Austria</i>	
TU2-7.2: High-Accuracy Positioning of Battery-Less Hybrid Gen2 UHF-UWB Tags .....	646
<i>Davide Fabbri, Nicolò Decarli, Anna Guerra, Aldo Romani, Davide Dardari, University of Bologna, Italy</i>	
TU2-7.3: RSS-Based Localization of Low-Power IoT Devices Exploiting AoA and Range Information .....	651
<i>Xuhong Li, Lund University, Sweden; Erik Leitinger, Graz University of Technology, Austria; Fredrik Tufvesson, Lund University, Sweden</i>	
TU2-7.4: Energy-Neutral Devices: Can Hybrid RF-Acoustic Signals Point Them Out? .....	657
<i>Bert Cox, Chesney Buyle, Liesbet Van der Perre, Lieven De Strycker, KU Leuven, Belgium</i>	
<b>TU2-8: Neural Generative Systems for Speech Compression, Synthesis, and Enhancement</b>	
TU2-8.1: A Study on Conditional Features for a Flow-based Neural Vocoder .....	662
<i>Hyungseob Lim, Suhyeon Oh, Kyungguen Byun, Hong-Goo Kang, Yonsei University, Republic of Korea</i>	
TU2-8.2: Handling Background Noise in Neural Speech Generation .....	667
<i>Tom Denton, Alejandro Luebs, Michael Chinen, Felicia S. C. Lim, Andrew Storus, Yero Yeh, W. Bastiaan Kleijn, Jan Skoglund, Google, United States</i>	
TU2-8.3: WaveNetEQ — Packet Loss Concealment with WaveRNN .....	672
<i>Florian Stimberg, DeepMind, United Kingdom; Alex Narest, Alessio Bazzica, Lennart Kolmodin, Pablo Barrera González, Olga Sharonova, Henrik Lundin, Google, Sweden; Thomas C. Walters, DeepMind, Sweden</i>	
<b>TU3-1: Coding</b>	
TU3-1.1: A Novel Systematic Representation of Reed-Muller Codes with an Application to Linear Block Feedback Encoding .....	677
<i>Vinayak Suresh, David Love, Purdue University, United States</i>	
TU3-1.2: Iterative Detection and Decoding of Finite-Length Polar Codes in Gaussian Multiple Access Channels .....	683
<i>Moustafa Ebada, Sebastian Cammerer, Ahmed Elkelesh, Marvin Geiselhart, Stephan ten Brink, Stuttgart University, Germany</i>	
TU3-1.3: A Learning-Based Approach to Address Complexity-Reliability Tradeoff in OS Decoders .....	689
<i>Baptiste Cavarec, Hasan Basri Celebi, Mats Bengtsson, Mikael Skoglund, KTH, Royal Institute of Technology, Sweden</i>	
TU3-1.4: Joint Source-Channel Rate-Distortion Optimization for Wireless Video Transmission .....	693
<i>Rana Hegazy, University of California San Diego, United States; Qing Song, Dolby labs, United States; Arash Vosoughi, LG Electronics Mobile Research Lab, United States; Pamela Cosman, Laurence Milstein, University of California San Diego, United States</i>	
TU3-1.5: Comparison of Integrated and Independent RF/FSO Transceivers on a Fading Optical Channel .....	699
<i>Jonathan Nguyen, Ethan Liang, Linfang Wang, Richard Wesel, UCLA, United States; Todd Drullinger, Todd Chauvin, SA Photonics, United States</i>	
<b>TU3-2: Large Reconfigurable Intelligent Surfaces for Future Wireless Communications</b>	
TU3-2.1: Holographic MIMO Communications Under Spatially-Stationary Scattering .....	702
<i>Andrea Pizzo, Thomas L. Marzetta, New York University, United States; Luca Sanguinetti, University of Pisa, Italy</i>	
TU3-2.3: Deep Learning-based Phase Reconfiguration for Intelligent Reflecting Surfaces .....	707
<i>Özgecan Özdoğan, Emil Björnson, Linköping University, Sweden</i>	

TU3-2.4: Generalized Polarization–Space Modulation in Reconfigurable Intelligent Surfaces .....	712
<i>John Hodge, Virginia Tech, United States; Kumar Vijay Mishra, Quang M. Nguyen, U.S. CCDC Army Research Lab, United States; Amir Zaghloul, U.S. CCDC Army Research Lab and Virginia Tech, United States</i>	
TU3-2.5: Secure Transmission in IRS-Assisted MIMO Systems with Active Eavesdroppers.....	718
<i>Ali Bereyhi, Saba Asaad, Ralf R. Müller, Friedrich–Alexander Universität Erlangen–Nürnberg, Germany; Rafael F. Schaefer, Technische Universität Berlin, Germany; H. Vincent Poor, Princeton University, United States</i>	
<b>TU3-3: Graph Signal Processing</b>	
TU3-3.1: Unveiling Anomalous Edges and Nominal Connectivity of Attributed Networks .....	726
<i>Konstantinos D. Polyzos, Costas Mavromatis, Vassilis N. Ioannidis, Georgios B. Giannakis, University of Minnesota, United States</i>	
TU3-3.2: Clustering in Partially Labeled Stochastic Block Models via Total Variation .....	731
Minimization <i>Alexander Jung, Aalto University, Finland</i>	
TU3-3.3: RATIONAL CHEBYSHEV GRAPH FILTERS .....	736
<i>Oxana Rimleascaia, University of Perugia, Italy; Elvin Isufi, Delft University of Technology, Netherlands</i>	
TU3-3.4: Learning Undirected Graphs in Financial Markets.....	741
<i>José Vinícius de Miranda Cardoso, Daniel Palomar, The Hong Kong University of Science and Technology, Hong Kong SAR of China</i>	
TU3-3.5: Edge Entropy as an Indicator of the Effectiveness of GNNs over CNNs for Node .....	746
Classification <i>Lavender Yao Jiang, John Shi, Mark Cheung, Oren Wright, José M. F. Moura, Carnegie Mellon University, United States</i>	
<b>TU3-4: Machine Learning in Communications</b>	
TU3-4.1: Strategic Remote Estimation.....	751
<i>Griffin Rule, NYU, United States; Emrah Akyol, Binghamton University, United States</i>	
TU3-4.2: Kernel Recursive Least Squares Based Cancellation of Second–Order .....	758
Intermodulation Distortion <i>Christina Auer, Thomas Paireder, Oliver Lang, Mario Huemer, Johannes Kepler University Linz, Austria</i>	
TU3-4.3: How to Make 5G Communications “Invisible”: Adversarial Machine Learning for .....	763
Wireless Privacy <i>Brian Kim, University of Maryland, United States; Yalin E. Sagduyu, Kemal Davaslioglu, Tugba Erpek, Intelligent Automation, Inc., United States; Sennur Ulukus, University of Maryland, United States</i>	
TU3-4.4: DNN-based Sum–Rate Maximization of Multicell MISO Networks.....	768
<i>Youjin Kim, Jonggyu Jang, Hyun Jong Yang, Ulsan National Institute of Science and Technology, Republic of Korea</i>	
<b>TU3-5: Robust Multi–Sensor Signal Processing: Challenges and Perspectives</b>	
TU3-5.1: Robust Registration of Multi–modal Medical Images Using Huber’s Criterion.....	773
<i>Nora Ouzir, Esa Ollila, Sergiy Vorobyov, Aalto University, Finland</i>	
TU3-5.2: A Mismatched Bound for Stochastic DOA Estimation.....	778
<i>Gerald LaMountain, Pau Closas, Northeastern University, United States</i>	
TU3-5.3: Linearly Constrained EKF for Non Linear Estimation Applied to Three–Wheeled .....	784
Vehicles <i>Emir Hrustic, Rayen Rayen Ben Abdallah, Damien Vivet, Eric Chaumette, Isae Supaero, France</i>	
TU3-5.5: Bounds on Bearing, Symbol, and Channel Estimation Under Model .....	791
Misspecification <i>Akshay Bondre, Touseef Ali, Christ Richmond, Arizona State University, United States</i>	

### **TU3-6: Neuroengineering and Neural Signal Processing**

TU3-6.1: On the Spatio-Temporo-Rhythmic Mapping of the Task-Associated Brain Functional Networks .....	797
<i>Ali Haddad, Laleh Najafizadeh, Rutgers University, United States</i>	
TU3-6.2: Exact Characterization of Phase Locking in a Linear Recurrent Spiking Neural Network .....	802
<i>Fatemeh Koohestanmahalian, Neil E. Cotter, University of Utah, United States</i>	
TU3-6.3: Machine Learning Enabled Adaptive Wireless Power Transmission System for Neuroscience Study .....	808
<i>Hyun-Myung Woo, Woo Seok Kim, Sungcheol Hong, Texas A&amp;M University, United States; Vivekanand Jeevakumar, Clay M. Smithhart, Theodore J. Price, University of Texas at Dallas, United States; Byung-Jun Yoon, Sung Il Park, Texas A&amp;M University, United States</i>	
TU3-6.4: Non-invasive Deep Brain Stimulation using Electromagnetic Waves.....	813
<i>Fatima Ahsan, Taiyun Chi, Rice University, United States; Raymond Cho, Sameer Anil Sheth, Wayne Goodman, Baylor College of Medicine, United States; Behnaam Aazhang, Rice University, United States</i>	
TU3-6.5: An end-to-end spike-based image compression architecture .....	818
<i>Effrosyni Doutsis, Foundation for Research and Technology - Hellas, Greece; Marc Antonini, Université Côte d'Azur, France; Panagiotis Tsakalides, Foundation for Research and Technology - Hellas, University of Crete, Greece</i>	

### **TU3-7: Massive MIMO: Cell-Free and Beyond**

TU3-7.1: Cell-free Massive MIMO with multi-antenna access points and user terminals.....	821
<i>Alister Burr, Shammi Islam, Junbo Zhao, University of York, United Kingdom; Manijeh Bashar, University of Surrey, United Kingdom</i>	
TU3-7.2: User Association in Scalable Cell-Free Massive MIMO Systems .....	826
<i>Carmen D'Andrea, University of Cassino and Southern Latium, Italy; Erik G. Larsson, University of Linköping, Sweden</i>	
TU3-7.3: Design of Pilots and Power Control in the Cell-Free Massive MIMO Uplink .....	831
<i>Trang C. Mai, Hien Quoc Ngo, Queen's University Belfast, United Kingdom; Le-Nam Tran, University College Dublin, Ireland</i>	
TU3-7.5: Co-Located vs Distributed vs Semi-Distributed MIMO: Measurement-Based Evaluation .....	836
<i>Thomas Choi, Peng Luo, Akshay Ramesh, Andreas Molisch, University of Southern California, United States</i>	

### **TU3-8: Image and Video Processing and Modeling**

TU3-8.1: Accurate Tensor Decomposition with Simultaneous Rank Approximation for Surveillance Videos .....	842
<i>Ramin Goudarzi Karim, Stillman College, United States; Guimu Guo, Da Yan, Carmeliza Navasca, University of Alabama at Birmingham, United States</i>	
TU3-8.2: TARA: Tracking with Aspect Ratio Adaptability .....	847
<i>Haoyi Ma, Scott Acton, Zongli Lin, University of Virginia, United States</i>	
TU3-8.3: Superresolution-Enabled Video CODEC.....	852
<i>James Glenn-Anderson, Mathematical Systems Theory Research Institute, United States</i>	
TU3-8.4: How the Discrete Hirschman Transform Inherits its Eigenstructure from the DFT .....	858
<i>Rajesh Thomas, Victor DeBrunner, Linda DeBrunner, Florida State University, United States</i>	
TU3-8.5: On-Chip Optical and Analog Processing in 180nm CMOS for Holography .....	863
<i>Mel White, Cornell University, United States; Vivek Boominathan, Ashok Veeraraghavan, Rice University, United States; Alyosha Molnar, Cornell University, United States</i>	

### **WE1-1: 5G and Beyond I**

WE1-1.1: Wideband Active Analog Self-Interference Cancellation for 5G and Beyond Full-Duplex Systems .....	868
<i>Haifeng Luo, The University of Edinburgh, United Kingdom; Mark Holm, Huawei Technologies {Sweden} Co., Ltd., Sweden; Tharmalingam Ratnarajah, The University of Edinburgh, United Kingdom</i>	

WE1-1.2: Offloading Hard-Deadline Constrained Traffic in Multi-Flow Interference-Aware Cellular Systems .....	873
<i>Ahmed Ewaisha, Cihan Tepedelenlioglu, Arizona State University, United States</i>	
WE1-1.3: Scheduling Cooperative IoT Devices in High-Dense Cellular Systems with QoS Guarantees .....	878
<i>Ahmed Ewaisha, Arizona State University, United States</i>	
WE1-1.4: On the Set of Joint Rayleigh Fading Distributions Achieving Positive Zero-Outage Capacities .....	882
<i>Karl-Ludwig Besser, Pin-Hsun Lin, Eduard A. Jorswieck, Technische Universität Braunschweig, Germany</i>	
<b>WE1-2: Signal Processing for Simultaneous Transmit-Receive Systems</b>	
WE1-2.1: Improving Digital Interference Cancellation in LTE-A/5G-Transceivers by Statistical Modeling .....	887
<i>Christian Motz, Thomas Paireder, Mario Huemer, Johannes Kepler University, Austria</i>	
WE1-2.2: Beamforming and Waveform Optimization for OFDM-based Joint Communications and Sensing at mm-Waves .....	895
<i>Carlos Baquero Barnero, Sahar Damith Liyanaarachchi, Taneli Riihonen, Mikko Heino, Lauri Anttila, Mikko Valkama, Tampere University, Finland</i>	
WE1-2.3: Full-Duplex Self Cancellation Techniques Using Independent Component Analysis.....	900
<i>Hsi-Hung Lu, National Taiwan University of Science and Technology, Taiwan; Mohammed Fouda, University of California, Irvine, United States; Chung-An Shen, National Taiwan University of Science and Technology, Taiwan; Ahmed Eltawil, King Abdullah University of Science and Technology, Saudi Arabia</i>	
WE1-2.4: Non-Linear Self-Interference Cancellation via Tensor Completion .....	905
<i>Freek Jochems, Alexios Balatsoukas-Stimming, Eindhoven University of Technology, Netherlands</i>	
<b>WE1-3: Decentralized Optimization</b>	
WE1-3.3: Exploring the Error-Runtime Trade-off in Decentralized Optimization .....	910
<i>Jianyu Wang, Carnegie Mellon University, United States; Anit Kumar Sahu, Bosch Center for Artificial Intelligence, United States; Gauri Joshi, Soumya Kar, Carnegie Mellon University, United States</i>	
WE1-3.4: SECOND-ORDER GUARANTEES IN FEDERATED LEARNING.....	915
<i>Stefan Vlaski, Elsa Rizk, Ali Sayed, EPFL, Switzerland</i>	
<b>WE1-4: Sparsity for Nonlinear Inverse Problems</b>	
<b>WE1-5: Learning-based Multichannel Signal Processing</b>	
WE1-5.1: Quantized Higher-Order Tensor Recovery by Exploring Low-Dimensional Structures .....	923
<i>Ren Wang, Meng Wang, Rensselaer Polytechnic Institute, United States; Jinjun Xiong, IBM Thomas J. Watson Research Center, United States</i>	
WE1-5.2: Convolutional Beamspace and Sparse Signal Recovery for Linear Arrays.....	929
<i>Po-Chih Chen, P. P. Vaidyanathan, Caltech, United States</i>	
WE1-5.3: Data Fusion for Multipath-Based SLAM.....	934
<i>Erik Leitinger, TU Graz, Austria; Florian Meyer, University of California San Diego, United States</i>	
WE1-5.4: L1-Norm RESCAL Decomposition .....	940
<i>Yorgos Tsitsikas, University of California, Riverside, United States; Dimitris G. Chachlakis, Rochester Institute of Technology, United States; Evangelos E. Papalexakis, University of California, Riverside, United States; Panos P. Markopoulos, Rochester Institute of Technology, United States</i>	

<b>WE1-6: Machine Learning for Physiological Signal Processing</b>	
WE1-6.1: Photoplethysmography-Based Blood Pressure Estimation Using Deep Learning.....	945
<i>Weinan Wang, Li Zhu, Rutgers University, United States; Fatemeh Marefat, Pedram Mohseni, Kevin Kilgore, Case Western Reserve University, United States; Laleh Najafizadeh, Rutgers University, United States</i>	
WE1-6.2: A Graph-Constrained Change-Point Learning Approach for Automatic QRS-Complex Detection .....	950
<i>Atiyeh Fotoohinasab, Toby Hocking, Fatemeh Afghah, Northern Arizona University, United States</i>	
WE1-6.3: Respiration and Cardiac Activity Sensing Using 3-D Cameras .....	955
<i>Yu Rong, Sharanya Srinivas, Huiwen Chu, Hanguang Yu, Kailing Liu, Daniel Bliss, Arizona State University, United States</i>	
WE1-6.4: An Uncertainty Estimation Framework for Risk Assessment in Deep Learning-based AFib Classification .....	960
<i>James Belen, Sajad Mousavi, Alireza Shamsoshoara, Fatemeh Afghah, Northern Arizona University, United States</i>	
<b>WE1-7: Algorithm-Architecture Co-Design for Energy Efficient (Beyond) 5G Systems</b>	
WE1-7.1: Energy-Efficient Precoding Architecture for Multi-User MIMO Systems.....	965
<i>Seungsik Moon, Deokhwan Hwan, Namyoon Lee, Youngjoo Lee, Pohang University of Science and Technology, Republic of Korea</i>	
WE1-7.2: On the Implementation Complexity of Digital Full-Duplex Self-Interference Cancellation .....	969
<i>Andreas Toftegaard Kristensen, École polytechnique fédérale de Lausanne, Switzerland; Alexios Balatsoukas-Stimming, Eindhoven University of Technology, Netherlands; Andreas Burg, École polytechnique fédérale de Lausanne, Switzerland</i>	
WE1-7.3: Handling PA nonlinearity in massive MIMO: What are the tradeoffs between system capacity and power consumption .....	974
<i>Sidra Muneer, Liang Liu, Ove Edfors, Henrik Sjöland, Lund University, Sweden; Liesbet Van der Perre, KU Leuven, Belgium</i>	
WE1-7.4: LSTM Network-Assisted Belief Propagation Flip Polar Decoder.....	979
<i>Yutai Sun, Yifei Shen, Southeast University, China; Wenqing Song, Nanjing University, China; Zihao Gong, Zaichen Zhang, Xiaohu You, Chuan Zhang, Southeast University, China</i>	
<b>WE1-8: Rate-Splitting and Robust Interference Management</b>	
WE1-8.1: Interference Mitigation for Cooperative MIMO Channels with Asymmetric Feedback .....	984
<i>Lorenzo Miretti, David Gesbert, EURECOM, France</i>	
WE1-8.2: Dirty Paper Coded Rate-Splitting for Non-Orthogonal Unicast and Multicast Transmission with Partial CSIT .....	990
<i>Yijie Mao, Bruno Clerckx, Imperial College London, United Kingdom</i>	
WE1-8.3: Coordinated Rate Splitting Multiple Access for Multi-Cell Downlink Networks .....	996
<i>Nohgyeom Ha, Wonjae Shin, Pusan National University, Republic of Korea; Mojtaba Vaezi, Villanova University, United States; H. Vincent Poor, Princeton University, United States</i>	
<b>WE2-1: 5G and Beyond II</b>	
WE2-1.1: Statistical Slice Selection in Multi-Tenant Networks with Maximum Isolation of Reserved Resources .....	1002
<i>Navid Reyhanian, University of Minnesota, Twin Cities, United States; Behrouz Maham, Nazarbayev University, Kazakhstan</i>	
WE2-1.2: Radio Weaves for Extreme Spatial Multiplexing in Indoor Environments .....	1007
<i>Unnikrishnan Kunnath Ganesan, Emil Björnson, Erik G. Larsson, Linköping University, Sweden</i>	
WE2-1.3: NR V2X: Technologies, Performance, and Standardization .....	1012
<i>Jie Chen, Jun Tan, Nokia, United States</i>	
WE2-1.4: Waveform Optimization for Near-Field Wireless Powered Communication Using a Coil Array .....	1017
<i>Tomohiro Arakawa, James Krogmeier, David Love, Purdue University, United States</i>	

<b>WE2-2: Signal Processing Algorithms and Hardware for Massive MIMO</b>	
WE2-2.1: Reciprocity Aided CSI Feedback for Massive MIMO .....	1022
<i>Emma Becirovic, Emil Björnson, Erik G. Larsson, Linköping University, Sweden</i>	
WE2-2.2: Reinforcement Learning based Per-antenna Discrete Power Control for Massive MIMO Systems .....	1028
<i>Navneet Garg, Tharmalingam Ratnarajah, The University of Edinburgh, United Kingdom</i>	
WE2-2.3: A Novel Approach for Combining Local Estimates for Fully Decentralized Feedforward Massive MIMO Equalization: The Multistep Fusion .....	1033
<i>Pascal Seidel, Ludwig Karsthof, Steffen Paul, University of Bremen, Germany</i>	
WE2-2.4: Hardware Architecture of a Decentralized Massive MIMO Equalizer based on Gauss-Seidel Detection .....	1037
<i>Ludwig Karsthof, Pascal Seidel, Raik Milautzki, Universität Bremen, Germany; Jochen Rust, DSI Aerospace Technologie GmbH, Germany; Steffen Paul, Universität Bremen, Germany</i>	
<b>WE2-3: Wireless Networks I</b>	
WE2-3.1: Scaling Laws of Dense Multi-Antenna Cellular Networks.....	1041
<i>Ahmad AlAmmouri, Jeffrey Andrews, Francois Baccelli, The University of Texas at Austin, United States</i>	
WE2-3.2: Decentralized Coded Caching For Interference Networks.....	1046
<i>Navneet Garg, Tharmalingam Ratnarajah, The University of Edinburgh, United Kingdom</i>	
WE2-3.3: 6DOF Virtual Reality Dataset and Performance Evaluation of Millimeter Wave vs. Free-Space-Optical Indoor Communications Systems for Lifelike Mobile VR Streaming .....	1051
<i>Jacob Chakareski, Mahmudur Khan, New Jersey Institute of Technology, United States; Tanguy Ropitault, Steve Blandino, National Institute of Standards, United States</i>	
WE2-3.4: Rate Allocation in Massive Multiple Access Combining Successive Decoding with Error Control .....	1059
<i>Francesc Molina, Josep Sala-Álvarez, Universitat Politècnica de Catalunya, Spain</i>	
<b>WE2-4: Distributed Coding and Optimization</b>	
WE2-4.1: Robust Class Parallelism - Error Resilient Parallel Inference with Low Communication Cost .....	1064
<i>Yaoqing Yang, Jichan Chung, Guanhua Wang, Vipul Gupta, Adarsh Karnati, Kenan Jiang, Ion Stoica, Joseph Gonzalez, Kannan Ramchandran, UC Berkeley, United States</i>	
WE2-4.3: Bandit-based Communication-Efficient Client Selection Strategies for Federated Learning .....	1066
<i>Yae Jee Cho, Gauri Joshi, Carnegie Mellon University, United States</i>	
<b>WE2-5: Parametric MIMO Channel Estimation</b>	
WE2-5.1: Analysis of multipath channel delay estimation using subspace fitting.....	1070
<i>Tarik Kazaz, Jac Romme, Gerard Janssen, Alle-Jan van der Veen, Delft University of Technology, Netherlands</i>	
WE2-5.2: Two-Layer J-Best Selection / Maximal-Ratio Combining in Rayleigh Fading .....	1075
<i>Sebastien Roy, Université de Sherbrooke, Canada</i>	
WE2-5.3: Detection and Tracking of Multipath Channel Parameters Using Belief Propagation .....	1083
<i>Xuhong Li, Lund University, Sweden; Erik Leitinger, Graz University of Technology, Austria; Fredrik Tufvesson, Lund University, Sweden</i>	
WE2-5.4: Detection and Estimation of a Spectral Line in MIMO Systems.....	1090
<i>Erik Leitinger, Stefan Grebien, Graz University of Technology, Austria; Bernard Fleury, Aalborg University, Denmark; Klaus Witrisal, Graz University of Technology, Austria</i>	

## **WE2-6: From Neural Networks to Neural Systems: Using AI to Decode the Brain in Health and Disease**

### **WE2-7: Low Power and Wide Area: Implementations That Make It Happen**

- WE2-7.1: Internet of Bouys: An Internet of Things implementation at sea..... 1096  
*Michiel Sandra, KU Leuven, Belgium; Sara Gunnarsson, Anders J Johansson, Lund University, Sweden*
- WE2-7.2: Massive MIMO goes Sub-GHz: Implementation and Experimental Exploration for ..... 1101  
LPWANs  
*Gilles Callebaut, KU Leuven, Belgium; Sara Gunnarsson, Lund University and KU Leuven, Sweden; Fredrik Tufvesson, Lund University, Sweden; Andrea P. Guevara, Sofie Pollin, Liesbet Van der Perre, KU Leuven, Belgium; Anders J. Johansson, Lund University, Sweden*
- WE2-7.3: A Maximum-Likelihood-based Multi-User LoRa Receiver Implemented in GNU ..... 1106  
Radio  
*Orion Afisiadis, École polytechnique fédérale de Lausanne (EPFL), Switzerland; Mathieu Xhonneux, UCLouvain, Belgium; Joachim Tapparel, Sitian Li, École polytechnique fédérale de Lausanne (EPFL), Switzerland; Alexios Balatsoukas-Stimming, Eindhoven University of Technology (TU/e), Netherlands; Andreas Burg, École polytechnique fédérale de Lausanne (EPFL), Switzerland*
- WE2-7.4: An Architecture for Grant-Free Random Access Massive Machine Type ..... 1112  
Communication Using Coordinate Descent  
*Mikael Henriksson, Oscar Gustafsson, Unnikrishnan Kunnath Ganesan, Erik G. Larsson, Linköping University, Sweden*

### **WE2-8: Advances in Visual Data Compression and Communication**

- WE2-8.1: Activation Map Saliency Guided Filtering for Efficient Image Compression for ..... 1117  
Vision Tasks  
*Yixin Mei, Fan Li, Xi'an Jiaotong University, China; Li Li, Zhu Li, University of Missouri-Kansas City, United States*
- WE2-8.2: A LIGHTWEIGHT MODEL FOR DEEP FRAME PREDICTION IN ..... 1122  
VIDEO CODING  
*Hyomin Choi, Ivan Bajic, Simon Fraser University, Canada*
- WE2-8.3: Transform Domain Temporal Prediction and Geodesic Motion Compensation in ..... 1127  
Spherical Video Coding  
*Kruthika Koratti Sivakumar, Bharath Vishwanath, Kenneth Rose, University of California Santa Barbara, United States*
- WE2-8.4: IN-CAMERA RAW COMPRESSION: A NEW PARADIGM FROM ..... 1132  
IMAGE ACQUISITION TO DISPLAY  
*Zhihao Li, Haojie Liu, Nanjing University, China; Lin Yang, Gyrfalcon Technology Inc., United States; Zhan Ma, Nanjing University, China*

### **WE3-1: Spectrum**

- WE3-1.1: Asynchronous Successive Interference Cancellation for 5G Receiver Operating in ..... 1137  
Shared Spectrum with Different Radio System  
*Issei Kanno, Ryochi Kataoka, KDDI Research Inc., Japan; Toshinori Suzuki, KDDI Research Inc. / Tohoku Gakuin University, Japan; Hiroyasu Ishikawa, KDDI Research Inc. / Nihon University, Japan; Kosuke Yamazaki, Yoji Kishi, KDDI Research Inc., Japan*
- WE3-1.3: Cell Association via Boundary Detection: A Scalable Approach Based on ..... 1142  
Data-Driven Random Features  
*Yinsong Wang, Texas A&M University, United States; Hessam Mahdaviifar, University of Michigan, United States; Kamran Entesari, Shahin Shahrapour, Texas A&M University, United States*
- WE3-1.4: A Tensor-Based Approach to Massive Random Access ..... 1147  
*Alexis Decurninge, Ingmar Land, Maxime Guillaud, Huawei Technologies France, France*
- WE3-1.5: Energy- vs Spectral-Efficiency for Energy-Harvesting Hybrid RF/VLC ..... 1152  
Networks  
*Yavuz Yapici, Ismail Guvenc, North Carolina State University, United States*

<b>WE3-2: Massive MIMO Radar</b>	
WE3-2.1: Limits of Transmit Beamforming for Massive MIMO Radar .....	1157
<i>Arindam Bose, Ahsan Ghauri, Mojtaba Soltanalian, University of Illinois at Chicago, United States</i>	
WE3-2.3: Constrained Maximum Likelihood Channel Estimation for CoFAR .....	1162
<i>Bosung Kang, University of Dayton, United States; Sandeep Gogineni, Information Systems Laboratories, Inc., United States; Muralidhar Rangaswamy, Air Force Research Laboratory, United States; Joseph Guerci, Information Systems Laboratories, Inc., United States</i>	
WE3-2.4: Multi-Frequency Sparse Array-Based Massive MIMO Radar for Autonomous .....	1167
Driving <i>Shunqiao Sun, University of Alabama, United States; Yimin Zhang, Temple University, United States</i>	
WE3-2.5: Multifunctionality In Radar: A Massive MIMO Radar Paradigm .....	1172
<i>Pawan Setlur, Adam Rose, Philip Chorman, Riverside Research, United States</i>	
<b>WE3-3: Wireless Networks II</b>	
WE3-3.1: An Energy-Efficient Event-Based MIMO Communication Scheme for UAV .....	1178
Formation Control <i>Yasemin Karacora, Aydin Sezgin, Ruhr University Bochum, Germany</i>	
WE3-3.2: Stochastic Geometry for Sensing Environmental Processes with a known .....	1183
Spatio-Temporal Profile <i>Abhishek Gupta, Kaushledra Pandey, Indian Institute of Technology Kanpur, India; Harpreet S. Dhillon, Virginia Tech, United States</i>	
WE3-3.3: Optimal Scheduling of Multiple Spatio-temporally Dependent Observations using .....	1188
Age-of-Information <i>Victor Watten Håkansson, Naveen K. D. Venkategowda, Stefan Werner, Norwegian University of Science and Technology, Norway</i>	
WE3-3.4: Rate Coverage of a Cellular Network with Users Distributed as Poisson Cluster .....	1193
Process <i>Chiranjib Saha, Praful Mankar, Harpreet S. Dhillon, Virginia Tech, United States</i>	
WE3-3.5: Model-Assisted Deep Reinforcement Learning for Dynamic Wireless Scheduling .....	1200
<i>Arjun Anand, Ravikumar Balakrishnan, V. Srinivasa Somayazulu, Rath Vannithamby, Intel Labs, United States</i>	
<b>WE3-4: Theory of Machine Learning</b>	
WE3-4.1: Learning Kolmogorov Models for Binary Random Variables .....	1204
<i>Hadi Ghauch, Telecom Paris, France; Hossein Shokri Ghadikolaei, Mikael Skoglund, Carlo Fischione, Royal Institute for Technology, KTH, Sweden</i>	
WE3-4.2: Successive Information Bottleneck and Applications in Deep Learning .....	1210
<i>Yassine Yousfi, Emrah Akyol, Binghamton University-SUNY, United States</i>	
WE3-4.3: Separating the Effects of Batch Normalization on CNN Training Speed and .....	1214
Stability Using Classical Adaptive Filter Theory <i>Elaina Chai, Mert Pilanci, Boris Murmann, Stanford University, United States</i>	
WE3-4.4: Global Convergence of Newton Method for Empirical Risk Minimization in .....	1222
Reproducing Kernel Hilbert Space <i>Ting-Jui Chang, Shahin Shahrapour, Texas A&amp;M University, United States</i>	
WE3-4.5: Knowing When to Stop: Joint Heterogeneous Feature Selection and Classification .....	1227
<i>Imara Nazar, Daphney-Stavroura Zois, Charalampos Chelmiss, University at Albany, SUNY, United States</i>	
<b>WE3-5: DOA Estimation and Source Localization</b>	
WE3-5.1: QR decomposition and Parallel Factor-based Model for Two-Dimensional .....	1232
Direction of Arrival Angle Estimation <i>Nizar Tayem, Texas A &amp; M University, United States</i>	
WE3-5.2: Colored Noise in DOA Estimation from Seismic Data: an Empirical Study.....	1240
<i>Neta Zimmerman, Jonathan D. Rosenblatt, Tirza Routtenberg, Ben-Gurion University of the Negev, Israel</i>	

WE3-5.3: On the Mutual Coupling Matrix in Array Signal Processing.....	1245
<i>Benjamin Friedlander, University of California, Santa Cruz, United States</i>	
WE3-5.4: 3-D MUSIC Spectrum Reconstruction for Joint Azimuth-Elevation-Frequency ..... Band Estimation	1250
<i>Hasbi Nur Prasetyo Wisudawan, Universitas Gadjah Mada and Universitas Islam Indonesia, Indonesia; Dyonisius Dony Ariananda, Risanuri Hidayat, Universitas Gadjah Mada, Indonesia</i>	
WE3-5.5: On the Cramer-Rao Bound for Sparse Linear Arrays .....	1255
<i>Benjamin Friedlander, University of California, Santa Cruz, United States</i>	
<b>WE3-6: In-Band Full Duplex Communications for Future Wireless Systems</b>	
WE3-6.1: In-Band, Full-Duplex Self-Interference Mitigation Using Sparse Tap-Delay ..... Models with Quantized and Power Constrained Weights	1260
<i>Andrew Herschfelt, Alex Chiriyath, Arizona State University, United States; Alyosha Christopher Molnar, Cornell University, United States; David G. Landon, L3Harris, United States; Daniel W. Bliss, Arizona State University, United States</i>	
WE3-6.3: Adaptive Cancellation of Nonlinear Self-Interference in Wireless Full-Duplex: ..... Cascaded Spline-Interpolated Methods	1265
<i>Pablo Pascual Campo, Lauri Anttila, Tampere University, Finland; Dani Korpi, Nokia Bell Labs, Finland; Mikko Valkama, Tampere University, Finland</i>	
WE3-6.4: On the Performance of Power Splitting-Based SWIPT in Self-Energy Recycling ..... Full-Duplex Relaying Networks	1272
<i>Isabella Wanderley Gomes da Silva, Federal University of São Carlos, Brazil; Diana Pamela Moya Osorio, University of Oulu, Finland; Edgar Eduardo Benitez Olivo, São Paulo State University, Brazil; Onel Luis Alcaraz López, Hirley Alves, Matti Latva-aho, University of Oulu, Finland</i>	
WE3-6.5: Simultaneous Data Communication and Channel Estimation in Multi-user Full ..... Duplex MIMO Systems	1277
<i>Md Atiqul Islam, University of Illinois at Chicago, United States; George C. Alexandropoulos, National and Kapodistrian University of Athens, Greece; Bisma Smida, University of Illinois at Chicago, United States</i>	
<b>WE3-7: Arithmetic, Algorithms, and Practicalities</b>	
WE3-7.1: Towards the Basic Linear Algebra Unit.....	1283
<i>Nicolas BRUNIE, Kalray, France</i>	
WE3-7.2: How the Sampling Rate Impacts Wordlength Selection for FIR Filter ..... Implementations	1291
<i>Victor DeBrunner, Linda S. DeBrunner, Florida State University, United States</i>	
WE3-7.3: HARDWARE IMPLEMENTATION OF FIXED-POINT DECODER ..... FOR LOW-DENSITY LATTICE CODES	1295
<i>Rachna Srivastava, Vincent C Gaudet, Patrick Mitran, University of Waterloo, Canada</i>	
WE3-7.4: Phase Unwrapping with Multiple Wavelengths on the Flat Torus .....	1301
<i>Arrigo Benedetti, Microsoft Corp., United States</i>	
<b>WE3-8: Learning from Light: Where Computer Vision and Machine Learning Meets Optics and Imaging</b>	
WE3-8.2: Boosting the Performance of Plug-and-Play Priors via Denoiser Scaling.....	1305
<i>Xiaojian Xu, Jiaming Liu, Yu Sun, Washington University in St. Louis, United States; Brendt Wohlberg, Los Alamos National Laboratory, United States; Ulugbek Kamilov, Washington University in St. Louis, United States</i>	
WE3-8.3: Deep Optics: Learning Cameras and Optical Computing Systems .....	1313
<i>Gordon Wetzstein, Hayato Ikoma, Christopher Metzler, Yifan Peng, Stanford University, United States</i>	
WE3-8.4: Low-budget 3D scanning and material estimation using PyTorch3D.....	1316
<i>Oliver Cossairt, Chia-Kai Yeh, Florian Willomitzer, Marc Walton, Aggelos Katsaggelos, Northwestern University, United States</i>	

## **TH1-1: Matrix Completion Methods for Wireless Systems**

- TH1-1.1: Joint Localization and Channel Estimation for UAV-Assisted Millimeter Wave ..... 1318  
Communications  
*George Alexandropoulos, National and Kapodistrian University of Athens, Greece; Evangelos Vlachos, Athena Research Center, Greece; Besma Smida, University of Illinois at Chicago, United States*
- TH1-1.2: Autoencoder Matrix Completion Based Indoor Localization ..... 1323  
*Iness Ahriz, Michel Terré, Wafa Njima, Le CNAM Paris, France*
- TH1-1.3: Discrete-Aware Matrix Completion via Proximal Gradient ..... 1327  
*Hiroki Iimori, Giuseppe Thadeu Freitas de Abreu, Jacobs University Bremen, Germany; Omid Taghizadeh, Technische Universität Berlin, Germany; Koji Ishibashi, The University of Electro-Communications, Japan*

## **TH1-2: Optimization and Learning**

- TH1-2.1: K-SVD based Periodicity Dictionary Learning ..... 1333  
*Pranav Kulkarni, P. P. Vaidyanathan, Caltech, United States*
- TH1-2.2: Beamforming optimization of wideband MISO systems in the presence of mutual ..... 1338  
coupling  
*Sandy Saab, University of Texas at Austin, United States; Amine Mezghani, University of Manitoba, Canada; Robert W. Heath Jr., University of Texas at Austin, United States*
- TH1-2.3: Situation-Aware Channel Covariance Prediction for Deep Learning Aided Massive ..... 1342  
MIMO Systems  
*Abdelrahman Taha, Ahmed Alkhateeb, Arizona State University, United States*
- TH1-2.4: Robust Transceiver Design for Full-Duplex Decode-and-Forward Relay-Assisted ..... 1347  
MIMO Systems  
*Hossein Esmaeili, Ali Kariminezhad, Aydin Sezgin, Ruhr-university bochum, Germany*

## **TH1-3: Novel Control Algorithms for Smart Grid Applications**

- TH1-3.1: Investigation of Power Quality Issues in Cold Ironed (Shore Connected) Grid ..... 1353  
Connected Electric Ships  
*Syed Rahman, Irfan Khan, Texas A&M University, United States*
- TH1-3.2: Cascaded Solid State Transformer Structure to Power Fast EV Charging Stations ..... 1359  
from Medium Voltage Transmission Lines  
*Syed Rahman, Texas A&M University, United States; Ahmed Imteaj, Florida International University, United States; Irfan Khan, Texas A&M University, United States; M.Hadi Amini, Florida International University, United States*

## **TH1-4: Bayesian Bounds for Stochastic Signal Recovery I**

- TH1-4.4: Bayesian Fisher Information, Shannon Information, and ROC Analysis for ..... 1365  
Classification Tasks  
*Eric Clarkson, University of Arizona, United States*

## **TH1-5: Sparsity-aware learning**

- TH1-5.1: Improved Time-Frequency Representation of Multi-Component FM Signals with ..... 1370  
Compressed Observations  
*Vaishali S. Amin, Yimin D. Zhang, Temple University, United States; Braham Himed, Air Force Research Laboratory, United States*
- TH1-5.2: Posterior Variance Predictions in Sparse Bayesian Learning under Approximate ..... 1375  
Inference Techniques  
*Christo Kurisummoottil Thomas, Dirk Slock, Eurecom, France*
- TH1-5.3: Third-order Cumulants Reconstruction from Compressive Measurements ..... 1380  
*Yanbo Wang, Zhi Tian, George Mason University, United States*
- TH1-5.4: Improved Block-Sparse Recovery Bound Using Cumulative Block Coherence ..... 1385  
*Pouria Saidi, George Atia, Azadeh Vosoughi, University of Central Florida, United States*

## **TH1-6: Image Recovery in Computational Imaging Applications**

TH1-6.1: Model-based Reconstruction for Single Particle Cryo-Electron Microscopy.....	1390
<i>Singanallur Venkatakrishnan, Oak Ridge National Lab, United States; Puneet Juneja, Emory University, United States; Hugh O'Neill, Oak Ridge National Lab, United States</i>	
TH1-6.2: A statistical framework for model-based inverse problems in ultrasound elastography .....	1395
<i>Narges Mohammadi, Marvin M. Dooley, Mujdat Cetin, University of Rochester, United States</i>	
TH1-6.3: Autotuning Plug-and-Play Algorithms for MRI .....	1400
<i>Saurav Shastri, Rizwan Ahmad, Philip Schniter, Ohio State, United States</i>	
TH1-6.4: Momentum-Net for Low-Dose CT Image Reconstruction .....	1405
<i>Siqi Ye, Yong Long, Shanghai Jiao Tong University, China; Il Yong Chun, University of Hawai'i at Manoa, United States</i>	

## **TH1-7: Adaptive Methods I**

TH1-7.1: Decentralized Multitask Recursive Least Squares with Local Linear Constraints.....	1410
<i>Xuanyu Cao, Tamer Basar, University of Illinois at Urbana-Champaign, United States</i>	
TH1-7.2: Adaptive Blind Equalization in Impulsive Noise.....	1415
<i>Shafayat Abrar, Habib University, Pakistan; Azzedine Zerguine, KFUPM, Saudi Arabia; Karim Abed-Meraim, PRISME Lab, France</i>	
TH1-7.3: A $q$ -Noise Constrained Least Mean Square Algorithm .....	1420
<i>Muhammad Omer Bin Saeed, Air University, Pakistan; Azzedine Zerguine, KFUPM, Saudi Arabia</i>	
TH1-7.4: Collision Avoidance by Utilizing Dynamic Road Friction Information.....	1425
<i>Jonas Herzfeld, Sanjiv Thottathodhi, Mats Jonasson, Chalmers University of Technology, Sweden; L. Srikar Muppirisetty, Volvo Cars Corporation, Sweden; Sohini Roychowdhury, Volvo Cars Technology, United States; Jonas Sjöberg, Chalmers University of Technology, Sweden</i>	

## **TH1-8: Modeling and Coding of Speech, Audio, and Acoustics**

TH1-8.1: Output Recursively Adaptive (ORA) Tree Coding of Speech with VAD/CNG .....	1430
<i>Hoontaek Oh, Jerry Gibson, University of California, Santa Barbara, United States</i>	
TH1-8.2: Sparse Framework for Reproduction of NFC-HOA .....	1437
<i>GYANAJYOTI ROUTRAY, RAJESH HEGDE, Indian Institute of Technology (IIT) Kanpur, India</i>	
TH1-8.3: Generating Personal Sound Zones using Directional Loudspeakers .....	1442
<i>Ajay Dagar, Rajesh Hegde, Indian Institute of Technology Kanpur, India</i>	
TH1-8.4: Modeling Ornaments in Carnatic Music Signals via Wavelets.....	1447
<i>Zitha Sasindran, Shayan Garani, Indian Institute of Science, India</i>	

## **TH2-1: Matrix Recovery**

TH2-1.1: An Adaptation for Iterative Structured Matrix Completion.....	1451
<i>Lara Kassab, Henry Adams, Colorado State University, United States; Deanna Needell, University of California, Los Angeles, United States</i>	
TH2-1.2: Nuclear Norm Based Spectrum Estimation for Molecular Dynamic Simulations.....	1457
<i>Shuang Li, Colorado School of Mines, United States; Stephen Becker, University of Colorado, Boulder, United States; Michael Wakin, Colorado School of Mines, United States</i>	
TH2-1.3: LOW-COST ADAPTIVE MAXIMUM ENTROPY COVARIANCE .....	1462
MATRIX RECONSTRUCTION FOR ROBUST BEAMFORMING	
<i>Saeed Mohammadzadeh, Vitor H. Nascimento, University of São Paulo, Brazil; Rodrigo C. de Lamare, CETUC/PUC-Rio, Brazil; Osman Kukrer, Eastern Mediterranean University, Turkey</i>	

## **TH2-3: Deep Learning and Reinforcement Learning**

TH2-3.3: A Dual Approach to Graph CNNs.....	1467
<i>John Shi, Mark Cheung, Wendy Summer, Jose Moura, Carnegie Mellon University, United States</i>	

## TH2-4: Bayesian Bounds for Stochastic Signal Recovery II

- TH2-4.1: On Misspecified Parameter Bounds with Application to Sparse Bayesian Learning.....1472  
*Christ Richmond, Abdulhakim Alhowaish, Arizona State University, United States*
- TH2-4.2: MMSE Bounds Under Kullback-Leibler Divergence Constraints on the Joint .....1477  
Input-Output Distribution  
*Michael Fauss, Alex Dytso, H. Vincent Poor, Princeton University, United States*
- TH2-4.3: Estimating oceanographic properties from ambient noise .....1479  
*John Gebbie, Metron, Inc., United States*

## TH2-5: Machine Learning Algorithms

- TH2-5.1: On Parametric Model Mismatch in Nonlinear EKF Approximations.....1486  
*Homeyra Khaledian, Universitat Politècnica de Catalunya (UPC), Spain; Jordi Vilà-Valls, Eric Chaumette, ISAE-SUPAERO/University of Toulouse, France; Xavier Prats, Universitat Politècnica de Catalunya (UPC), Spain*
- TH2-5.2: Distributed Boosting Classifiers over Noisy Channels .....1491  
*Yongjune Kim, Western Digital Research, United States; Yuval Cassuto, Technion – Israel Institute of Technology, Israel; Lav Varshney, University of Illinois at Urbana-Champaign, United States*
- TH2-5.3: A finite rate of innovation approach for the estimation of a stream of decaying .....1497  
exponentials  
*Benjamin Bejar, Swiss Data Science Center, Switzerland; Gavin Mischler, Johns Hopkins University, United States*
- TH2-5.4: On Human Assisted Decision Making for Machines Using Correlated Observations.....1502  
*Nandan Sriranga, Baocheng Geng, Pramod Varshney, Syracuse University, United States*

## TH2-6: Sequential Methods

- TH2-6.1: Sequential Estimation of Network Cascades .....1507  
*Anirudh Sridhar, H. Vincent Poor, Princeton University, United States*
- TH2-6.2: Maneuvering Target Tracking using the Autoencoder-Interacting Multiple Model .....1512  
Filter  
*Kirby Vedula, Matthew L Weiss, Randy C Paffenroth, Worcester Polytechnic Institute, United States; Joshua R. Uzarski, U.S. Army CCDC-SC, United States; D. Richard Brown III, Worcester Polytechnic Institute, United States*
- TH2-6.3: METRIC-Bayes: Measurements Estimation for Tracking in High Clutter using .....1518  
Bayesian Nonparametrics  
*Bahman Moraffah, Christ Richmond, Raha Moraffah, Antonia Papandreou-Suppappola, Arizona State University, United States*
- TH2-6.4: Transfer Learning with Bayesian Filtering for Object Tracking Under Varying .....1523  
Conditions  
*Omar Alotaibi, Antonia Papandreou-Suppappola, Arizona State University, United States*

## TH2-7: Adaptive Methods II

- TH2-7.1: Graph Diffusion Kernel LMS using Random Fourier Features.....1528  
*Vitor R. M. Elias, Federal University of Rio de Janeiro, Brazil; Vinay C. Gogineni, Norwegian University of Science and Technology, Norway; Wallace A. Martins, University of Luxembourg, Luxembourg; Stefan Werner, Norwegian University of Science and Technology, Norway*
- TH2-7.2: Energy-Efficient Distributed Recursive Least Squares Learning with Coarsely .....1533  
Quantized Signals  
*Alireza Danaee, Rodrigo C. de Lamare, Pontifical Catholic University of Rio de Janeiro, Brazil; Vitor H. Nascimento, University of São Paulo, Brazil*
- TH2-7.3: Diffusion PSO-LMS Adaptation over Networks .....1538  
*Sameer Arastu, Naveed Iqbal, Muhammad Bin Saeed, Azzedine Zerguine, KFUPM, Saudi Arabia*

**TH2-8: Deep Learning Techniques for Detection and Classification in Images and Video**

TH2-8.1: Quadric-based Traffic Sign Landmarks Initialization for Object-oriented .....1542  
EKF-SLAM  
*Emir HRUSTIC, Damien VIVET, ISAE-SUPAERO, France*

TH2-8.2: Pedestrian Detection from Thermal Images Incorporating Saliency Features.....1548  
*Fatih Altay, Senem Velipasalar, Syracuse University, United States*

TH2-8.3: Multi-Class Micro-CT Image Segmentation Using Sparse Regularized Deep .....1553  
Networks  
*Amirsaeed Yazdani, Yung-Chen Sun, Nicholas B. Stephens, Timothy Ryan, Vishal Monga, Pennsylvania State University, United States*

TH2-8.4: Hierarchical Grow Network for Point Cloud Segmentation.....1558  
*Jiajing Chen, Burak Kakillioglu, Senem Velipasalar, Syracuse University, United States*