

# IEEE **GlobalSIP**

## 2016 IEEE Global Conference on Signal and Information Processing

December 7-9, 2016  
Greater Washington, DC, USA

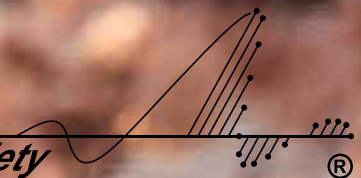
Program Guide



**IEEE**

IEEE

*Signal Processing Society*



# SCHEDULE AT A GLANCE

<b>Tue - Dec. 6</b>				
13:30 - 17:00	Tutorial: Graph Signal Processing: Fundamentals and Applications to Diffusion Processes			Rosslyn I (2 <sup>nd</sup> floor)
<b>Wed - Dec. 7</b>				
	Salon A	Salon B	Salon C	Salon H
08:30 - 09:30	PLEN-1: Ben Vigoda - Deep Bayesian Program Learning			Salon ABC
10:00 - 11:00	RMN-K1: Angelia Nedic - Distributed Hypothesis Testing on Graphs	ITSP-K1: H. Vincent Poor - Secure Broadcasting with Independent Secret Keys	SGI-K1: Georgios B. Giannakis - Online Learning and Management of Future Cyber-Physical Networks	SPBD-K1: Jelena Kovačević - Sampling on Graphs
11:00 - 12:20	RMN-K2: Pramod Varshney - On Optimization of Sensor Management Policies for Distributed Estimation	ITSP-1: Information Theoretic Approaches to Security and Privacy I	SGI-1: State Estimation	SPBD-1: Signal Processing of Big Data I
12:30 - 14:00	Lunch			Salon 1
14:00 - 17:00	Workshop: WS-MW: Signal Processing for Sensing and Machine Learning			Salon 2
14:00 - 15:40	RMN-1: Distributed Information Processing, Optimization, and Resource Management over Networks I	ITSP-K2: Ashish Khisti - The MIMOME Channel	SGI-2: Measurement-based Smart Grid Analytics	SPBD-2: Signal Processing of Big Data II
		ITSP-2: Information Theoretic Approaches to Security and Privacy II		
16:10 - 17:30	GS-1: General Symposium: Optical and Visible Light Communications		SGI-3: Cyber-physical Attacks and Forensics	SPBD-3: Signal Processing of Big Data III
17:45 - 19:15	Welcome Reception			Grand Foyer
<b>Thur - Dec. 8</b>				
	Salon A	Salon B	Salon C	Salon H
08:30 - 09:30	PLEN-2: Danielle S. Bassett – Network Dynamics and Control in the Human Brain			Salon ABC
10:00 - 12:00	Associate Editors Best Practices Discussion			Rosslyn I (2 <sup>nd</sup> floor)
10:00 - 11:00	BDMI-K1: Dimitri Van De Ville - The Big Neuroimaging Data Extraction: How Advanced Signal Processing Can Unravel the Brain's Functional Organization	SPN-K1: Antonio Ortega - Learning Graphs from Data	DT5G-K1: Robert W. Heath Jr - Signal Processing Challenges in Broadband mmWave	SGI-K2: Joshua Taylor - Power Systems Without Fuel
11:00 - 12:20	BDMI-1: Big Data Analysis and Challenges in Medical Imaging I	SPN-1: Signal and Information Processing Over Networks I	DT5G-K2: Joseph Cavallaro - Algorithms, Architectures, and Testbeds for 5G Wireless Communication Systems DT5G-1: Transceiver Implementations and Architectures	SGI-4: Smart Grid Control
12:30 - 14:00	Lunch			Salon 1
	Ethics for Authors and Volunteers - Things You Should Know Before Submitting Your Next Paper			Rosslyn II (2 <sup>nd</sup> floor)
13:00 - 13:45	PANEL: Perspectives on Machine Learning			Salon 2
14:00 - 15:40	RMN-2: Distributed Information Processing, Optimization, and Resource Management over Networks II	SPN-2: Signal and Information Processing Over Networks II	DT5G-2: Millimeter Wave Technologies	SGI-5: Optimal Power Flow and Power Markets
16:10 - 17:30	BDMI-K2: Tulay Adali - Data-Driven Analysis of Medical Imaging Data: Overview, Challenges, and Prospects	CSDL-5: Compressed Sensing, Deep Learning V	DT5G-3: Cellular 5G Systems	
	BDMI-2: Big Data Analysis and Challenges in Medical Imaging II			
17:30 - 19:00	Young Professionals Event			Salon 2
17:45 - 19:15	Evening Reception			Grand Foyer
<b>Fri - Dec. 9</b>				
	Salon A	Salon B	Salon C	Salon H
08:30 - 09:30	PLEN-3: Stéphane Mallat – High Dimensional Learning with Deep Neural Networks			Salon ABC
10:00 - 11:00	SPN-K2: Alejandro Ribeiro - Statistical Signal Processing on Graphs	DT5G-K3: Thomas L. Marzetta - Massive MIMO: It Really Works!	SSPC-K1: Georgios B. Giannakis - Sparsity and Low Rank for Inference of Cognitive Network States	CCR-K2: Sejong Yoon - Decentralized Probabilistic Learning for Sensor Network
11:00 - 12:20	SPN-3: Signal and Information Processing Over Networks III	DT5G-4: Transceiver Algorithms	SGI-6: Power Line and Smart Grid Communications	CCR-2: Machine Learning for Characterization of Cognitive Communications and Radar II
11:30 - 14:00	Meeting: GlobalSIP to GlobalSIP			Rosslyn I (2 <sup>nd</sup> floor)
12:30 - 14:00	Lunch			Salon 2
14:00 - 15:40	SPN-4: Signal and Information Processing Over Networks IV	DT5G-5: Massive MIMO Systems	SGI-7: Electric Vehicles	CCR-3: Machine Learning for Characterization of Cognitive Communications and Radar III
16:10 - 17:30		DT5G-6: Full Duplex, Transceiver and RF Technologies	<span style="color: orange;">■</span> Plenary Talk <span style="color: lightblue;">■</span> Lecture Session <span style="color: lightgreen;">■</span> Keynote Talk <span style="color: lightblue;">■</span> Poster Session <span style="color: pink;">■</span> Event <span style="color: darkgreen;">■</span> Break	

# SCHEDULE AT A GLANCE

<b>Tue - Dec. 6</b>		
13:30 - 17:00		
<b>Wed - Dec. 7</b>		
Salon J		Salon K
08:30 - 09:30		
10:00 - 11:00	UCD-K1: Nuno Vasconcelos - Understanding Video of Crowded Environments	
11:00 - 12:20	UCD-1: Signal Processing for Understanding Crowd Dynamics I	CSDL-1: Compressed Sensing, Deep Learning I
12:30 - 14:00		
14:00 - 17:00		
14:00 - 15:40	UCD-2: Signal Processing for Understanding Crowd Dynamics II	CSDL-2: Compressed Sensing, Deep Learning II
16:10 - 17:30	CCR-K1: Maria Sabrina Greco - Cognitive Radars: Some Applications	CSDL-3: Compressed Sensing, Deep Learning III
	CCR-1: Machine Learning for Characterization of Cognitive Communications and Radar I	
18:00 - 19:30		
<b>Thur - Dec. 8</b>		
Salon J		Salon K
08:30 - 09:30		
10:00 - 12:00		
10:00 - 11:00	ESP-K1: Behzad Shahraray - Multimedia Signal Processing: From Feature Engineering to Deep Learning	SPBD-K2: Aleksandra Mojsilovic - Data 4 Good
11:00 - 12:20	ESP-1: Emerging Signal Processing Applications I	CSDL-4: Compressed Sensing, Deep Learning IV
12:30 - 14:00		
13:00 - 13:45		
14:00 - 15:40	ESP-K2: Robert Pack - Signals, Information & Systems In Consumer Robot Products	SSPC-1: Sparse Signal Processing for Communications I
	ESP-2: Emerging Signal Processing Applications II	
16:10 - 17:30		SSPC-2: Sparse Signal Processing for Communications II
17:30 - 19:00		
17:45 - 19:15		
<b>Fri - Dec. 9</b>		
Salon J		Salon K
08:30 - 09:30		
10:00 - 11:00	BDMI-K3: Yoram Bresler - Adventures in Learning and Sparse Modeling for Bio-imaging	NCTA-K1: Al Hero - Non-commutativity in Signal Processing
11:00 - 12:20	BDMI-3: Big Data Analysis and Challenges in Medical Imaging III	GS-2: General Symposium: Statistical Signal Processing and Estimation
12:30 - 14:00		
14:00 - 15:40	GS-3: General Symposium: Speech Processing	NCTA-1: Non-Commutative Theory and Applications I
16:10 - 17:30	BDMI-4: Big Data Analysis and Challenges in Medical Imaging IV	NCTA-2: Non-Commutative Theory and Applications II

<b>Poster Sessions</b>	
Salon DEFG	
<b>Wed - Dec. 7</b>	
14:00 - 15:40	
GS-P1: General Symposium Poster: Source Separation and Deconvolution	
16:10 - 17:30	
ITSP-P1: Information Theoretic Approaches to Security and Privacy Poster	
RMN-P1: Distributed Information Processing, Optimization, and Resource Management over Networks Poster	
UCD-P1: Signal Processing for Understanding Crowd Dynamics Poster	
<b>Thu - Dec. 8</b>	
14:00 - 15:40	
CSDL-P1: Compressed Sensing, Deep Learning Poster I	
GS-P2: General Symposium Poster: Signal Decomposition	
16:10 - 17:30	
DT5G-P1: Transceivers and Signal Processing for 5G Wireless Systems	
ESP-P1: Emerging Signal Processing Applications Poster	
GS-P3: General Symposium Poster: Detection and Tracking	
SGI-P1: Storage Management and Demand Response	
SPN-P1: Signal and Information Processing Over Networks Poster I	
<b>Fri - Dec. 9</b>	
14:00 - 15:40	
CSDL-P2: Compressed Sensing, Deep Learning Poster II	
DT5G-P2: Massive MIMO and mmWave	
SSPC-P1: Sparse Signal Processing for Communications Poster I	
16:10 - 17:30	
CSDL-P3: Compressed Sensing, Deep Learning Poster III	
GS-P4: General Symposium Poster: Signal Processing for Communications	
SPN-P2: Signal and Information Processing Over Networks Poster II	

## GENERAL CHAIRS' WELCOME

On behalf of the IEEE Global Conference on Signal and Information Processing (GlobalSIP) Organizing Committee, we would like to cordially welcome you to the Greater Washington DC area. The nation's capital has a rich and vibrant cultural, educational and scientific identity. It is home to many national monuments, museums, art centers, federal agencies, international organizations, professional associations, and fantastic restaurants, attracting a global population. The greater Washington-Baltimore area has a number of research universities, where research excellence and innovative programs in cutting-edge topical areas have been their tradition. In addition, there are a large number of research labs and government contract companies, that have a long-standing practice of employing signal and information processing techniques as part of their core business. Washington DC cordially invites you to share this global spirit of scientific collaboration by participating in GlobalSIP 2016!

The conference venue is Marriott Crystal Gateway at Crystal City, Arlington, Virginia. It allows convenient access to Washington's numerous cultural attractions and fine restaurants from a safe and pedestrian-friendly milieu. Several landmarks are within three metro stops through the Metropolitan Metrorail system, including Capitol Hill, Smithsonian at the National Mall, Pentagon city, Arlington Cemetery, Reagan Airport and Old Town Alexandria.

A flagship conference of the IEEE Signal Processing Society, GlobalSIP is structured around coherent symposia that explore new and emerging developments in the field, while maintaining a format that encourages accessibility to interested researchers and fosters interaction and cross-pollination of ideas. This year, GlobalSIP 2016 will feature a government panel, a tutorial, keynote lectures, oral and poster sessions on signal and information processing, with an emphasis on up-and-coming themes.

It takes a village to organize a conference. Our sincere gratitude goes to our technical program chairs, Phil

Regalia, Brian Mark and Trac Tran for all the heavy lifting in putting together a strong technical program. We are indebted to Joel Goodman, whose leadership led to a unique government panel for this year. We particularly thank our finance chair Jill Nelson for dealing with the various uncertainties in the flowing conference organization. Our two publicity chairs, Piya Pal and Seung-jun Kim, worked enthusiastically to publicize and promote the event at various stages of the conference development. Special mention also goes to Nathalia Peixoto for local arrangements, Kathleen Wage for publication, Kristine Bell as an industrial liaison and Win Mu for the Mathworks workshop. Finally, Billene Cannon and CMS were essential for the smooth operation of GlobalSIP. The entire team deserves our deep appreciation for being so patient with us. We also gratefully acknowledge the financial support from our Bronze Sponsor, the Mathworks, as well as the National Science Foundation and the IEEE Signal Processing Society for offering student travel grants.

We hope that you will not only enjoy the technical and social programs of the conference, but also take advantage of the dynamic location of Washington DC that offers ample opportunities for engaging social and entertainment activities.



**Zhi (Gerry) Tian**  
*George Mason University*



**Brian M. Sadler**  
*Army Research Laboratory*

## TECHNICAL PROGRAM OVERVIEW

Welcome to Washington, DC for the fourth annual IEEE Global Conference on Signal and Information Processing! GlobalSIP has emerged as a flagship IEEE Signal Processing Society conference that targets hot topics and up-and-coming themes in signal and information processing. GlobalSIP is organized differently from other IEEE SPS meetings to encourage new SPS research directions and to foster emerging areas.

GlobalSIP is comprised of symposia selected to span a diverse range of exciting and important topics in signal and information processing. Each symposium listed below was organized separately by independent technical committees. The symposia are tied together through co-location, common timing, shared plenaries, and parallel poster sessions. While Big Data and Machine Learning underscore recent advances throughout the symposia, traditional signal processing themes also figure prominently in the symposia titles:

- Symposium on Compressed Sensing, Deep Learning
- Symposium on Signal and Information Processing Over Networks
- Symposium on Distributed Information Processing, Optimization, and Resource Management over Networks
- Symposium on Transceivers and Signal Processing for 5G Wireless and mm-Wave Systems
- Symposium on Signal and Information Processing for Smart Grid Infrastructures
- Symposium on Information Theoretic Approaches to Security and Privacy
- Symposium on Emerging Signal Processing Applications
- Symposium on Machine Learning for Characterization of Cognitive Communications and Radar
- Symposium on Big Data Analysis and Challenges in Medical Imaging
- Symposium on Signal Processing for Understanding Crowd Dynamics
- Symposium on Signal Processing of Big Data
- Symposium on Non-Commutative Theory and Applications
- Symposium on Sparse Signal Processing for Communications
- General Symposium

In addition, we are proud to host a government panel offering a leadership view of machine learning, thanks to the following technical leaders from the DoD: David Aha, Charles Clancy, Jill Crisman, Tom Rondeau, and Paul Tilghman.

The symposia program committees have done an amazing job of bringing researchers together on these exciting

themes and carefully reviewing submitted papers to ensure a high quality conference. Special thanks go to the symposia organizers: John Apostolopoulos, Selin Aviyente, Necdet Serhat Aybat, Masoumeh Azghani, Umit Batur, Holger Boche, Jani Boutellier, Sang Peter Chin, Nicola Conci, Abdallah Farraj, Nikolaos Gatsis, Mazin Gilbert, Anubha Gupta, Mingyi Hong, Yuan-Hao Huang, Markku Juntti, Vassilis Kekatos, Seung-Jun Kim, Silvija Kokalj-Filipovic, Negar Kiyavash, Deepa Kundur, Qing Ling, Fa-Long Luo, Zhi-Quan Luo, Lucio Marcenaro, Antonio G. Marques, Farokh Marvasti, Gonzalo Mateos, Piya Pal, Mike Polley, H. Vincent Poor, Michael G. Rabbat, Russell Rodrigues, Rafael F. Schaefer, Gaurav Sharma, George Stantchev, Peter Tu, Mikko Valkama, Lav R. Varshney, Namrata Vaswani, Meng Wang, and Patrick Wolfe.

We are especially pleased with the outstanding set of plenary speeches and keynote talks at GlobalSIP. Many of the symposia target new theory, methods and applications. The plenary talks are common to all symposia, offered by three outstanding researchers: Ben Vigoda, Danielle S. Bassett, and Stéphane Mallat. The keynotes will help to introduce the themes of each symposium and have been alternately scheduled between morning and afternoon slots. We would like to thank the keynote speakers for their important contributions to GlobalSIP: Tulay Adali, Yoram Bresler, Joe Cavallaro, Georgios B. Giannakis, Maria Sabrina Greco, Robert W. Heath, Jr., Al Hero, Ashish Khisti, Jelena Kovačević, Thomas L. Marzetta, Aleksandra Mojsilović, Angelia Nedic, Antonio Ortega, Robert Pack, H. Vincent Poor, Alejandro Ribeiro, Behzad Shahraray, Josh Taylor, Dimitri Van De Ville, Pramod K. Varshney, Nuno Vasconcelos, and Sejong Yoon.

Finally we wish to thank all the authors for their efforts. Their papers are the key to the exceptionally high quality of GlobalSIP. We appreciate their participation and look forward to learning about their research. Finally, we express our gratitude to Lance Cotton from Conference Management Services, whose prompt and professional assistance was invaluable in putting together the technical program.



**Phillip Regalia**  
*Catholic University  
of America*



**Brian Mark**  
*George Mason  
University*



**Trac D. Tran**  
*Johns Hopkins  
University*

## CONFERENCE ORGANIZING COMMITTEE

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*George Mason University*

Brian M. Sadler  
*Army Research Laboratory*

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*Catholic University of America*

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*Johns Hopkins University*

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*George Mason University*

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*George Mason University*

### **General Symposium**

Zhi Tian, George Mason University

Brian M. Sadler, Army Research Laboratory

### **Symposium on Compressed Sensing, Deep Learning**

Sang Peter Chin, Boston University and Draper Laboratory

### **Symposium on Signal and Information Processing Over Networks**

Michael G. Rabbat, McGill University

Antonio G. Marques, King Juan Carlos University

Gonzalo Mateos, University of Rochester

### **Symposium on Distributed Information Processing, Optimization, and Resource Management over Networks**

Zhi-Quan Luo, University of Minnesota

### **Symposium on Transceivers and Signal Processing for 5G Wireless and mm-Wave Systems**

Mikko Valkama Tampere University of Technology

Yuan-Hao Huang National Tsing Huang University

### **Symposium on Signal and Information Processing for Smart Grid Infrastructures**

Deepa Kundur, University of Toronto

Nikolaos Gatsis, University of Texas at San Antonio

Vassilis Kekatos, Virginia Tech

Meng Wang, Rensselaer Polytechnic Institute

Abdallah Farraj, University of Toronto

### **Symposium on Information Theoretic Approaches to Security and Privacy**

Rafael F. Schaefer, Technische Universität Berlin

Holger Boche, Technische Universität München

### **Symposium on Emerging Signal Processing**

#### **Applications**

Mike Polley, Samsung

Mazin Gilbert, ATT Labs

### **Symposium on Machine Learning for Characterization of Cognitive Communications and Radar**

Silvija Kokalj-Filipovic, Naval Research Laboratory

George Stantchev, Naval Research Laboratory

### **Symposium on Big Data Analysis and Challenges in Medical Imaging**

Anubha Gupta, IIT-Delhi

Namrata Vaswani, Iowa State University

Selin Aviyente, Michigan State University

### **Symposium on Signal Processing for Understanding Crowd Dynamics**

Lucio Marcenaro, University of Genova

### **Symposium on Signal Processing of Big Data**

Patrick Wolfe, University College London

Lav R. Varshney, University of Illinois at Urbana-Champaign

### **Symposium on Non-Commutative Theory and Applications**

Negar Kiyavash, University of Illinois-Urbana

Champaign

### **Symposium on Sparse Signal Processing for Communications**

Masoumeh Azghani, Sahand University of Technology

Farokh Marvasti, Sharif University of Technology

### **General Symposium**

Brian Mark, George Mason University  
Phillip Regalia, Catholic University of America  
Trac D. Tran, Johns Hopkins University

### **Symposium on Compressed Sensing, Deep Learning**

Trac D. Tran, Johns Hopkins University  
Seung-Jun Kim, University of Maryland, Baltimore County  
Piya Pal, University of California, San Diego

### **Symposium on Signal and Information Processing Over Networks**

Gonzalo Mateos, University of Rochester  
Antonio G. Marques, King Juan Carlos University  
Michael Rabbat, McGill University

### **Symposium on Distributed Information Processing, Optimization, and Resource Management over Networks**

Necdet Serhat Aybat, The Pennsylvania State University  
Mingyi Hong, Iowa State University  
Qing Ling, University of Science and Technology of China

### **Symposium on Transceivers and Signal Processing for 5G Wireless and mm-Wave Systems**

Markku Juntti, University of Oulu  
Jani Boutellier, Tampere University of Technology  
Mikko Valkama, Tampere University of Technology

### **Symposium on Signal and Information Processing for Smart Grid Infrastructures**

Abdallah Farraj, University of Toronto  
Nikolaos Gatsis, University of Texas at San Antonio  
Vassilis Kekatos, Virginia Tech  
Meng Wang, Rensselaer Polytechnic Institute

### **Symposium on Information Theoretic Approaches to Security and Privacy**

Rafael Schaefer, Technische Universität Berlin  
Holger Boche, Technische Universität München

### **Symposium on Emerging Signal Processing Applications**

Umit Batur, Faraday Future  
Fa-Long Luo, Element CXI  
Mazin Gilbert, AT&T Labs  
Mike Polley, Samsung USA  
John Apostolopoulos, Cisco  
Gaurav Sharma, University of Rochester

### **Symposium on Machine Learning for Characterization of Cognitive Communications and Radar**

Silvija Kokalj-Filipovic, Naval Research Laboratory  
George Stantchev, Naval Research Laboratory  
H. Vincent Poor, Princeton University

### **Symposium on Big Data Analysis and Challenges in Medical Imaging**

Anubha Gupta, IIT-Delhi  
Namrata Vaswani, Iowa State University  
Selin Aiyente, Michigan State University

### **Symposium on Signal Processing for Understanding Crowd Dynamics**

Nicola Conci, Università degli Studi di Trento  
Lucio Marcenaro, University of Genova  
Peter Tu, GE Global Research

### **Symposium on Signal Processing of Big Data**

Patrick Wolfe, University College London  
Lav R. Varshney, University of Illinois at Urbana-Champaign  
Russell Rodrigues, University College London

### **Symposium on Non-Commutative Theory and Applications**

Negar Kiyavash, Univ. Illinois Urbana-Champaign

### **Symposium on Sparse Signal Processing for Communications**

Masoumeh Azghani, Sahand University of Technology



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 Silvija Kokalj-Filipovic, Naval Research Laboratory  
 Farinaz Koushanfar, University of California San Diego (UCSD)  
 Jelena Kovacevic, Carnegie Mellon University  
 Ioannis Krikidis, University of Cyprus  
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 Na Li, Harvard University  
 Zhu Li, University of Missouri  
 Qilian Liang, University of Texas at Arlington  
 Pin-Hsun Lin, Technische Universität Dresden  
 Qihang Lin, University of Iowa  
 Kai Liu, Sichuan University  
 Roberto López-Valcarce, Universidad de Vigo  
 Alexander C. Loui, Kodak Alaris Inc.  
 Fa-Long Luo, Element CXI and Anyka, Inc.  
 Bing Ma, University of Nevada, Las Vegas  
 Shiqian Ma, The Chinese University of Hong Kong  
 Behrouz Maham, Nazarbayev University  
 Ali Makhdoumi, Massachusetts Institute of Technology  
 Vishnu Makkapati, Myntra Designs Pvt. Ltd.  
 Ahmed Mansour, Technische Universität München  
 Hassan Mansour, Mitsubishi Electric Research Laboratories  
 Brian Mark, George Mason University  
 Antonio G. Marques, King Juan Carlos University  
 Farokh Marvasti, Sharif University of Technology  
 Gonzalo Mateos, University of Rochester  
 Sellathurai Mathini, Heriot-Watt University  
 Vincenzo Matta, University of Salerno  
 Riccardo Mazzon, Queen Mary University of London  
 John McAllister, Queen's University Belfast  
 Benjamin Miller, MIT Lincoln Laboratory  
 Kazushi Mimura, Hiroshima City University  
 Elaheh Mohammadi, Sharif University of Technology  
 Mohammadali Mohammadi, Shahrekord University  
 Daniel Molzahn, Argonne National Lab  
 Vishal Monga, The Pennsylvania State University  
 Inmaculada Mora, King Juan Carlos University  
 Pietro Morerio, Istituto Italiano di Tecnologia (IIT)  
 Martin Mueller, Texas Instruments  
 Christopher Mueller-Smith, SRI International  
 Chandra Murthy, University of California, San Diego  
 Eric Nassor, Canon Research  
 Derrick Wing Kwan Ng, The University of New South Wales  
 Francesca Odone, Università degli Studi di Genova  
 Tobias Oechtering, KTH Royal Institute of Technology  
 Alex Oleshevsky, University of Illinois at Urbana-Champaign  
 Antonio Ortega, USC  
 Piya Pal, University of California, San Diego  
 Vishal M Patel, Rutgers University  
 Maxime Pelcat, INSA Rennes  
 Ana Isabel Perez, Universitat Politècnica de Catalunya  
 Fernando Perez-Cruz, Bell Laboratories  
 Samir Perlaza, INRIA  
 Marius Pesavento, Technische Universität Darmstadt  
 Athina Petropulu, Rutgers University  
 Claudio Picirelli, Università degli Studi di Udine  
 Jorge Plata, KU Leuven  
 Mike Polley, Samsung USA  
 Sofie Pollin, KU Leuven  
 Fatih Porikli, Australian National University  
 Victor Preciado, University of Pennsylvania  
 Zheng Qu, University of Hong Kong  
 Michael Rabbat, McGill University  
 Vasanthan Raghavan, Qualcomm Flarion Technologies  
 Nandana Rajatheva, University of Oulu  
 David Ramirez, Universidad Carlos III de Madrid  
 Shantanu Rane, Palo Alto Research Center (PARC)  
 Phillip Regalia, Catholic University of America  
 Carlo S. Regazzoni, Università degli Studi di Genova  
 Paolo Remagnino, Kingston University London  
 Markku Renfors, Tampere University of Technology  
 Alejandro Riberio, University of Pennsylvania  
 Cédric Richard, Université de Nice Sophia Antipolis  
 Peter Richtarik, University of Edinburgh  
 Taneli Riihonen, Aalto University  
 Bernhard Rinner, Universität Klagenfurt  
 Jana Rittwik, AT&T Labs  
 Mohammad Robotmili, Azad University  
 Andrew Robertson, Naval Research Laboratory  
 Daniel Romero, University of Minnesota  
 Walid Saad, Virginia Tech  
 Ravishankar Saiprasad, University of Michigan  
 Saeed Sanej, University of Surrey

Lalitha Sankar, Arizona State University  
 Murat Saraclar, Bogaziçi University  
 Anand Sarwate, Rutgers, The State University of New Jersey  
 Ali H Sayed, University of California, Los Angeles  
 Anna Scaglione, Arizona State University  
 Rafael Schaefer, Technische Universität Berlin  
 Patrick Schaumont, Virginia Tech  
 Ioannis Schizas, University of Texas at Arlington  
 Jessica Schrouff, Stanford University  
 Gesualdo Scutari, Purdue University  
 Farnaz Sedighin, Sharif University of Technology  
 Santiago Segarra, University of Pennsylvania  
 Erchin Serpedin, Texas A&M University  
 Aydin Sezgin, Ruhr University Bochum  
 Aydin Sezgin, Ulm University  
 Farhana Sheikh, Intel  
 Cong Shen, University of Science and Technology of China  
 Wei Shi, University of Illinois at Urbana-Champaign  
 David Shuman, Macalester College  
 Nikolaos Sidiropoulos, University of Minnesota  
 Georg Sigl, Technische Universität München  
 Olli Silvén, University of Oulu  
 Osvaldo Simeone, New Jersey Institute of Technology  
 Andrea Simonetto, UC Louvain  
 Elaheh Sobhani, Sharif University of Technology  
 Leonel Sousa, INESC-ID  
 Predrag Spasojevic, Rutgers University  
 Pirathayini Srikantha, University of Toronto  
 George Stantchev, Naval Research Laboratory  
 Christoph Studer, Cornell University  
 Yang Sun, Qualcomm  
 Himal Suraweera, University of Peradeniya  
 Ananthram Swami, ARL  
 Ali Tajer, Rensselaer Polytechnic Institute  
 Gongguo Tang, Colorado School of Mines  
 Ivan Tashev, Microsoft  
 Nima Tavangaran, Technische Universität München  
 Joshua Taylor, University of Toronto  
 Cem Tekin, Bilkent University  
 Valtteri Tervo, University of Oulu  
 Dorina Thanou, EPFL  
 Nikolaos Thomos, University of Essex  
 Gerry Tian, George Mason University  
 Olav Tirkkonen, Aalto University  
 Ehsan Tohidi, Sharif University of Technology  
 Laurissa Tokarchuk, Queen Mary University of London  
 Antti Tölli, University of Oulu  
 Stefano Tomasin, University of Padova  
 Behrouz Touri, University of Colorado at Boulder  
 LeNam Tran, Maynooth University  
 Trac D. Tran, Johns Hopkins University  
 Pei-Yun Tsai, National Central University  
 Stefano Tubaro, Politecnico di Milano  
 Jitendra Tugnait, Auburn University  
 Sennur Ulkulus, University of Maryland at College Park  
 Wolfgang Utschick, TU Munich  
 Mikko Valkama, Tampere University of Technology  
 Jaap van de Beek, Luleå University of Technology  
 Jagannadan Varadarajan, Advanced Digital Sciences Center  
 Pramod Varshney, Syracuse University  
 Namrata Vaswani, Iowa State University  
 Mikko Vehkaperä, University of Sheffield  
 Sergio A Velastin, University Carlos III de Madrid  
 Christos Verikoukis, Centre Tecnològic Telecomunicacions  
 Catalunya  
 Giuseppe Vizzari, Università degli Studi di Milano-Bicocca  
 Hoi-To Wai, Arizona State University  
 Liming Wang, The Ohio State University  
 Meng Wang, Rensselaer Polytechnic Institute  
 Yun Wang, Princeton University, Amazon.com, Inc.  
 Z. Jane Wang, University of British Columbia  
 Zhengdao Wang, Iowa State University  
 Zhongfeng Wang, Broadcom  
 Ermin Wei, Northwestern University  
 Jin Wei Kocsis, University of Akron  
 Stefan Werner, Aalto University  
 Risto Wichman, Aalto University  
 Gang Wu, University of Electronic Science and Technology of China  
 Sau-Hsuan Wu, National Chiao Tung University  
 Gerhard Wunder, Fraunhofer Heinrich Hertz Institute  
 Pengfei Xia, InterDigital  
 Yuanzhang Xiao, Northwestern University  
 Yao Xie, Georgia Institute of Technology  
 Jie Xu, University of Miami  
 Zhiyuan Yan, Lehigh University  
 Zaiyue Yang, Zhejiang University  
 Roy Yates, Rutgers University  
 Anastasia Yendiki, Harvard Medical School  
 Shingo Yoshizawa, Kitami Institute of Technology  
 Hojatollah Zamani, Sharif University of Technology  
 Nematollah Zarmehi, Sharif University of Technology  
 Hadi Zayyani, Qom University of technology  
 Baosen Zhang, University of Washington  
 Chuan Zhang, Southeast University  
 Haijun Zhang, University of British Columbia  
 June Zhang, Centers for Disease Control and Prevention  
 Wei Zhang, Ohio State University  
 Wenyi Zhang, University of Science and Technology of China  
 Xinmiao Zhang, Western Digital Corporation  
 Yimin Zhang, Temple University  
 Yu Zhang, UC Berkeley  
 Zhengya Zhang, University of Michigan  
 Ming Zhao, Arizona State University  
 Yue Zhao, Stony Brook University  
 Yuanqing Zheng, The Hong Kong Polytechnic University  
 Ning Zhou, Binghamton University  
 Hao Zhu, University of Illinois at Urbana-Champaign  
 Minghui Zhu, Pennsylvania State University  
 Saman Zonouz, Rutgers University  
 Michele Zorzi, University of Padova, Italy

**GRAPH SIGNAL PROCESSING: FUNDAMENTALS AND APPLICATIONS TO DIFFUSION PROCESSES**

Tuesday, December 6, 13:30–17:00, Rosslyn I (2<sup>nd</sup> floor)

**Instructors**

**Prof. Antonio G. Marques**, King Juan Carlos University, Spain; **Dr. Santiago Segarra**, Massachusetts Institute of Technology, USA; and **Prof. Gonzalo Mateos**, University of Rochester, USA

The tutorial consists of two parts of similar length: an introduction to the basics of Graph Signal Processing (GSP), which will review and illustrate main existing results, and the application of GSP-tools to distributed network processing and diffusion processes over networks. The first part introduces the field of GSP, motivates its usefulness via meaningful applications, and presents in a didactic yet concise manner its foundational concepts, which have been derived over the past five years. The second part focuses on contemporary results. We will first illustrate that GSP is well suited to model and study diffusion processes over networks. With this premise in mind, we revisit classical SP problems such as sampling, interpolation, system identification, and filtering. We first present the theoretical results and then discuss their implications for distributed and dynamic processing. Furthermore, we illustrate the utility of applying GSP to analyze dynamics on networks through a diverse gamut of applications from social sciences to biology, spanning well-established problems like consensus and emerging neuroscience challenges like brain state induction.

**Antonio G. Marques** received the Telecommunications Engineering degree and the Doctorate degree, both with highest honors, from the Carlos III University of Madrid, Spain, in 2002 and 2007, respectively. In 2007, he became a faculty of the Department of Signal Theory and Communications, King Juan Carlos University, Madrid, Spain, where he currently develops his research and teaching activities as an Associate Professor. From 2005 to 2015, he held different visiting positions at the University of Minnesota, Minneapolis. In 2015 and 2016 he was a Visiting Scholar at the University of Pennsylvania. His research interests lie in the areas of communication theory, signal processing, and networking. His current research focuses on stochastic resource allocation wireless networks and smart grids, nonlinear network optimization, and signal processing for graphs. Dr. Marques has served the IEEE and the EURASIP in a number of posts (currently, he is an Associate Editor of the IEEE Signal Process. Letters and of the EURASIP J. on Advances in Signal Process.), and his work has been awarded in several conferences and workshops.

**Santiago Segarra** received the B.Sc. degree in industrial engineering with highest honors (Valedictorian) from the Instituto Tecnológico de Buenos Aires (ITBA), Argentina, in 2011 and the M.Sc. and Ph.D. degrees in electrical and systems engineering from the University of Pennsylvania, Philadelphia, in 2014 and 2016. Since 2016, he has been working as a postdoctoral researcher with the Institute for Data, Systems, and Society at the Massachusetts Institute of Technology. His research interests include network theory, data analysis, machine learning, and graph signal processing. Dr. Segarra received the ITBA's 2011 Best Undergraduate Thesis Award in industrial engineering, the 2011 Outstanding Graduate Award granted by the National Academy of Engineering of Argentina, the Best Student Paper Awards at the 2015 Asilomar Conference and the 2016 Statistical Signal Processing Workshop, and the Best Paper Award at the 2016 Sensor Array and Multichannel Signal Processing Workshop.

**Gonzalo Mateos** received the B.Sc. degree from Universidad de la República, Uruguay, in 2005, and the M.Sc. and Ph.D. degrees from the University of Minnesota, Twin Cities, in 2009 and 2011, all in electrical engineering. He joined the University of Rochester, Rochester, NY, in 2014, where he is currently an Assistant Professor with the Department of Electrical and Computer Engineering, as well as a member of the Goergen Institute for Data Science. During the 2013 academic year, he was a visiting scholar with the Computer Science Department at Carnegie Mellon University. From 2004 to 2006, he worked as a Systems Engineer at Asea Brown Boveri (ABB), Uruguay. Dr. Mateos received the Best Student Paper Award at the 2012 IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), and was also a finalist of the Student Paper Contest at the 2011 IEEE DSP/SPE Workshop. His doctoral work has been recognized with the 2013 University of Minnesota's Best Dissertation Award (Honorable Mention) across all Physical Sciences and Engineering areas. His research interests lie in the areas of statistical learning from Big Data, network science, decentralized optimization, and graph signal processing, with applications in dynamic network health monitoring, social, power grid, and Big Data analytics. Dr. Mateos currently serves as Associate Editor for the IEEE Trans. on Signal Process. and the EURASIP J. on Advances on Signal Process.

### PLEN-1: DEEP BAYESIAN PROGRAM LEARNING

Wednesday, December 7, 08:30 - 09:30, Salon ABC

#### Ben Vigoda, Gamalon Machine Intelligence

Before founding Gamalon Machine Intelligence, **Ben Vigoda** was technical co-founder and CEO of Lyric Semiconductor, a startup that created the first integrated circuits and processor architectures for statistical machine learning and signal processing. The company was named one of the 50 Most Innovative Companies by Technology Review and was featured in the Wall Street Journal, New York Times, EE Times, Scientific American, Wired, and other media. Lyric was successfully acquired by Analog Devices, and Lyric's products and technology are being deployed in leading smart phones and consumer electronics, medical devices, wireless base stations, and automobiles.



Ben completed his PhD at MIT developing circuits for implementing machine learning algorithms natively in hardware. He has won entrepreneurship competitions at MIT and Harvard, fellowships from Intel and the Kavli Foundation/National Academy of Sciences, and has held research appointments at MIT, HP, Mitsubishi, and the Santa Fe Institute. He has authored over 120 patents and academic publications. He currently serves on the DARPA Information Science and Technology (ISAT) steering committee.

Ben also co-founded Design That Matters, a not-for-profit that for the past decade has helped solve engineering and design problems in under-served communities and has saved thousands of infant lives by developing low-cost, easy-to-use medical technology such as infant incubators, UV therapy, pulse oximeters, and IV drip systems that have been fielded in 20 countries.

### PLEN-2: NETWORK DYNAMICS AND CONTROL IN THE HUMAN BRAIN

Thursday, December 8, 08:30 - 09:30, Salon ABC

#### Danielle S. Bassett, University of Pennsylvania

The human brain is a complex organ characterized by heterogeneous patterns of interconnections. New non-invasive imaging techniques now allow for these patterns to be carefully and comprehensively mapped in individual humans, paving the way for a better understanding of how wiring supports our thought processes. While a large body of work now focuses on descriptive statistics to characterize these wiring patterns, a critical open question lies in how the organization of these networks constrains the potential repertoire of brain dynamics. In this talk, I will describe an approach for understanding how perturbations to brain dynamics propagate through complex wiring patterns, driving the brain into new states of activity. Drawing on a range of disciplinary tools - from graph theory and graph signal processing to network control theory and optimization - I will identify control points in brain networks, characterize trajectories of brain activity states following perturbation to those points, and propose a mechanism for how network control evolves in our brains as we grow from children into adults. Finally, I will describe how these computational tools and approaches can be used to better understand how the brain controls its own dynamics (and we in turn control our own behavior), but also how we can inform stimulation devices to control abnormal brain dynamics, for example in patients with severe epilepsy.



**Danielle S. Bassett** is an Associate Professor in the Department of Bioengineering at the University of Pennsylvania. She is most well-known for her work blending neural and systems engineering to identify fundamental mechanisms of cognition and disease in human brain networks. She received a B.S. in physics from the Pennsylvania State University and a Ph.D. in physics from the University of Cambridge, UK. Following a postdoctoral position at UC Santa Barbara, she was a Junior Research Fellow at the Sage Center for the Study of the Mind. In 2012, she was named American Psychological Association's 'Rising Star' and given an Alumni Achievement Award from the Schreyer Honors College at Pennsylvania State University for extraordinary achievement under the age of 35. In 2014, she was named an Alfred P Sloan Research Fellow and received the MacArthur Fellow Genius Grant. In 2015, she received the IEEE EMBS Early Academic Achievement Award, and was named an ONR Young Investigator. In 2016, she received an NSF CAREER award and was named one of Popular Science's Brilliant 10. She is the founding director of the Penn Network Visualization Program, a combined undergraduate art internship and K-12 outreach program bridging network science and the visual arts. Her work has been supported by the National Science Foundation, the National Institutes of Health, the Army Research Office, the Army Research Laboratory, the Alfred P Sloan Foundation, the John D and Catherine T MacArthur Foundation, and the Office of Naval Research. She lives with her husband and two sons in Wallingford, Pennsylvania.

## PLEN-3: HIGH DIMENSIONAL LEARNING WITH DEEP NEURAL NETWORKS

Friday, December 9, 08:30 – 09:30, Salon ABC

**Stéphane Mallat, Ecole Normale Supérieure, France**

Deep convolutional networks have obtained spectacular results for image understanding, audio and medical signal analysis, natural languages... We review their architecture, and analyze their mathematical properties, with many open questions. These architectures seem to linearize important non-linear transformations, while reducing dimensionality with appropriate invariants. They are computed with non-linear contractions, and multiscale linear operators, where wavelets play an important role. Applications are shown for image and audio classification as well as regressions of quantum molecular energies.

**Stéphane Mallat** received the Ph.D. from the University of Pennsylvania, in 1988. He was then Professor at the Courant Institute of Mathematical Sciences, until 1994. In 1995, he became Professor in Applied Mathematics at Ecole Polytechnique, Paris and Department Chair in 2001. From 2001 to 2007 he was co-founder and CEO of a semiconductor start-up company. In 2012 he joined the Computer Science Department of Ecole Normale Supérieure, in Paris.

Stéphane Mallat's research interests include learning, signal processing, and harmonic analysis. He is a member of the French Academy of sciences, an IEEE Fellow and an EUSIPCO Fellow. In 1997, he received the Outstanding Achievement Award from the SPIE Society and was a plenary lecturer at the International Congress of Mathematicians in 1998. He also received the 2004 European IST Grand prize, the 2004 INIST-CNRS prize for most cited French researcher in engineering and computer science, the 2007 EADS grand prize of the French Academy of Sciences, the 2013 Innovation medal of the CNRS, and the 2015 IEEE Signal Processing best sustaining paper award.



## PANEL SESSION

### PERSPECTIVES ON MACHINE LEARNING

Thursday, December 8, 13:00 - 13:45, Salon 2

Machine learning and artificial intelligence can be found in everyday applications ranging from autonomous navigation, to extracting information from 'Big Data'. The application of machine learning raises a number of interesting and diverse questions. For example, how have aspects of machine learning positively and/or adversely impacted our everyday lives (e.g., smart phones), and is it someday possible for machine learning to provide a comprehensive framework for knowledge representation and reasoning? An expert panel made up of program managers and researchers from multiple government agencies will discuss these topics and more, as well as where future investments may lead.

#### Moderator

Brian Sadler, ARL

Brian M. Sadler is the Army Senior Scientist for Intelligent Systems, and General Co-Chair of GlobalSIP'16. He is a Fellow of IEEE, and a Fellow of the Army Research Laboratory. He is an IEEE Signal Processing Society Distinguished Lecturer for 2017-2018, and his lecture topics include distributed collaborative intelligent systems, human-autonomy querying and interaction, and autonomous networking.



#### Panelists

David Aha, U.S. Naval Research Laboratory

Charles Clancy, Virginia Tech

Jill Crisman, Intelligence Advanced Research Projects Activity (IARPA)

Tom Rondeau, Defense Advanced Research Projects Agency (DARPA)

Paul Tilghman, Defense Advanced Research Projects Agency (DARPA)

**Dr. David W. Aha** (UCI, 1990) leads the Adaptive Systems Section within the U.S. Naval Research Laboratory's Navy Center for Applied Research in Artificial Intelligence. His research interests include goal reasoning, case-based reasoning, mixed-initiative interaction, machine learning, planning, text analysis, and related topics pertaining to intelligent decision aids. He was a AAAI Councilor, founded the UCI Repository of Machine Learning Databases, co-founded the AI Video Competitions, and has received three Best Paper awards. David has (co)organized 24 international research events, (co)edited three special journal issues on AI topics, participated on 14 dissertation committees, serves on the editorial boards for three journals, and serves annually on the PCs for several conferences, workshops, and doctoral symposiums.



**Dr. Charles Clancy** is an Associate Professor of Electrical and Computer Engineering at Virginia Tech and directs of the Hume Center for National Security and Technology. Prior to joining Virginia Tech in 2010, he served as a senior researcher at the Laboratory for Telecommunications Sciences, a defense research lab at the University of Maryland, where he led research programs in software-defined and cognitive radio. Dr. Clancy received his B.S. in Computer Engineering from the Rose-Hulman Institute of Technology, M.S. in Electrical Engineering from the University of Illinois, and his Ph.D. in Computer Science from the University of Maryland. He is a Senior Member of the IEEE and has over 150 peer-reviewed technical publications. His current research interests include cognitive communications and spectrum security.



From December 2010-September 2016, **Dr. Jill Crisman** was a Program Manager at Intelligence Advanced Research Projects Activity (IARPA) in the Incisive Analysis Office. She created and directed the Finder Program which developed technologies to geolocate where a query image or video was taken based on the query's content alone. She also directed the Aladdin Video program which developed technologies that can quickly search massive video collections for a user's events-of-interest. She is currently Chief Scientist at Next Century Corporation.



Dr. Jill Crisman came to IARPA after over 20 years in academia and industry. Dr. Crisman participated in both DARPA Grand and Urban Challenges and developed algorithms for 3D reconstruction while at SAIC. She was a founding faculty member of the Franklin W. Olin College of Engineering where she created project courses to help reinforce learning in co-taught physics and mathematics courses. Dr. Crisman was Director of the Robotics and Vision Systems Laboratory at Northeastern University where she collaborated with colleagues on many projects including development of a robot hand, wheelchair, and lobster. She received her Ph.D. in Electrical and Computer Engineering from Carnegie Mellon University and has authored over 50 academic publications.

**Dr. Tom Rondeau** joined DARPA as a program manager in the Microsystems Technology Office in May 2016. His research interests include adaptive and reconfigurable radios, improving the development cycle for new signal-processing techniques, and creating general purpose electromagnetic systems.

Prior to joining DARPA, Dr. Rondeau was the maintainer and lead developer of the GNU Radio project and a consultant on signal processing and wireless communications. He worked as a visiting researcher with the University of Pennsylvania and as an Adjunct with the IDA Center for Communications Research in Princeton, NJ. In these roles, he helped push forward architectures and algorithms in signal processing for communications, signal analysis, and spectrum monitoring and usage.



Dr. Rondeau is active in many conferences and workshops around the world to help further research and technology in these areas, and he has consulted with many companies and government organizations on new techniques in wireless signal processing. He has published widely in the fields of wireless communications, software radio, and cognitive radio. Dr. Rondeau holds a Ph.D. in electrical engineering from Virginia Tech and won the 2007 Outstanding Dissertation Award in math, science, and engineering from the Council of Graduate Schools for his work in artificial intelligence in wireless communications.

**Mr. Paul Tilghman** joined DARPA in December 2014 as a Program Manager in the Microsystems Technology Office. His research interests include intelligent and adaptive RF systems, digital signal processing, machine learning, wireless communications and electronic warfare. Prior to joining DARPA, Mr. Tilghman was a senior research engineer at Lockheed Martin's Advanced Technology Laboratories where he led programs in adaptive electronic warfare, signals intelligence and non-cooperative geolocation. While at Lockheed Martin, Tilghman led the development of a real-time cognitive electronic warfare system, which used machine learning techniques to characterize and counter previously unknown radio emitters on the battlefield. He is a recipient of Lockheed Martin's highest award, the NOVA award, and was also previously honored as the company's Engineer of the Year. Mr. Tilghman received a bachelor of science in computer engineering from the Rochester Institute of Technology and a master of science in electrical engineering from Drexel University.



### SIGNAL PROCESSING FOR SENSING AND MACHINE LEARNING

Wednesday, December 7, 14:00–17:00, Salon 2

**Presenter: Kirthi K. Devleker**



In the past few years we have witnessed an explosion in embedded sensors and the sheer volume of signal data generated across a range of industry segments. Applications that utilize the signal data must be able to acquire, process and derive insights from the signal data efficiently. They usually require the joint use of signal processing and machine learning techniques on the time series and sensor data sent by wearable devices to classify activities and identify any abnormal physiological conditions.

In this workshop you will learn how you can accelerate the development of such data analytics and sensor processing systems in a single environment with a full range of modeling, classification, and design capabilities. Specifically we will focus on these topics in detail:

- Exploring different classification algorithms and identifying physical activity from accelerometer signals generated by a smartphone
- Processing real world ECG signals and computing heart rate accurately using feature extraction algorithms in MATLAB
- Exploring the fundamentals of deep learning and its use to solve computer vision problems (e.g. object detection and object recognition using convolutional neural networks)
- Noise and vibration signal processing and feature extraction for machine health monitoring
- Accelerating the processing of large datasets using parallel computing

**Kirthi K. Devleker** is a product manager in the area of Signal Processing and Communications at MathWorks. Kirthi regularly interacts with customers to help them adopt MATLAB & Signal Processing tools and has been with MathWorks for 6 years. He has a Masters in Electrical Engineering from San Jose State University.

### REGISTRATION HOURS

The GlobalSIP 2016 Registration Desk is located in the Grand Foyer. Hours of operation are:

Tuesday, December 6 ..... 12:00 - 17:00  
Wednesday, December 7 ..... 07:00 - 19:15

Thursday, December 8 ..... 07:30 - 19:15  
Friday, December 9 ..... 08:00 - 17:00

### GETTING AROUND IN WASHINGTON, DC

#### METRO DURING THE CONFERENCE

The Crystal Gateway Marriott is conveniently located on the DC Metro (WMATA) routes. Take the Yellow or Blue line to the Crystal City Station. The hotel lobby is connected to the Crystal City Station through an interior pedestrian concourse within the complex of Crystal City Shops, without going outdoors.

The Metro is an excellent way to explore all of Washington, D.C. and the surrounding communities. Use the Trip Planner to create a customized route from your location to anywhere else in the D.C. Metro area. Consider purchasing a MetroRail Pass for a day or a week with unlimited travel on the Metro during your visit to Washington.

Trip Planner: [http://www.wmata.com/rider\\_tools/tripplanner/tripplanner.cfm](http://www.wmata.com/rider_tools/tripplanner/tripplanner.cfm)



#### PARKING

The cost to park at the hotel is either US\$ 29/day (self parking) or US\$34/day (valet parking).

#### CAR RENTAL AT THE HOTEL

Hertz tel. +1-703-271-5245

#### BICYCLING

When weather permits, biking is a good way to beat the traffic or enjoy the riding pleasure. CapitalBikeShare is available in the metropolitan area. We suggest you look at the details here: <http://www.capitalbikeshare.com/>. The area around the hotel has several racks and bikes are usually available.





## RESTAURANTS

The hotel is connected to the Crystal City Metro Station through the Crystal City Shops, where you can find markets, shops, restaurants without going outdoors.

**Yelp:** how to see which good restaurants that people are talking about: yelp it. Download the yelp app if you do not have it yet. People in DC yelp a lot.

**Groceries:** If you prefer to go to the grocery store, there are convenient stores within Crystal City Shops that can be accessed from hotel lobby. For more options, there is a Costco, a Seven-eleven, and a Harris Teeter (grocery store near the Pentagon City metro station) nearby.



**Delivery:** If you want your food delivered to the hotel then one option (that is different from pizza) is UberEats: <https://eats.uber.com/>. Make sure you enter "1700 Jefferson Davis Highway, Arlington, VA". The delivery times range from 30 to 55 minutes, and the number of restaurants available is around 100 (depending on which ones are open at the time).



**Food trucks** are hot (and yummy) in DC right now. And, it turns out, on Thursday they park 0.2 miles from the hotel. Check here when we are closer to the conference week to see which truck will be there! (from 11 am to 2 pm): <http://www.crystalcity.org/do/food-truck-thursdays1>

**Restaurants:** Two shopping areas in Crystal City are nearby where you can find plenty of restaurants from fast casual to fine dining. They are: *Crystal City Shops* to the southeast and *Pentagon Row* to the northwest of the hotel. Of course, dining options abound when you take metro to downtown DC.



**Southeast** (*within 0.5 miles of the hotel*): go southeast (0.5 miles) to find restaurants within walking distance. Many of them are connected to the hotel through interior pedestrian concourses of Crystal City Shops. See the map and directory at <http://www.thecrystalcityshops.com>. You can also find bars and restaurants to the south along the 23rd Street.

**Northwest** (*approx. 1 mile*): if you prefer to walk closer to 1 mile, you may go northwest from the hotel towards the direction of the Pentagon City metro station.

You can take the metro to the Pentagon City Station. Within walking distance (less than 0.2 miles) of that station there are many restaurants, some spas, and spots to drink and chat with colleagues. Check out their site here: <http://pentagonrow.com/>. If you prefer to walk there, it should take less than 20 min.



## VENUE

Crystal Gateway Marriott  
1700 Jefferson Davis Highway  
Arlington, VA 22202, US  
Phone: +1-703-920-3230

URL: <http://www.marriott.com/hotels/travel/wasgw-crystal-gateway-marriott/>



## INTERNET ACCESS

GlobalSIP 2016 attendees staying at the Crystal Gateway Marriott have free WiFi Internet access in the guest rooms. Follow the instructions provided to you when you checked into your hotel room.

Free WiFi Internet access is also available to all attendees in the hotel foyer area, as well as the session & meeting rooms. Connect to network "IEEE" and use the password "globalsip" to join the network.

## SOCIAL EVENTS

### WELCOME RECEPTION

Wednesday, December 7, 17:45 - 19:15, Grand Foyer

Catch up on news from long-time colleagues and make new friends at the opening reception. Enjoy a selection of hors'd'voures along with your choice of wine, beer or soda.

### EVENING RECEPTION

Thursday, December 8, 17:45 - 19:15, Grand Foyer

Light hors'd'voures and soft drinks.

### YOUNG PROFESSIONALS EVENT

Thursday, December 8, 17:30 - 19:00, Salon 2

## OTHER EVENTS

### ASSOCIATE EDITORS BEST PRACTICES DISCUSSION

Thursday, December 8, 10:00 - 12:00, Rosslyn I (2<sup>nd</sup> floor)

### ETHICS FOR AUTHORS AND VOLUNTEERS - THINGS YOU SHOULD KNOW BEFORE SUBMITTING YOUR NEXT PAPER

Thursday, December 8, 12:30 - 14:00, Rosslyn II (2<sup>nd</sup> floor)

This presentation and discussion will focus on what to do—and what not to do—for successfully publishing a technical paper (and avoiding common mistakes that can result in a quick rejection). Navigate the review process more smoothly with insider information about peer-review and by better understanding the ethics and etiquette standards that authors are expected to uphold and that reviewers and editors are looking for.

### GLOBALSIP TO GLOBALSIP MEETING

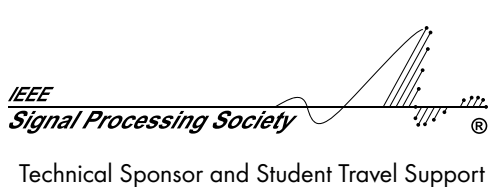
Friday, December 9, 11:30 - 14:00, Rosslyn I (2<sup>nd</sup> floor)

## PRESENTATIONS ON SIGPORT

Many GlobalSIP 2016 presenters have provided their presentation notes on IEEE Signal Processing Society's SigPort system. The GlobalSIP 2016 page on SigPort is <https://www.sigport.org/events/documents/GlobalSIP-2016>

## GLOBALSIP 2016 SUPPORTERS

GlobalSIP 2016 thanks the following for their support of the conference and student travel grants!



**Secure Broadcasting with Independent Secret Keys****H. Vincent Poor, Princeton University**

Information Theoretic Security (ITS) was introduced by Claude Shannon in 1948. In Shannon's setting the legitimate parties share a common secret key but communicate over a public noiseless channel, which can be wiretapped by an eavesdropper. Shannon's main result was to establish the minimum key-rate necessary to guarantee ITS against the eavesdropper. Wyner introduced the wiretap channel in 1975, where the legitimate parties communicate over a (possibly) noisy channel, which could be wiretapped by an eavesdropper over another noisy channel. Wyner established the maximum communication rate in this setting, while guaranteeing ITS (in an asymptotic sense) against the eavesdropper.



In this talk we will review the above results and then introduce a new setting where a single (common) message must be transmitted to two receivers over a wiretap channel. In addition we assume that the transmitter shares an independent secret key with each of the two receivers not known to the eavesdropper. We will explain how the coding techniques developed by Shannon and Wyner can be unified in this setting. By focusing on the "degraded" channel model, we will discuss conditions under which the following approaches are optimal (i) using secret-keys as one-time pads and ignoring the contribution of the noisy channel (ii) ignoring the secret-keys and only relying on the noisy channel (iii) hybrid schemes that combine both approaches.

**Distributed Hypothesis Testing on Graphs****Angelia Nedic, Arizona State University**

We will consider the problem of distributed cooperative non-Bayesian learning in a network of agents, where the agents are repeatedly gaining partial information about an unknown random variable whose distribution is to be jointly estimated. The joint objective of the agent system is to globally agree on a hypothesis (distribution) that best describes the observed data by all agents in the network. Interactions between agents occur according to an unknown sequence of time-varying graphs. We highlight some interesting aspects of Bayesian learning and stochastic approximation approach for the case of a single agent, which has not been observed before and it allows for a new connection between optimization and statistical learning. Then, we discuss and analyze the general case where subsets of agents have conflicting hypothesis models, in the sense that the optimal solutions are different if the subset of agents were isolated. Additionally, we provide a new non-Bayesian learning protocol that converges an order of magnitude faster than the learning protocols currently available in the literature for arbitrary fixed undirected graphs. Our results establish consistency and a non-asymptotic, explicit, geometric convergence rate for the learning dynamics.



**Online Learning and Management of Future Cyber-Physical Networks**

**Georgios B. Giannakis, University of Minnesota**

Cyber-physical systems (CPS) are engineered systems with built-in seamless integration of computational and physical components. Fundamental advances in sensing, learning, control, and information technologies, are well motivated to endow CPS with resilience, adaptability, scalability, and sustainability. In this context, the present talk will start with online convex optimization algorithms for estimating the state of future power grids. A framework will be then introduced for joint active and reactive power control in distribution grids, which also accounts for stochastic constraints of voltages and inverters to reduce losses. Efficacy of the novel approaches will be assessed using standard IEEE power grid benchmark distribution feeders. Leveraging statistical inference and stochastic optimization tools, the final topic will deal with state-of-the-art learning-aided management for sustainable data centers. Both analytical and empirical results will demonstrate how valuable insights from big data analytics can lead to markedly improved management policies by learning from historical user and network patterns.



**Sampling on Graphs**

**Jelena Kovačević, Carnegie Mellon University**

With the explosive growth of information and communication, signals are generated at an unprecedented rate from various sources, including social, citation, biological, and physical infrastructure, among others.

Unlike time-series signals or images, these signals possess complex, irregular structure, which requires novel processing techniques leading to the emerging field of signal processing on graphs.

Signal processing on graphs extends classical discrete signal processing to signals with an underlying complex, irregular structure. The framework models that underlying structure by a graph and signals by graph signals, generalizing concepts and tools from classical discrete signal processing to graph signal processing. I will talk about graph signal processing, and, in particular, the classical signal processing task of sampling and interpolation within the framework of signal processing on graphs. As the bridge connecting sequences and functions, classical sampling theory shows that a bandlimited function can be perfectly recovered from its sampled sequence if the sampling rate is high enough. I will follow up with a number of applications where sampling on graphs is of interest.



**Understanding Video of Crowded Environments****Nuno Vasconcelos, University of California, San Diego**

Classical work in computer vision has emphasized the study of individual objects, e.g. object recognition or tracking. More recently, it has been realized that most of these approaches do not scale well to scenes that depict crowded environments. These are scenes with many objects, which are imaged at low resolution, and interact in complex ways. Solving vision problems in these environments requires the ability to model and reason about a crowd as a whole. I will review recent work in my lab in this area, including the design of statistical models for the appearance and dynamics of crowd video with multiple flows, and their application to the solution of problems such as crowd counting, dynamic background subtraction, anomaly detection, domain adaptation, and crowd activity analysis.

**On Optimization of Sensor Management Policies for Distributed Estimation****Pramod K. Varshney, Syracuse University**

Wireless Sensor Networks (WSNs) often operate in environments where available energy and bandwidth are limited. It is imperative that suitable resource management policies be adopted to maximize system performance while prolonging the lifetime of the WSN. This talk will provide a review of the current state-of-the-art of sensor management approaches for distributed estimation problems. This will be followed by a more detailed discussion on optimization of sensor management policies for distributed estimation including sensor selection, sensor scheduling and sensor collaboration. Sensor management for distributed estimation in crowdsourcing based WSNs will also be discussed.



**Compressed Sensing, Deep Learning I**

- CSDL-1.1** 11:00 **COMPRESSIVE CODING VIA RANDOM REPLICATE MIRROR**  
*Dung Tran, Luoluo Liu, Trac Tran, Johns Hopkins University, United States; Sang Chin, Boston University, United States; Jeffrey Korn, Eric Hoke, Draper laboratory, United States*
- CSDL-1.2** 11:20 **APPROXIMATE SUPPORT RECOVERY OF ATOMIC LINE SPECTRAL ESTIMATION: A TALE OF RESOLUTION AND PRECISION**  
*Qiuwei Li, Gongguo Tang, Colorado School of Mines, United States*
- CSDL-1.3** 11:40 **ITERATIVE ULTRASONIC IMAGE RECONSTRUCTION BY QUADTREE MESHES USING TARGET SPARSITY**  
*Yuanwei Jin, University of Maryland Eastern Shore, United States; Chengdong Dong, Shanghai University of Finance and Economics, China; Enyue Lu, Salisbury University, United States*
- CSDL-1.4** 12:00 **COUPLED DICTIONARY LEARNING FOR MULTIMODAL IMAGE SUPER-RESOLUTION**  
*Pingfan Song, Joao Mota, University College London, United Kingdom; Nikos Deligiannis, Vrije Universiteit Brussel, Belgium; Miguel Rodrigues, University College London, United Kingdom*

**Information Theoretic Approaches to Security and Privacy I**

Session Chair: Onur Günlü, Technical University of Munich

- ITSP-1.1** 11:00 **THE CAPACITY OF PRIVATE INFORMATION RETRIEVAL WITH COLLUDING DATABASES**  
*Hua Sun, Syed Jafar, University of California Irvine, United States*
- ITSP-1.2** 11:20 **ON DETERMINISTIC IC WITH COMMON AND PRIVATE MESSAGE UNDER SECURITY CONSTRAINTS**  
*Hendrik Vogt, Zohaib Hassan Awan, Aydin Sezgin, Ruhr-Universität Bochum, Germany*
- ITSP-1.3** 11:40 **ON THE DUALITY BETWEEN STATE-DEPENDENT CHANNELS AND WIRETAP CHANNELS**  
*David Kibloff, Samir M. Perlaza, INRIA, France; Guillaume Villemaud, Leonardo Cardoso, INSA de Lyon, France*
- ITSP-1.4** 12:00 **THE MISO WIRETAP CHANNEL WITH CHANNEL UNCERTAINTY: ASYMPTOTIC PERSPECTIVES**  
*Anas Chaaban, King Abdullah University of Science and Technology, Saudi Arabia; Zouheir Rezki, University of Idaho, United States; Basel Alomair, KACST, Saudi Arabia; Mohamed-Slim Alouini, King Abdullah University of Science and Technology, Saudi Arabia*

**State Estimation**

Session Chair: Vassilis Kekatos, Virginia Tech

- SGI-1.1**  
11:00 **POWER SYSTEM STATE ESTIMATION VIA FEASIBLE POINT PURSUIT**  
*Gang Wang, Ahmed S. Zamzam, Georgios B. Giannakis, Nicholas D. Sidiropoulos, University of Minnesota, United States*
  
- SGI-1.2**  
11:20 **DISTRIBUTED ESTIMATION OF THE OPERATING STATE OF A SINGLE-BUS DC MICROGRID WITHOUT AN EXTERNAL COMMUNICATION INTERFACE**  
*Marko Angelichinoski, Aalborg University, Denmark; Anna Scaglione, Arizona State University, United States; Petar Popovski, Cedimir Stefanovic, Aalborg University, Denmark*
  
- SGI-1.3**  
11:40 **ON IDENTIFIABILITY OF SPARSE GROSS ERRORS IN POWER SYSTEM MEASUREMENTS**  
*Jinsub Kim, Sharmin Kibria, Oregon State University, United States*
  
- SGI-1.4**  
12:00 **AUTOMATIC REGIONALIZATION ALGORITHM FOR DISTRIBUTED STATE ESTIMATION IN POWER SYSTEMS**  
*Dexin Wang, Liuqing Yang, Colorado State University, United States; Anthony Florita, S M Shafiul Alam, Tarek Elgindy, Bri-Mathias Hodge, National Renewable Energy Laboratory, United States*

**Signal Processing of Big Data I**

Session Chair: Lav R. Varshney, University of Illinois at Urbana-Champaign

- SPBD-1.1**  
11:00 **NEAR-OPTIMALITY OF GREEDY SET SELECTION IN THE SAMPLING OF GRAPH SIGNALS**  
*Luiz F. O. Chamon, Alejandro Ribeiro, University of Pennsylvania, United States*
  
- SPBD-1.2**  
11:20 **MONITORING MANHATTAN'S TRAFFIC AT 5 INTERSECTIONS?**  
*Siheng Chen, Yaoqing Yang, Christos Faloutsos, Jelena Kovacevic, Carnegie Mellon University, United States*
  
- SPBD-1.3**  
11:40 **NEW YORK CITY TAXI ANALYSIS WITH GRAPH SIGNAL PROCESSING**  
*Joya A. Derj, José M.F. Moura, Carnegie Mellon University, United States*
  
- SPBD-1.4**  
12:00 **PARAFAC-BASED MULTILINEAR SUBSPACE CLUSTERING FOR TENSOR DATA**  
*Panagiotis Traganitis, Georgios B. Giannakis, University of Minnesota, United States*

### Signal Processing for Understanding Crowd Dynamics I

Session Chair: Lucio Marcenaro, University of Genova

**UCD-1.1** **CROWD ANALYTICS VIA ONE SHOT LEARNING AND AGENT  
11:00** **BASED INFERENCE**

*Peter Tu, Ming-Ching Chang, Tao Gao, General Electric, United States*

**UCD-1.3** **MODELING CROWDS AS SINGLE-MINDED ENTITIES**

**11:40**  
*Oscar J. Urizar, Emilia I. Barakova, Eindhoven University of Technology, Netherlands; Carlo S. Regazzoni, University of Genova, Italy; Matthias Rauterberg, Eindhoven University of Technology, Netherlands*

### The MIMOME Channel

#### Ashish Khisti, University of Toronto

While multiple antennas provide a natural mechanism for securing wireless communications at a physical layer, both the fundamental limits and practical coding schemes for the Multi-Input-Multi-Output-Multi-Eavesdropper (MIMOME) channel have only been developed in the last few years.



We first discuss how to design a layered coding scheme for the MIMOME channel that achieves the secrecy capacity. Our scheme only uses codes for the scalar wiretap channel, and successive interference cancellation at the receiver, as in traditional V-Blast schemes. Our approach is based on simultaneous joint unitary triangularization of the channel matrices of the legitimate user and the eavesdropper. As a byproduct it also provides a more transparent understanding of the structure of the optimal covariance matrix for the MIMOME channel.

In the second part of the talk we will consider the case when there are only a limited number of RF chains in the MIMOME system. We will discuss how Artificial Noise based Secure-MIMO schemes can be used in such systems, and discuss the constraints on the beam-forming vectors, and propose some novel solutions to these.



**Compressed Sensing, Deep Learning II**

- CSDL-2.1**  
14:00 **A FAST ITERATIVE ALGORITHM FOR DEMIXING SPARSE SIGNALS FROM NONLINEAR OBSERVATIONS**  
*Mohammadreza Soltani, Chinmay Hegde, Iowa State University, United States*
  
- CSDL-2.2**  
14:20 **ACTIVE REGRESSION WITH COMPRESSIVE-SENSING BASED OUTLIER MITIGATION FOR BOTH SMALL AND LARGE OUTLIERS**  
*Jian Zheng, Xiaohua Li, State University of New York at Binghamton, United States*
  
- CSDL-2.3**  
14:40 **BURN SCAR DETECTION USING CLOUDY MODIS IMAGES VIA LOW-RANK AND SPARSITY-BASED MODELS**  
*Minh Dao, The Johns Hopkins University, United States; Chiman Kwan, Bulent Ayhan, Applied Research LLC, United States; Trac Tran, The Johns Hopkins University, United States*
  
- CSDL-2.4**  
15:00 **SPARSITY-BASED FUSION OF MULTIPLE SENSORS AND MULTIPLE FEATURES FOR ACOUSTIC TRANSIENTS CLASSIFICATION**  
*Minh Dao, Tung-Duong Tran-Luu, U.S. Army Research Laboratory, United States; Nasser Nasrabadi, West Virginia University, United States*

**Information Theoretic Approaches to Security and Privacy II**

Session Chair: David Kibloff, INRIA

- ITSP-K2**  
14:00 **Keynote: SECURE BROADCASTING OVER A WIRETAP CHANNEL USING SHARED SECRET KEYS**  
*Ashish Khisti, University of Toronto*
  
- ITSP-2.4**  
15:00 **ACHIEVING SEMANTIC SECURITY WITHOUT KEYS THROUGH CODING AND ALL-OR-NOTHING TRANSFORMS OVER WIRELESS CHANNELS**  
*Marco Baldi, Linda Senigagliaesi, Franco Chiaraluca, Università Politecnica delle Marche, Italy*
  
- ITSP-2.5**  
15:20 **ON THE INPUT DISTRIBUTION AND OPTIMAL BEAMFORMING FOR THE MISO VLC WIRETAP CHANNEL**  
*Mohamed Amine Arfaoui, Texas A&M University at Qatar, Qatar; Zouheir Rezki, University of Idaho, United States; Ali Ghrayeb, Texas A&M University at Qatar, Qatar; Mohamed-Slim Alouini, King Abdullah University of Science and Technology, Saudi Arabia*

**Distributed Information Processing, Optimization, and Resource Management over Networks I**

Session Chair: Alejandro Ribeiro, University of Pennsylvania

- RMN-1.1**  
14:00 **A PROJECTION-FREE DECENTRALIZED ALGORITHM FOR NON-CONVEX OPTIMIZATION**  
*Hoi-To Wai, Anna Scaglione, Arizona State University, United States; Jean Lafond, Telecom ParisTech, France; Eric Moulines, Ecole Polytechnique, France*
- RMN-1.2**  
14:20 **DISTRIBUTED FIRST AND SECOND ORDER METHODS WITH INCREASING NUMBER OF WORKING NODES**  
*Dusan Jakovetic, Natasa Krklec Jerinkic, Natasa Krejic, Dragana Bajovic, University of Novi Sad, Serbia*
- RMN-1.3**  
14:40 **LINEARLY CONVERGENT DECENTRALIZED CONSENSUS OPTIMIZATION OVER DIRECTED NETWORKS**  
*Angelia Nedich, Alex Olshevsky, Wei Shi, University of Illinois at Urbana-Champaign, United States*
- RMN-1.4**  
15:00 **ROBUST GROUP LASSO OVER DECENTRALIZED NETWORKS**  
*Manxi Wang, Yongcheng Li, State Key Laboratory of Complex Electromagnetic Environment Effects on Electronics and Information System, China; Xiaohan Wei, University of Southern California, United States; Qing Ling, University of Science and Technology of China, China*
- RMN-1.5**  
15:20 **DISTRIBUTED FICTITIOUS PLAY FOR MULTI-AGENT SYSTEMS WITH UNCERTAINTY**  
*Ceyhun Eksin, Georgia Institute of Technology, United States; Alejandro Ribeiro, University of Pennsylvania, United States*

**Measurement-based Smart Grid Analytics**

Session Chair: Abdallah Farraj, University of Toronto

- SGI-2.1**  
14:00 **COHERENCE FUNCTION ESTIMATION WITH A DERIVATIVE CONSTRAINT FOR POWER GRID OSCILLATION DETECTION**  
*Mohammadreza Ghorbaniparvar, Ning Zhou, Xiaohua Li, Binghamton University, United States*
- SGI-2.2**  
14:20 **PERSISTENT-HOMOLOGY-BASED DETECTION OF POWER SYSTEM LOW-FREQUENCY OSCILLATIONS USING PMUS**  
*Yang Chen, PJM Interconnection, United States; Harish Chintakunta, Florida Polytechnic University, United States; Le Xie, Texas A&M University, United States; Yuliy Baryshnikov, University of Illinois at Urbana-Champaign, United States; P. R. Kumar, Texas A&M University, United States*
- SGI-2.3**  
14:40 **MULTIVARIATE EMPIRICAL MODE DECOMPOSITION BASED SIGNAL ANALYSIS AND EFFICIENT-STORAGE IN SMART GRID**  
*Liu Liu, University of Tennessee, United States; Austin Albright, Oak Ridge National Laboratory, United States; Alireza Rahimpour, Jiahui Guo, Hairong Qi, Yilu Liu, University of Tennessee, United States*
- SGI-2.4**  
15:00 **ANTICIPATORY SYSTEM FOR DETECTION OF HIDDEN FACILITIES UTILIZING NODAL LOAD CONSUMPTION INFORMATION IN SMART GRIDS**  
*Miltiadis Alamaniotis, Lefteri Tsoukalas, Purdue University, United States*
- SGI-2.5**  
15:20 **EFFICIENT NEURAL NETWORK ARCHITECTURE FOR TOPOLOGY IDENTIFICATION IN SMART GRID**  
*Yue Zhao, Stony Brook University, United States; Jianshu Chen, Microsoft Research, United States; H. Vincent Poor, Princeton University, United States*

Wednesday, December 7	14:00 - 15:40	Wednesday, December 7	14:00 - 15:40
Lecture Session	SPBD-2	Lecture Session	UCD-2
	Salon H		Salon J

## Signal Processing of Big Data II

Session Chair: Patrick Wolfe, University College London

- SPBD-2.1** **THE BRAIN STRATEGY FOR ONLINE LEARNING**  
14:00  
*Stefan Vlaski, Bicheng Ying, Ali Sayed, University of California, Los Angeles, United States*
- SPBD-2.2** **STABLE ESTIMATION OF GRANGER-CAUSAL FACTORS OF COUNTRY-LEVEL INNOVATION**  
14:20  
*Aurelie Lozano, Prasanna Sattigeri, Aleksandra Mojsilovic, Kush Varshney, IBM Thomas J. Watson Research Center, United States*
- SPBD-2.3** **SUBMODULAR MAXIMIZATION WITH MULTI-KNAPSACK CONSTRAINTS AND ITS APPLICATIONS IN SCIENTIFIC LITERATURE RECOMMENDATIONS**  
14:40  
*Qilian Yu, University of California, Davis, United States; Easton Li Xu, Texas A&M University, United States; Shuguang Cui, University of California, Davis, United States*
- SPBD-2.4** **EXTRACTING SIGNALS FROM NEWS STREAMS FOR DISEASE OUTBREAK PREDICTION**  
15:00  
*Sunandan Chakraborty, Lakshminarayanan Subramanian, New York University, United States*

## Signal Processing for Understanding Crowd Dynamics II

Session Chair: Peter Tu, GE Global Research

- UCD-2.1** **AN ANALYSIS OF THE ROBUSTNESS OF DEEP FACE RECOGNITION NETWORKS TO NOISY TRAINING LABELS**  
14:00  
*Christopher Reale, University of Maryland, United States; Nasser Nasrabadi, West Virginia University, United States; Rama Chellappa, University of Maryland, United States*
- UCD-2.2** **A GAME-THEORETIC MODELING OF POPULARITY DYNAMICS**  
14:20  
*Xuanyu Cao, University of Maryland, United States; Yan Chen, University of Electronic Science and Technology of China, China; K.J. Ray Liu, University of Maryland, United States*
- UCD-2.3** **DATA MINING THE UNDERLYING TRUST IN THE US CONGRESS**  
14:40  
*Xiaoxiao Wu, Hoi-To Wai, Anna Scaglione, Arizona State University, United States*
- UCD-2.4** **ACTIVE SPEAKER DETECTION IN HUMAN MACHINE MULTIPARTY DIALOGUE USING VISUAL PROSODY INFORMATION**  
15:00  
*Fasih Haider, Trinity College Dublin, Ireland; Saturnino Luz, University of Edinburgh, United Kingdom; Nick Campbell, Trinity College Dublin, Ireland*
- UCD-2.5** **THE CROWD CONGESTION LEVEL - A NEW MEASURE FOR RISK ASSESSMENT IN VIDEO-BASED CROWD MONITORING**  
15:20  
*Sebastian Bek, Eduardo Monari, Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (IOSB), Germany*

**General Symposium Poster: Source Separation and Deconvolution**

Session Chair: Brian Mark, George Mason University

- GS-P1.1** **DEFLATIONARY BLIND SOURCE EXTRACTION USING AN EXACT SOLUTION SUBSPACE SEARCHING SCHEME**  
*Mingjian Zhang, Hunan Police Academy, China; Xiaohua Li, State University of New York at Binghamton, United States*
  
- GS-P1.2** **PROJECTIONS ONTO THE EPIGRAPH SET OF THE FILTERED VARIATION FUNCTION BASED DECONVOLUTION ALGORITHM**  
*Mohammad Tofiqi, The Pennsylvania State University, United States; A. Enis Cetin, Bilkent University, Turkey*
  
- GS-P1.3** **ROBUST REGULARIZED LEAST-SQUARES BEAMFORMING APPROACH TO SIGNAL ESTIMATION**  
*Mohamed Suliman, Tarig Ballal, Tareq Y. Al-Naffouri, King Abdullah University of Science and Technology, Saudi Arabia*
  
- GS-P1.4** **ROBUST PCA: LOW RANK MATRIX ESTIMATION WITH HARD OR SOFT THRESHOLDING-BASED OUTLIER REJECTION**  
*Brian Moore, Raj Rao Nadakuditi, University of Michigan, United States*

**Cognitive Radars: Some Applications**

**Maria Sabrina Greco, University of Pisa**



This paper focuses on some applications of cognitive radars. Cognitive radars are systems based on a perception-action cycle that sense the environment and learn from it important information on the target and its background, then adapt the transmitted waveform to optimally satisfy the needs of their mission according to a desired goal. Both active and passive radars are considered, highlighting the limits and the path forward. In particular, we here consider cognitive active radars that work in spectrally dense environments and change the transmitted waveform on-the-fly to avoid interference with the primary user of the channel, such as broadcast or communication systems.

We also describe cognitive passive radars, which contrary to the active ones cannot directly change the transmitted waveforms on-the-fly but can instead select the best source of opportunity to improve the detection and tracking performance.

**Machine Learning for Characterization of Cognitive Communications and Radar I**

Session Chair: George Stantchev, Naval Research Laboratory

**CCR-K1** **Keynote: COGNITIVE RADARS: SOME APPLICATIONS**  
16:10 *Maria S. Greco, Fulvio Gini, Pietro Stinco, University of Pisa, Italy*

**CCR-1.3** **TARGET DETECTION AND RCS AMPLITUDE ESTIMATION IN**  
16:50 **LARGE-SCALE MIMO RADAR USING FREE PROBABILITY THEORY**  
*Hong Jiang, Wenbo Zhang, Yin Li, Jilin University, China*

**CCR-1.4** **OPTIMAL EXPLOITATION OF FLUCTUATING TARGET**  
17:10 **MEASUREMENTS**  
*Chris Kreucher, Paul Bierdz, IAI, United States; Kristine Bell, Metron Scientific Solutions, United States*

**Compressed Sensing, Deep Learning III**

Session Chair: Piya Pal, University of California, San Diego

**CSDL-3.1** **PAIRWISE INTERACTION ANALYSIS OF LOGISTIC**  
16:10 **REGRESSION MODELS**  
*Easton Li Xu, Xiaoning Qian, Tie Liu, Texas A&M University, United States; Shuguang Cui, University of California, Davis, United States*

**CSDL-3.2** **RECONSTRUCTION OF SPARSE VECTORS IN COMPRESSIVE**  
16:30 **SENSING WITH MULTIPLE MEASUREMENT VECTORS USING BIDIRECTIONAL LONG SHORT-TERM MEMORY**  
*Hamid Palangi, Rabab Ward, University of British Columbia, Canada; Li Deng, Microsoft Research, United States*

**CSDL-3.3** **GHOSTING SUPPRESSION FOR INCREMENTAL PRINCIPAL**  
16:50 **COMPONENT PURSUIT ALGORITHMS**  
*Paul Rodriguez, PUCP, Peru; Brendt Wohlberg, LANL, United States*

**CSDL-3.4** **SYMMETRIC POLYNOMIAL & CRT BASED ALGORITHMS FOR**  
17:10 **MULTIPLE FREQUENCY DETERMINATION FROM UNDERSAMPLED WAVEFORMS**  
*Hanshen Xiao, MIT, United States; Cas Cremers, University of Oxford, United Kingdom; Hari Krishna Garg, National University of Singapore, Singapore*

**General Symposium: Optical and Visible Light Communications**

Session Chair: Brian Mark, George Mason University

- GS-1.1** 16:10 **DOWNLINK RESOURCE ALLOCATION FOR MULTICHANNEL TDMA VISIBLE LIGHT COMMUNICATIONS**  
*Amr M. Abdelhady, Osama Amin, Anas Chaaban, Mohamed-Slim Alouini, King Abdullah University of Science and Technology, Saudi Arabia*
- GS-1.2** 16:30 **INTER-CELL INTERFERENCE COORDINATION FOR MULTI-COLOR VISIBLE LIGHT COMMUNICATION NETWORKS**  
*Kaixiong Zhou, Chen Gong, Qian Gao, Zhengyuan Xu, University of Science and Technology of China, China*
- GS-1.3** 16:50 **OPTICAL WIRELESS SCATTERING COMMUNICATION SYSTEM WITH A NON-IDEAL PHOTON-COUNTING RECEIVER**  
*Difan Zou, Chen Gong, Zhengyuan Xu, University of Science and Technology of China, China*
- GS-1.4** 17:10 **ACHIEVABLE RATE AND OPTIMAL SIGNALING FOR AN OPTICAL WIRELESS DECODE-AND-FORWARD RELAYING CHANNEL**  
*Guangtao Zheng, Qian Gao, Cheng Gong, Zhengyuan Xu, University of Science and Technology of China, China*

**Cyber-physical Attacks and Forensics**

Session Chair: Meng Wang, Rensselaer Polytechnic Institute

- SGI-3.1** 16:10 **ONLINE ROBUST SUBSPACE CLUSTERING FOR ANALYZING INCOMPLETE SYNCHROPHASOR MEASUREMENTS**  
*Young-hwan Lee, Seung-Jun Kim, University of Maryland, Baltimore County, United States*
- SGI-3.3** 16:50 **LOAD OSCILLATING SMART METER ATTACK**  
*Carter Lassetter, Eduardo Cotilla-Sanchez, Jinsub Kim, Oregon State University, United States*
- SGI-3.4** 17:10 **ADAPTIVE STATISTICAL DETECTION OF FALSE DATA INJECTION ATTACKS IN SMART GRIDS**  
*Michael Kallitsis, Merit Network, Inc., United States; Shrijita Bhattacharya, Stilian Stoev, University of Michigan, United States; George Michailidis, University of Florida, United States*

### Signal Processing of Big Data III

Session Chair: Georgios B. Giannakis, University of Minnesota

- SPBD-3.1** 16:10 **SPARSE LINEAR REGRESSION VIA GENERALIZED ORTHOGONAL LEAST-SQUARES**  
*Abolfazl Hashemi, Haris Vikalo, The University of Texas at Austin, United States*
- SPBD-3.2** 16:30 **FAST AND COST-EFFECTIVE GREEDY ALGORITHM FOR COMPRESSIVE SENSING OF LARGE-SCALE SIGNALS**  
*Sung-Hsien Hsieh, Chun-Shien Lu, Academia Sinica, Taiwan; Soo-Chang Pei, National Taiwan University, Taiwan*
- SPBD-3.3** 16:50 **A DICTIONARY BASED GENERALIZATION OF ROBUST PCA**  
*Sirisha Rambhatla, Xingguo Li, Jarvis Haupt, University of Minnesota - Twin Cities, United States*
- SPBD-3.4** 17:10 **SCALABLE AND ROBUST PCA APPROACH WITH RANDOM COLUMN/ROW SAMPLING**  
*Mostafa Rahmani, George Atia, University of Central Florida, United States*

### Information Theoretic Approaches to Security and Privacy Poster

Session Chair: Ana Chabaan, King Abdullah University of Science and Technology

- ITSP-P1.1** **A MINORIZATION-MAXIMIZATION ALGORITHM FOR AN-BASED MIMOME SECRECY RATE MAXIMIZATION**  
*Mudassir Masood, Ali Ghayeb, Texas A&M University at Qatar, Qatar; Prabhu Babu, CARE, IIT Delhi, India; Issa Khalil, QCRI, Qatar; Mazen Hasna, Qatar University, Qatar*
- ITSP-P1.2** **ROBUST ENERGY-EFFICIENT TRANSMIT DESIGN FOR MISOME WIRETAP CHANNELS**  
*Weidong Mei, Zhi Chen, Jun Fang, University of Electronic Science and Technology of China, China*
- ITSP-P1.3** **RELIABLE SECRET-KEY BINDING FOR PHYSICAL UNCLONABLE FUNCTIONS WITH TRANSFORM CODING**  
*Onur Günlü, Technical University of Munich, Germany; Onurcan Iscan, Huawei Technologies Duesseldorf GmbH, Germany; Vladimir Sidorenko, Gerhard Kramer, Technical University of Munich, Germany*
- ITSP-P1.4** **PHYSICAL LAYER SECURITY GAME WITH FULL-DUPLEX PROACTIVE EAVESDROPPER**  
*Wei Huang, Wei Chen, Bo Bai, Shidong Zhou, Tsinghua University, China; Zhu Han, University of Houston, United States*
- ITSP-P1.5** **ACHIEVING FULL SECURE DEGREES-OF-FREEDOM FOR THE MISO WIRETAP CHANNEL WITH AN UNKNOWN EAVESDROPPER**  
*Mohamed Chraïti, Concordia University, Canada; Ali Ghayeb, Texas A&M University at Qatar, Qatar; Chadi Assi, Concordia University, Canada*
- ITSP-P1.6** **STRONG SECRECY CAPACITY OF ARBITRARILY VARYING WIRETAP CHANNELS WITH FINITE COORDINATION RESOURCES**  
*Ahmed Mansour, Holger Boche, Technische Universität München, Germany*
- ITSP-P1.7** **PRIVACY PROTECTION: A COMMUNITY-STRUCTURED EVOLUTIONARY GAME APPROACH**  
*Jun Du, Chunxiao Jiang, Tsinghua University, China; Shui Yu, Deakin University, Australia; Kwang-Cheng Chen, National Taiwan University, Taiwan; Yong Ren, Tsinghua University, China*

**Distributed Information Processing, Optimization, and Resource Management over Networks Poster**

Session Chair: Qing Ling, University of Science and Technology of China

- RMN-P1.1 SENSOR PLACEMENT FOR FIELD ESTIMATION VIA POISSON DISK SAMPLING**  
*Sijia Liu, University of Michigan, United States; Nianxia Cao, Pramod K. Varshney, Syracuse University, United States*
- RMN-P1.2 A ROBUST STATE-TRANSFER ARCHITECTURE FOR DISTRIBUTED AND ASYNCHRONOUS OPTIMIZATION**  
*Tarek Lahlou, Tom Baran, MIT, United States*
- RMN-P1.3 ON LEADER-FOLLOWER MULTI-AGENT SYSTEMS IN DIRECTED LATTICES**  
*Fu Lin, United Technologies Research Center, United States*
- RMN-P1.4 DISTRIBUTED LEARNING FOR RESOURCE ALLOCATION UNDER UNCERTAINTY**  
*Panayotis Mertikopoulos, French National Center for Scientific Research, France; E. Veronica Belmega, École Nationale Supérieure de l'Électronique et de ses Applications, France; Luca Sanguinetti, University of Pisa, Italy*
- RMN-P1.5 DISTRIBUTED REGULARIZED PRIMAL-DUAL METHOD**  
*Masoud Badii Khuzani, Na Li, Harvard University, United States*
- RMN-P1.6 SAMPLING AND DISTORTION TRADEOFFS FOR INDIRECT SOURCE RETRIEVAL**  
*Elaheh Mohammadi, Alireza Fallah, Farokh Marvasti, Sharif University of Technology, Iran*
- RMN-P1.7 A DISTRIBUTED SOLUTION FOR PROPORTIONAL FAIRNESS OPTIMIZATION IN LOAD COUPLED OFDMA NETWORKS**  
*Miguel Angel Gutierrez-Estevéz, Renato Luis Garrido Cavalcante, Slawomir Stanczak, Fraunhofer Heinrich Herz Institute, Germany; Jietao Zhang, Hongcheng Zhuang, Huawei Technologies Co., China*
- RMN-P1.8 DISTRIBUTED SPARSITY-BASED BEARING ESTIMATION WITH A SWARM OF COOPERATIVE AGENTS**  
*Dmitriy Shutin, Siwei Zhang, German Aerospace Center (DLR), Germany*
- RMN-P1.9 OPPORTUNISTIC SENSING FOR JOINT ENERGY HARVESTING AND CHANNEL ACCESS**  
*Fahira Sangare, University of Houston, United States; Duy Huu Ngoc Nguyen, The University of Texas at Austin, United States; Yong Xiao, Zhu Han, University of Houston, United States*
- RMN-P1.10 DECENTRALIZED CONSTRAINED CONSENSUS OPTIMIZATION WITH PRIMAL DUAL SPLITTING PROJECTION**  
*Han Zhang, University of Science and Technology of China, China; Wei Shi, University of Illinois at Urbana-Champaign, United States; Aryan Mokhtari, Alejandro Ribeiro, University of Pennsylvania, United States; Qing Ling, University of Science and Technology of China, China*
- RMN-P1.11 AN ASYNCHRONOUS QUASI-NEWTON METHOD FOR CONSENSUS OPTIMIZATION**  
*Mark Eisen, Aryan Mokhtari, Alejandro Ribeiro, University of Pennsylvania, United States*
- RMN-P1.12 DISTRIBUTED RAN AND BACKHAUL OPTIMIZATION FOR ENERGY EFFICIENT WIRELESS NETWORKS**  
*Daniyal Amir Awan, Technische Universitaet Berlin, Germany; Renato Luis Garrido Cavalcante, Slawomir Stanczak, Fraunhofer Heinrich Hertz Institute, Germany*
- RMN-P1.13 IN-NETWORK LINEAR REGRESSION WITH ARBITRARILY SPLIT DATA MATRICES**  
*Francois Cote, Ioannis Psaromiligkos, Warren J. Gross, McGill University, Canada*
- RMN-P1.14 DISTRIBUTED NETWORK RESOURCE ALLOCATION WITH INTEGER CONSTRAINTS**  
*Yujiao Cheng, Houfeng Huang, Gang Wu, Qing Ling, University of Science and Technology of China, China*

**Signal Processing for Understanding Crowd Dynamics Poster**

Session Chair: Eduardo Monari, Fraunhofer IOSB

- UCD-P1.1 SURFACE-BASED BACKGROUND COMPLETION IN 3D SCENE**  
*Po-Jen Lai, Yung-Lin Huang, Shao-Yi Chien, National Taiwan University, Taiwan*
- UCD-P1.2 A HIERARCHICAL APPROACH TO EVENT DISCOVERY FROM SINGLE IMAGES USING MIL FRAMEWORK**  
*Kashif Ahmad, Francesco De Natale, Giulia Boato, Andrea Rosani, University of Trento, Italy*
- UCD-P1.3 THE IMPACT OF PHASE TRANSITION ON QUALITY ASSESSMENT OF NATURAL IMAGES**  
*Ning Liu, Guangtao Zhai, Shanghai Jiao Tong University, China*
- UCD-P1.4 EMPLOYING VECTOR QUANTIZATION ON DETECTED FACIAL PARTS FOR FACE RECOGNITION**  
*Ahmed Aldhahab, Taif Al Obaidi, Wasfy B. Mikhael, University of Central Florida, United States*
- UCD-P1.5 TRACKING HIERARCHICAL STRUCTURE OF WEB VIDEO GROUPS BASED ON SALIENT KEYWORD MATCHING INCLUDING SEMANTIC BROADNESS ESTIMATION**  
*Ryosuke Harakawa, Takahiro Ogawa, Miki Haseyama, Hokkaido University, Japan*
- UCD-P1.6 A TRAFFIC CONGESTION PREDICTION AND RELIEF MODEL BASED ON THE MARKOV CHAIN**  
*Yang Bao, Yan Zheng, Jesse Jin, Yanran Li, Youpeng Deng, Tianjin University, China; Lei Gao, Liping Xiao, Beijing Aerospace Institute, China*
- UCD-P1.7 CROWD ANALYSIS USING VISUAL AND NON-VISUAL SENSORS, A SURVEY**  
*Muhammad Irfan, University of Genova, Italy; Laurissa Tokarchuk, Queen Mary University of London, United Kingdom; Lucio Marcenaro, University of Genova, Italy*
- UCD-P1.8 DYNAMIC SCENE CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORKS**  
*Aalok Gangopadhyay, Shivam Mani Tripathi, Ishan Jindal, Shanmuganathan Raman, IIT Gandhinagar, India*
- UCD-P1.9 ACTION CLASSIFICATION FROM MOTION CAPTURE DATA USING TOPOLOGICAL DATA ANALYSIS**  
*Alireza Dirafzoon, Namita Lokare, Edgar Lobaton, North Carolina State University, United States*



## The Big Neuroimaging Data Extraction: How Advanced Signal Processing Can Unravel the Brain's Functional Organization

Dimitri Van De Ville, EPFL

Observing and analyzing human brain function is a truly interdisciplinary endeavor combining engineering, neurosciences, and medicine. State-of-the-art technologies such as functional magnetic resonance imaging (fMRI) allow to non-invasively acquire a sequence of whole-brain snapshots that indirectly measure neuronal activity. Recent "big data" initiatives (e.g., Human Connectome Project) provide us with large datasets reflecting the complex structure of human brain activity. Advanced signal processing plays a major role to extract meaningful and interpretable features. Here we present one such example to characterize dynamics of resting-state fMRI. Using state-of-the-art sparsity-driven deconvolution [1,2], we extract innovation-driven co-activation patterns (iCAPs) from resting-state fMRI [3]. The iCAPs' maps are spatially overlapping and their activity-inducing signals temporally overlapping. Decomposing resting-state fMRI in terms of iCAPs reveals the rich spatiotemporal structure of functional components that dynamically assemble known resting-state networks. The temporal overlap between iCAPs is substantial, which confirms crosstalk happening at the fMRI timescale; on average, three to four iCAPs occur simultaneously in specific combinations that are consistent with their behaviour profiles according to BrainMap. Intriguingly, in contrast to conventional connectivity analysis, which suggests a negative correlation between fluctuations in the default-mode network (DMN) and task-positive networks, we instead find evidence for two DMN-related iCAPs consisting the posterior cingulate cortex that differentially interact with the attention network. These findings illustrate how conventional correlational approaches might be misleading in terms of how task-positive and -negative networks interact, and suggest that more detailed, dynamical decompositions can give more accurate descriptions of functional components of spontaneous activity.



## Signal Processing Challenges in Broadband mmWave

Robert W. Heath, Jr., University of Texas at Austin

Millimeter wave is the future of cellular and local area networks. Though the main motivation for mmWave is large spectral channels, most signal processing work has focused on tractable narrowband signal models. In this talk I review the challenges associated with signal processing in broadband millimeter wave channels.

Then I review recent developments on two important topics. First, I explain the design of hybrid precoding and combining algorithms, which use a mixture of frequency-flat analog and frequency-selective digital precoding and combining. Second, I show how to formulate the hybrid frequency selective channel estimation algorithm to exploiting sparsity in the delay and angular domains. The hybrid precoders and combiners can then be configured based on the channel estimates, to achieve high spectral efficiency in broadband MIMO channels.



## Multimedia Signal Processing: From Feature Engineering to Deep Learning

**Behzad Shahraray, AT&T Labs**

Driven by the Internet and the Web, an increasing amount of multimedia data is generated and shared by a variety of sources including Internet of Things (IoT) and mobile devices. The enormous amount of available multimedia data has created new challenges for management and effective discovery and utilization of this data. Fortunately, the same drivers have also enabled and facilitated the generation of accompanying auxiliary descriptive information through social networks and crowdsourcing. This combination of the large annotated datasets and high performance computing resources has given rise to a new generation of data-driven algorithms. Deep convolutional neural networks have generated impressive results in multimedia signal processing problems such as image classification, face processing, and speech recognition. This talk will mainly focus on visual information processing and will present the progress in the last decade or so in feature-based algorithms and data-driven algorithms based on deep learning that have surpassed previous algorithms, and in some cases even human performance on these visual tasks.



## Power Systems Without Fuel

**Josh Taylor, University of Toronto**

Renewable integration is a century-long project. Over the past decade we have made impressive progress in integrating renewables, energy storage, and demand response into the existing power infrastructure. In this talk, we jump forward to a hypothetical final destination: power systems without fuel. In power systems without fuel, small, modular, renewable sources supply all power. In addition to sustainability and environmental benevolence, power systems without fuel offer superior operation to current power systems due to, for example, the obsolescence of unit commitment, the decreased importance of frequency, and the increased viability of direct current. We motivate several research problems under this umbrella, including electricity markets without fuel costs, decentralized control of direct current systems, and machine learning for demand response.



**Data 4 Good****Aleksandra Mojsilović, IBM Research**

The social good movement has taken root with many a corporation, entrepreneur and big thinker, with the simple aim of using technology to help create a better world. Data analytics, signal processing and related disciplines present one increasingly important way in which social good can be made possible and new communities are growing around it, fueled in large part by the fact that we are no longer constrained by data. Everything from Internet activity, satellite imagery, social media, health records, news, scientific publications, economic data, weather data, and government records is at our fingertips, giving us an unprecedented opportunity to change the world for the better using data sciences. From reducing or eliminating inequalities, to improving access to health care and education, to reducing pollution and our carbon footprint, the opportunities are endless. In this talk, Saška will give an overview of the emerging area of data science for social good. She will illustrate how the state of the art signal processing toolkit (e.g. prediction, classification, optimization, visualization, NLP) is driving new social good applications, and will present a broad range of innovative examples of doing good with data. She will explore the interdisciplinary nature of social good projects, and highlight data and algorithmic challenges that might call for new research directions.

**Learning Graphs from Data****Antonio Ortega, University of Southern California**

There has been significant recent progress in the development of tools for graph signal processing, including methods for sampling and transforming graph signals. In many applications, a graph needs to be learned from data before these graph signal processing methods can be applied. A standard approach for graph learning is to estimate the empirical covariance from the data and then compute an inverse covariance (precision) matrix under desirable structural constraints. We present recent results that allow us to solve these problems under constraints that encompass a broad class of generalized graph Laplacians. These methods are computationally efficient, can incorporate sparsity constraints, and can also be used to optimize weights for a given known topology. We illustrate these ideas with examples in image processing and other areas.



## Algorithms, Architectures, and Testbeds for 5G Wireless Communication Systems

Joe Cavallaro, Rice University

Wireless communication system concepts for 5G include a variety of advanced physical layer algorithms to provide high data rates and increased efficiency. Each of these algorithms provide different challenges for real-time performance based on the tradeoffs between computation, communication, and I/O bottlenecks and area, time, and power complexity. In particular, Massive MIMO systems can provide many benefits for both uplink detection and downlink beamforming as the number of base station antennas increases. Similarly, channel coding, such as LDPC, can support high data rates in many channel conditions. At the RF level, limited available spectrum is leading to noncontiguous channel allocations where digital pre-distortion (DPD) can be used to improve power amplifier efficiency. Each of these schemes impose complex system organization challenges in the interconnection of multiple RF transceivers with multiple memory and computation units with multiple data rates within the system. Parallel numerical methods can be applied to tradeoff computational complexity with minimal effect on error rate performance. Simulation acceleration environments can be used to provide thorough system performance analysis. In this talk, we will focus on design tools for high level synthesis (HLS) to capture and express parallelism in wireless algorithms. This also includes the mapping to GPU and multicore systems for high speed simulation. HLS can also be applied to FPGA and ASIC synthesis, however, there exist tradeoffs in area with flexibility and reuse of designs. Heterogeneous system architectures as expressed by Systems on Chip (SoC) attempt to address these system issues. The talk will conclude with a discussion of computation testbeds from supercomputers through desktop GPU to single board systems. The integration with radio testbeds from WARP and USRP to NI and Argos prototype massive MIMO systems will be explored.



## Big Data Analysis and Challenges in Medical Imaging I

Session Chair: Selin Aviyente, Michigan State University

- BDMI-1.1**  
11:00 **COMPLEXITY REDUCTION TECHNIQUES IN MUSIC-BASED EEG SOURCE LOCALIZATION**  
*Seyedemahya Safavi, SeungJae Lee, Beth Lopour, Pai Chou, University of California, Irvine, United States*
- BDMI-1.2**  
11:20 **GRAPH INFORMATION THEORETIC MEASURES ON FUNCTIONAL CONNECTIVITY NETWORKS BASED ON GRAPH-TO-SIGNAL TRANSFORM**  
*Marisel Villafane-Delgado, Selin Aviyente, Michigan State University, United States*
- BDMI-1.3**  
11:40 **SUM OF OUTER PRODUCTS DICTIONARY LEARNING FOR INVERSE PROBLEMS**  
*Saiprasad Ravishankar, Raj Rao Nadakuditi, Jeffrey A. Fessler, University of Michigan, United States*

### Compressed Sensing, Deep Learning IV

Session Chair: Farhad Pourkamali-Anaraki, University of Colorado, Boulder

- CSDL-4.1**  
11:00 **A RANDOMIZED APPROACH TO EFFICIENT KERNEL CLUSTERING**  
*Farhad Pourkamali-Anaraki, Stephen Becker, University of Colorado at Boulder, United States*
- CSDL-4.2**  
11:20 **INVARIANT HIERARCHICAL SPARSE CODING FOR OBJECT RECOGNITION VIA BAGS OF ATOMS**  
*Xiaoxia Sun, Johns Hopkins University, United States; Nasser Nasrabadi, West Virginia University, United States; Trac Tran, Johns Hopkins University, United States*
- CSDL-4.3**  
11:40 **AXIOMATIC HIERARCHICAL CLUSTERING FOR INTERVALS OF METRIC DISTANCES**  
*Weiyu Huang, Alejandro Ribeiro, University of Pennsylvania, United States*
- CSDL-4.4**  
12:00 **EFFICIENT LEARNING OF DICTIONARIES WITH LOW-RANK ATOMS**  
*Saiprasad Ravishankar, Brian Moore, Raj Rao Nadakuditi, Jeffrey A. Fessler, University of Michigan, United States*

### Transceiver Implementations and Architectures

Session Chair: Liang Dong, Baylor University

- DT5G-K2**  
11:00 **Keynote: ALGORITHMS, ARCHITECTURES, AND TESTBEDS FOR 5G WIRELESS COMMUNICATION SYSTEMS**  
*Joe Cavallaro, Rice University*
- DT5G-1.3**  
11:40 **DECENTRALIZED BEAMFORMING FOR MASSIVE MU-MIMO ON A GPU CLUSTER**  
*Kaipeng Li, Rice University, United States; Rishi Sharan, Cornell University, United States; Yujun Chen, Joseph R. Cavallaro, Rice University, United States; Tom Goldstein, University of Maryland, United States; Christoph Studer, Cornell University, United States*
- DT5G-1.4**  
12:00 **COMPACT MODELING AND MANAGEMENT OF RECONFIGURATION IN DIGITAL CHANNELIZER IMPLEMENTATION**  
*Adrian Sapio, University of Maryland, United States; Marilyn Wolf, Georgia Institute of Technology, United States; Shuvra Bhattacharyya, University of Maryland, United States*

### Emerging Signal Processing Applications I

Session Chair: Umit Batur, Faraday Future

- ESP-1.1**  
11:00 **FROM CELLULAR NETWORKS TO THE GARDEN HOSE: ADVANCES IN RAINFALL MONITORING VIA CELLULAR POWER MEASUREMENTS**  
*Hagit Messer, Lior Gazit, Tel Aviv University, Israel*
- ESP-1.2**  
11:20 **HIDDEN MARKOV MODEL-BASED GESTURE RECOGNITION WITH FMCW RADAR**  
*Greg Malysa, Dan Wang, Lorin Netsch, Murtaza Ali, Texas Instruments, United States*
- ESP-1.3**  
11:40 **TIME-REVERSAL INDOOR POSITIONING WITH CENTIMETER ACCURACY USING MULTI-ANTENNA WIFI**  
*Chen Chen, Yi Han, University of Maryland College Park, United States; Yan Chen, School of Electronic Engineering, University of Electronic Science and Technology of China, China; Feng Zhang, K.J. Ray Liu, University of Maryland College Park, United States*
- ESP-1.4**  
12:00 **I-LOVIT: INDOOR LOCALIZATION BY VIBRATION TRACKING**  
*Jeffrey Poston, Virginia Tech, United States*

### Smart Grid Control

Session Chair: Abdallah Farraj, University of Toronto

- SGI-4.1**  
11:00 **WIDE-AREA CONTROL OF POWER SYSTEMS USING CLOUD-IN-THE-LOOP FEEDBACK**  
*Matthew Weiss, Jianhua Zhang, Aranya Chakraborty, North Carolina State University, United States*
- SGI-4.2**  
11:20 **SPARSITY-PROMOTING CONTROLLER DESIGN FOR VSC-BASED MICROGRIDS**  
*Yanhua Tian, Joshua A. Taylor, University of Toronto, Canada*
- SGI-4.3**  
11:40 **CYBER-RESILIENT CONTROL OF INVERTER BASED MICROGRIDS**  
*Martine Chlela, Diego Mascarella, Geza Joos, McGill University, Canada; Marthe Kassouf, Hydro-Québec (IREQ), Canada*

### Signal and Information Processing Over Networks I

Session Chair: Santiago Segarra, University of Pennsylvania

- SPN-1.1**  
11:00 **DISTRIBUTED SEQUENCE PREDICTION: A CONSENSUS + INNOVATIONS APPROACH**  
*Anit Kumar Sahu, Soumya Kar, Carnegie Mellon University, United States*
  
- SPN-1.2**  
11:20 **MULTILAYER SPECTRAL GRAPH CLUSTERING VIA CONVEX LAYER AGGREGATION**  
*Pin-Yu Chen, Alfred Hero, University of Michigan, United States*
  
- SPN-1.3**  
11:40 **CONSTRUCTION OF UNDERSAMPLED GRAPH FILTER BANKS VIA ROW SUBSET SELECTION**  
*Akie Sakiyama, Yuichi Tanaka, Tokyo University of Agriculture and Technology, Japan*
  
- SPN-1.4**  
12:00 **SHANNON SAMPLING AND AN INVERSE PROBLEM FOR THE SCHRÖDINGER EQUATION ON COMBINATORIAL GRAPHS**  
*Isaac Pesenson, Temple University, United States*

### Signals, Information & Systems In Consumer Robot Products

**Robert Pack, Jibo, Inc.**



The application space of robotics sparks the imagination and provides a daunting set of challenges for any product developer. What was once fiction is now in our homes and where fear of rejection once dominated the thoughts of robotics visionaries, the amazing reality is that we are not delivering new products fast enough into a diverse and growing market. This talk will provide some background about the consumer robotics market and outline the challenges that robot product developers face by describing the architecture and elements of a modern robot product. It will touch on hardware, sensing and processors up through the many interacting layers of signal and information processing that breathe life into a consumer robot system.

By illustrating key signal processing and information processing challenges that arise in such an integrated system, the talk will provide insights and feedback from the trenches of product development to the signal and information processing community on technical enablers that can help developers address the growing market of consumer robot products worldwide.

### Millimeter Wave Technologies

Session Chair: Shengqian Han, Beihang University

- DT5G-2.1**  
14:00 **DYNAMIC SUBARRAY ARCHITECTURE FOR WIDEBAND HYBRID PRECODING IN MILLIMETER WAVE MASSIVE MIMO SYSTEMS**  
*Sungwoo Park, Ahmed Alkhateeb, Robert W. Heath Jr., The University of Texas at Austin, United States*
- DT5G-2.2**  
14:20 **JOINT SPATIALLY SPARSE CHANNEL ESTIMATION FOR MILLIMETER-WAVE CELLULAR SYSTEMS**  
*Cheng-Rung Tsai, Chiang-Hen Chen, Yu-Hsin Liu, An-Yeu (Andy) Wu, National Taiwan University, Taiwan*
- DT5G-2.3**  
14:40 **PROGRESSIVE CHANNEL ESTIMATION FOR ULTRA-LOW LATENCY MILLIMETER-WAVE COMMUNICATIONS**  
*Hung-Yi Cheng, Ching-Chun Liao, An-Yeu (Andy) Wu, National Taiwan University, Taiwan*
- DT5G-2.4**  
15:00 **ANALYSIS OF BEAM SWEEP CHANNEL ESTIMATION IN MMWAVE MASSIVE MIMO NETWORKS**  
*Tianyang Bai, Robert W. Heath Jr., The University of Texas at Austin, United States*
- DT5G-2.5**  
15:20 **COMPRESSIVE SENSING BASED INITIAL BEAMFORMING TRAINING FOR MASSIVE MIMO MILLIMETER-WAVE SYSTEMS**  
*Han Yan, Danijela Cabric, University of California, Los Angeles, United States*

### Emerging Signal Processing Applications II

Session Chair: Mike Polley, Samsung USA

- ESP-K2**  
14:00 **Keynote: SIGNALS, INFORMATION & SYSTEMS IN CONSUMER ROBOT PRODUCTS**  
*Robert Pack, Jibo, Inc.*
- ESP-2.4**  
15:00 **CASCADED REGRESSION FOR 3D POSE ESTIMATION FOR MOUSE IN FISHEYE LENS DISTORTED MONOCULAR IMAGES**  
*Ghadi Salem, Jonathan Krynsky, National Institutes of Health, United States; Monson Hayes, George Mason University, United States; Thomas Pohida, National Institutes of Health, United States; Xavier Burgos-Artizzu, Transmural Biotech, Spain*
- ESP-2.5**  
15:20 **COMPLEX INPUT CONVOLUTIONAL NEURAL NETWORKS FOR WIDE ANGLE SAR ATR**  
*Michael Wilmanski, University of Michigan & Integrity Applications Incorporated, United States; Chris Kreucher, Integrity Applications Incorporated, United States; Alfred Hero, University of Michigan, United States*



## Distributed Information Processing, Optimization, and Resource Management over Networks II

Session Chair: Wei Shi, University of Illinois at Urbana-Champaign

**RMN-2.1**  
14:00 **TOWARDS AN ONLINE ENERGY ALLOCATION POLICY FOR DISTRIBUTED ESTIMATION WITH SENSOR COLLABORATION USING ENERGY HARVESTING SENSORS**

*Sijia Liu, University of Michigan, United States; Vinod Sharma, Indian Institute of Science, India; Pramod K. Varshney, Syracuse University, United States*

**RMN-2.2**  
14:25 **A DISTRIBUTED ALGORITHM FOR DICTIONARY LEARNING OVER NETWORKS**

*Mingmin Zhao, Zhejiang University, China; Qingjiang Shi, Zhejiang Sci-Tech University, China; Mingyi Hong, Iowa State University, United States*

**RMN-2.3**  
14:50 **A DATA-DRIVEN APPROACH TO STOCHASTIC NETWORK OPTIMIZATION**

*Tianyi Chen, University of Minnesota, United States; Aryan Mokhtari, University of Pennsylvania, United States; Xin Wang, Fudan University, China; Alejandro Ribeiro, University of Pennsylvania, United States; Georgios B. Giannakis, University of Minnesota, United States*

**RMN-2.4**  
15:15 **DECENTRALIZED ONLINE OPTIMIZATION WITH HETEROGENEOUS DATA SOURCES**

*Alec Koppel, University of Pennsylvania, United States; Brian M. Sadler, U.S. Army Research Laboratory, United States; Alejandro Ribeiro, University of Pennsylvania, United States*

## Optimal Power Flow and Power Markets

Session Chair: Deepa Kundur, University of Toronto

**SGI-5.1**  
14:00 **A CONVEX-OPTIMIZATION METHOD TO PROPAGATE UNCERTAINTY IN POWER FLOW**

*Hyungjin Choi, Peter Seiler, Sairaj Dhople, University of Minnesota, United States*

**SGI-5.2**  
14:20 **CONVERGENCE OF THE Z-BUS METHOD AND EXISTENCE OF UNIQUE SOLUTION IN SINGLE-PHASE DISTRIBUTION LOAD-FLOW**

*Mohammadhafez Bazrafshan, Nikolaos Gatsis, University of Texas at San Antonio, United States*

**SGI-5.3**  
14:40 **MOMENT RELAXATIONS OF OPTIMAL POWER FLOW PROBLEMS: BEYOND THE CONVEX HULL**

*Daniel Molzahn, Argonne National Laboratory, United States; Cédric Josz, RTE, France; Ian Hiskens, University of Michigan, United States*

**SGI-5.4**  
15:00 **SUPPLY FUNCTION EQUILIBRIUM IN POWER MARKETS: MESH NETWORKS**

*Yuanzhang Xiao, Chaithanya Bandi, Ermin Wei, Northwestern University, United States*

**SGI-5.5**  
15:20 **CONTEXTUAL LEARNING FOR UNIT COMMITMENT WITH RENEWABLE ENERGY SOURCES**

*Hyun-Suk Lee, Yonsei University, Korea (South); Cem Tekin, Bilkent University, Turkey; Mihaela van der Schaar, University of California, Los Angeles, United States; Jang-Won Lee, Yonsei University, Korea (South)*

## Signal and Information Processing Over Networks II

Session Chair: Michael Rabbat, McGill University

- SPN-2.1** 14:00 **LOCALIZATION BOUNDS FOR THE GRAPH TRANSLATION**  
*Benjamin Girault, University of Southern California, United States; Paulo Gonçalves, Inria, United States; Shrikanth S. Narayanan, Antonio Ortega, University of Southern California, United States*
- SPN-2.2** 14:20 **CENTER-WEIGHTED MEDIAN GRAPH FILTERS**  
*Santiago Segarra, University of Pennsylvania, United States; Antonio Garcia Marques, King Juan Carlos University, Spain; Gonzalo Arce, University of Delaware, United States; Alejandro Ribeiro, University of Pennsylvania, United States*
- SPN-2.3** 14:40 **EGONET TENSOR DECOMPOSITION FOR COMMUNITY IDENTIFICATION**  
*Fatemeh Sheikholeslami, Brian Baingana, Georgios B. Giannakis, Nicholas D. Sidiropoulos, University of Minnesota, United States*
- SPN-2.4** 15:00 **FREQUENCY ANALYSIS OF TIME-VARYING GRAPH SIGNALS**  
*Andreas Loukas, Damien Foucard, Technical University of Berlin, Switzerland*
- SPN-2.5** 15:20 **TRACKING TIME-VERTEX PROPAGATION USING DYNAMIC GRAPH WAVELETS**  
*Francesco Grassi, Politecnico di Torino, Italy; Nathanaël Perraudin, Benjamin Ricaud, Ecole Polytechnique Fédérale de Lausanne, Switzerland*

## Sparse Signal Processing for Communications I

Session Chair: Farokh Marvasti, Sharif University of Technology

- SSPC-1.1** 14:00 **APPLICATIONS OF SPARSE SIGNAL PROCESSING**  
*Masoumeh Azghani, Sahand University of Technology, Iran; Farokh Marvasti, Sharif University of Technology, Iran*
- SSPC-1.2** 14:20 **DECENTRALIZED JOINT SPARSITY PATTERN RECOVERY USING 1-BIT COMPRESSIVE SENSING**  
*Swatantra Kafle, Bhavya Kailkhura, Thakshila Wimalajeewa, Pramod K. Varshney, Syracuse University, United States*
- SSPC-1.3** 14:40 **FAST COMPUTATIONS FOR APPROXIMATION AND COMPRESSION IN SLEPIAN SPACES**  
*Santhosh Karnik, Georgia Institute of Technology, United States; Zhihui Zhu, Michael Wakin, Colorado School of Mines, United States; Justin Romberg, Mark Davenport, Georgia Institute of Technology, United States*
- SSPC-1.4** 15:00 **NONNEGATIVE GRIDLESS COMPRESSIVE SENSING FOR CO-PRIME ARRAYS**  
*Heeseong Yang, KAIST, Korea (South); Haris Vikalo, The University of Texas at Austin, United States; Joohwan Chun, KAIST, Korea (South)*
- SSPC-1.5** 15:20 **ON THE EARTH MOVER'S DISTANCE AS A PERFORMANCE METRIC FOR SPARSE SUPPORT RECOVERY**  
*Anastasia Lavrenko, Florian Römer, Technische Universität Ilmenau, Germany; Giovanni Del Galdo, Fraunhofer Institute for Integrated Circuits, Germany; Reiner Thomä, Technische Universität Ilmenau, Germany*

**Compressed Sensing, Deep Learning Poster I**

- CSDL-P1.1 MINIMUM-VOLUME-REGULARIZED WEIGHTED SYMMETRIC NONNEGATIVE MATRIX FACTORIZATION FOR CLUSTERING**  
*Tianxiang Gao, Sigurdur Olafsson, Songtao Lu, Iowa State University, United States*
- CSDL-P1.2 BEST BASIS SELECTION USING SPARSITY DRIVEN MULTI-FAMILY WAVELET TRANSFORM**  
*Romain Cosentino, Randall Balestriero, Ecole Normale Supérieure & RICE University, United States; Behnaam Aazhang, Rice University, United States*
- CSDL-P1.3 DEFENDING ACTIVE LEARNING AGAINST ADVERSARIAL INPUTS IN AUTOMATED DOCUMENT CLASSIFICATION**  
*Lei Pi, University of Memphis, United States; Zhuo Lu, University of South Florida, United States; Yalin Sagduyu, Intelligent Automation Inc., United States; Su Chen, University of Memphis, United States*
- CSDL-P1.4 SPARSE RECONSTRUCTION FOR FLUORESCENCE LIFETIME IMAGING MICROSCOPY WITH POISSON NOISE**  
*Lasith Adhikari, Arnold Kim, Roummel Marcia, University of California, Merced, United States*
- CSDL-P1.5 D-OAMP: A DENOISING-BASED SIGNAL RECOVERY ALGORITHM FOR COMPRESSED SENSING**  
*Zhipeng Xue, ShanghaiTech University, China; Junjie Ma, City University of Hong Kong, China; Xiaojun Yuan, ShanghaiTech University, China*

**General Symposium Poster: Signal Decomposition**

Session Chair: Phillip Regalia, Catholic University of America

- GS-P2.1 CONSTRUCTION OF COMPLEMENTARY SETS OF SEQUENCES WITH LOW APERIODIC CORRELATION AND COMPLEMENTARY CORRELATION**  
*Israel Alejandro Arriaga-Trejo, CONACYT-Autonomous University of Zacatecas, Mexico*
- GS-P2.2 EMPIRICAL MODE DECOMPOSITION ANALYSIS OF ALCOHOL WITHDRAWAL TREMOR SIGNALS**  
*Narges Norouzi, Parham Aarabi, University of Toronto, Canada; Taylor Dear, Sally Carver, Schwartz/Reisman Emergency Medicine Institute, Mount Sinai Hospital, Canada; Simon Bromberg, University of Toronto, Canada; Mel Kahan, Department of Family and Community Medicine, Women's College Hospital, Canada; Sara Gray, Emergency Medicine and Critical Care, St. Michael's Hospital, Canada; Bjug Borgundvaag, Schwartz/Reisman Emergency Medicine Institute, Mount Sinai Hospital, Canada*
- GS-P2.3 OPTIMAL EXPERIMENTAL DESIGN IN CANONICAL EXPANSIONS WITH APPLICATIONS TO SIGNAL COMPRESSION**  
*Roozbeh Dehghannasiri, Xiaoning Qian, Edward Dougherty, Texas A&M University, United States*
- GS-P2.4 IMPROVED REMOTE ESTIMATION OF HEART RATE IN FACE VIDEOS**  
*Alain Malacarne, Mattia Bonomi, Cecilia Pasquini, Giulia Boato, University of Trento, Italy*
- GS-P2.5 QUALITY FACTOR ESTIMATION OF JPEG COMPRESSED IMAGES**  
*Thi Ngoc Canh Doan, Florent Reiraint, Thanh Hai Thai, University of Technology of Troyes, France; Cathel Zitzmann, EPF Graduate School of Engineering, France*

### Data-Driven Analysis of Medical Imaging Data: Overview, Challenges, and Prospects

Tulay Adali, University of Maryland, Baltimore County

Data-driven methods such as independent component analysis (ICA) have proven quite effective for the analysis of functional magnetic resonance (fMRI) data and for discovering associations between fMRI and other medical imaging data types such as electroencephalography (EEG) and structural MRI data. Without imposing strong modeling assumptions, these methods effectively take advantage of the multivariate nature of fMRI data and are particularly attractive for use in cognitive paradigms where detailed a priori models of brain activity are not available.

This talk reviews major data-driven methods that have been successfully applied to fMRI analysis, presents recent examples of their application for studying the brain function, and addresses current challenges and prospects.



### Big Data Analysis and Challenges in Medical Imaging II

Session Chair: Selin Aviyente, Michigan State University

**BDMI-K2**  
16:10 **Keynote: DATA-DRIVEN ANALYSIS OF MEDICAL IMAGING DATA: OVERVIEW, CHALLENGES, AND PROSPECTS**  
*Tulay Adali, University of Maryland, Baltimore County, United States*

**BDMI-2.3**  
16:50 **COMMUNITY DETECTION FROM GENOMIC DATASETS ACROSS HUMAN CANCERS**  
*Nandinee Haq, Z. Jane Wang, University of British Columbia, Canada*

**BDMI-2.4**  
17:10 **CLOUD-BASED DEEP LEARNING OF BIG EEG DATA FOR EPILEPTIC SEIZURE PREDICTION**  
*Mohammad-Parsa Hosseini, Rutgers University, United States; Hamid Soltanian-Zadeh, Henry Ford Health System, United States; Kost V Elisevich, Michigan State University, United States; Dario Pompili, Rutgers University, The State University of New Jersey, United States*

### Compressed Sensing, Deep Learning V

Session Chair: Seung-Jun Kim, University of Maryland, Baltimore County

- CSDL-5.1**  
16:10 **ONSAGER-CORRECTED DEEP LEARNING FOR SPARSE LINEAR INVERSE PROBLEMS**  
*Mark Borgerding, Philip Schniter, The Ohio State University, United States*
- CSDL-5.2**  
16:30 **IMAGE AESTHETIC ASSESSMENT VIA DEEP SEMANTIC AGGREGATION**  
*Kung-Hung Lu, Kuang-Yu Chang, Chu-Song Chen, Institute of Information Science, Academia Sinica, Taiwan*
- CSDL-5.3**  
16:50 **DEEP LEARNING BASED IMAGE SUPER-RESOLUTION WITH COUPLED BACKPROPAGATION**  
*Tiantong Guo, Hojjat Seyed Mousavi, Vishal Monga, The Pennsylvania State University, United States*
- CSDL-5.4**  
17:10 **RECURRENT NEURAL NETWORK FOR SPECTRAL MAPPING IN SPEECH BANDWIDTH EXTENSION**  
*Yingxue Wang, Shenghui Zhao, Beijing Institute of Technology, United States; Jianxin Li, Beihang University, China; Jingming Kuang, Beijing Institute of Technology, China; Qiang Zhu, University of Maryland, United States*

### Cellular 5G Systems

Session Chair: Yuan-Hao Huang, National Tsing Hua University

- DT5G-3.1**  
16:10 **ENERGY EFFICIENT MULTI-HOP WIRELESS BACKHAUL IN HETEROGENEOUS CELLULAR NETWORKS**  
*Yuan Liang, Tianlong Song, Tongtong Li, Michigan State University, United States*
- DT5G-3.2**  
16:30 **JOINT UL/DL MODE SELECTION AND TRANSCEIVER DESIGN FOR DYNAMIC TDD SYSTEMS**  
*Antti Tolli, Jarkko Kaleva, Ganesh Venkatraman, University of Oulu, Finland; David Gesbert, EURECOM, France*
- DT5G-3.3**  
16:50 **FAST-CONVOLUTION FILTERED OFDM WAVEFORMS WITH ADJUSTABLE CP LENGTH**  
*Markku Renfors, Juha Yli-Kaakinen, Toni Levanen, Mikko Valkama, Tampere University of Technology, Finland*
- DT5G-3.4**  
17:10 **TRANSMIT BEAMFORMER AND QUANTIZATION DESIGN FOR MULTI-CARRIER CRAN COMP**  
*Ganesh Venkatraman, Antti Tolli, Jarkko Kaleva, Markku Juntti, University of Oulu, Finland*

**Sparse Signal Processing for Communications II**

Session Chair: Farokh Marvasti, Sharif University of Technology

- SSPC-2.1**  
16:10  
**IMAGE COMPRESSION VIA MULTIPLE LEARNED GEOMETRIC DICTIONARIES**  
 Danlan Huang, Xiaoming Tao, Tsinghua University, China; Mai Xu, Beihang University, China; Shenghua Gao, ShanghaiTech University, China; Jianhua Lu, Tsinghua University, China
- SSPC-2.2**  
16:30  
**AUTONOMOUS COMPRESSIVE SPECTRUM SENSING APPROACH FOR 3.5 GHZ SHARED SPECTRUM**  
 Xingjian Zhang, Yuan Ma, Yue Gao, Queen Mary University of London, United Kingdom
- SSPC-2.3**  
16:50  
**OPTIMAL STOCHASTIC POWER CONTROL WITH COMPRESSIVE CSI ACQUISITION FOR CLOUD-RAN**  
 Fnu Suya, Arizona State University, United States; Yuanming Shi, ShanghaiTech University, China; Bo Bai, Wei Chen, Tsinghua University, China; Jun Zhang, Khaled Letaief, The Hong Kong University of Science and Technology, China; Shidong Zhou, Tsinghua University, China
- SSPC-2.4**  
17:10  
**DETERMINISTIC MEASUREMENT PROCEDURES FOR DIAGNOSIS OF MASSIVE UNIFORM LINEAR ANTENNA ARRAYS**  
 Mohamed Mokhtar Awadin, Ridha Hamila, Qatar University, Qatar; Waheed Bajwa, Rutgers University, The State University of New Jersey, United States; Naofal Al-Dhahir, University of Texas at Dallas, United States

**Transceivers and Signal Processing for 5G Wireless Systems**

Session Chair: Chaitali Chakrabarti, Arizona State University

- DT5G-P1.1**  
**STALL PATTERN AVOIDANCE IN POLYNOMIAL PRODUCT CODES**  
 Carlo Condo, Francois Leduc-Primeau, Gabi Sarkis, Pascal Giard, Warren J. Gross, McGill University, Canada
- DT5G-P1.2**  
**SPECTRAL- AND ENERGY-EFFICIENT TRANSMISSION WITH JOINT BANDWIDTH ASSIGNMENT AND TRANSMIT POWER ALLOCATION**  
 Liang Dong, Baylor University, United States
- DT5G-P1.3**  
**A LOW-RANK APPROACH FOR INTERFERENCE MANAGEMENT IN DENSE WIRELESS NETWORKS**  
 Kai Yang, Yuanming Shi, ShanghaiTech University, China; Jun Zhang, Hong Kong University of Science and Technology, China; Zhi Ding, University of California, Davis, United States; Khaled Letaief, Hong Kong University of Science and Technology, China
- DT5G-P1.4**  
**CACHING POLICY OPTIMIZATION FOR RATE ADAPTIVE VIDEO STREAMING**  
 Huiting Su, Shengqian Han, Chenyang Yang, Beihang University, China
- DT5G-P1.5**  
**ENERGY EFFICIENCY MAXIMIZATION FOR HETEROGENEOUS NETWORKS: A JOINT LINEAR PRECODER DESIGN AND SMALL-CELL SWITCHING-OFF APPROACH**  
 Long D. Nguyen, Trung Q. Duong, Queen's University Belfast, United Kingdom; Diep N. Nguyen, University of Technology Sydney, Australia; Le-Nam Tran, Maynooth University, Ireland
- DT5G-P1.6**  
**NOVEL EXTENDED MODIFIED TWIN TEST BASED SENSING FOR COOPERATIVE COMMUNICATION UNDER NOISE UNCERTAINTY**  
 Antonio Tedeschi, Roma TRE University, Italy; Sener Dikmese, Tampere University of Technology, Finland; Francesco Benedetto, Roma TRE University, Italy; Markku Renfors, Tampere University of Technology, Finland; Gaetano Giunta, Roma TRE University, Italy
- DT5G-P1.7**  
**LOW POWER BASEBAND PROCESSOR FOR IOT TERMINALS WITH LONG RANGE WIRELESS COMMUNICATIONS**  
 Shunyao Wu, Arizona State University, United States; Sungmoon Kang, Kwangwoon University, Korea (South); Chaitali Chakrabarti, Arizona State University, United States; Hyunseok Lee, Kwangwoon University, Korea (South)
- DT5G-P1.8**  
**SOFTWARE DEFINED RADIO IMPLEMENTATION OF ADAPTIVE NONLINEAR DIGITAL SELF-INTERFERENCE CANCELLATION FOR MOBILE INBAND FULL-DUPLEX RADIO**  
 Mona Aghababaeetafreshi, Matias Koskela, Dani Korpi, Pekka Jääskeläinen, Mikko Valkama, Jarmo Takala, Tampere University of Technology, Finland

### Emerging Signal Processing Applications Poster

Session Chair: Mazin Gilbert, AT&T Labs

- ESP-P1.1 HIERARCHICAL ACTIVITY CLUSTERING ANALYSIS FOR ROBUST GRAPHICAL STRUCTURE RECOVERY**  
*Namita Lokare, Daniel Benavides, Sahil Juneja, Edgar Lobaton, North Carolina State University, United States*
- ESP-P1.2 SHARING FOR SAFETY: THE BANDWIDTH ALLOCATION AMONG AUTOMOTIVE RADARS**  
*Hang Ruan, Yimin Liu, Tsinghua University, China; Huadong Meng, University of California, Berkeley, United States; Xiqin Wang, Tsinghua University, China*
- ESP-P1.3 ON THE TRADEOFF BETWEEN RESOLUTION AND AMBIGUITIES FOR NON-UNIFORM LINEAR ARRAYS**  
*Francois Vincent, Olivier Besson, University of Toulouse, France; Souleymane Abakar-Issakha, Frantz Bodereau, Autocruise, France; Laurent Ferro-Famil, University of Rennes 1, France*
- ESP-P1.4 CONTROL LOOP AUTOMATION MANAGEMENT PLATFORM (CLAMP)**  
*Mazin Gilbert, Rittwik Jana, Eric Noel, Vijay Gopalakrishnan, AT&T Labs, United States*
- ESP-P1.5 MULTI-PERSON BREATHING RATE ESTIMATION USING TIME-REVERSAL ON WIFI PLATFORMS**  
*Chen Chen, Yi Han, University of Maryland College Park, United States; Yan Chen, School of Electronic Engineering, University of Electronic Science and Technology of China, China; K.J. Ray Liu, University of Maryland College Park, United States*
- ESP-P1.6 AUTONOMOUS SERVICES COMPOSITION IN DOMAIN 2**  
*Mazin Gilbert, Anwar Syed Aftab, Farheen Cefalu, Pamela Dragosh, Rittwik Jana, Serban Jora, Thomas Kirk, John Lucas, Arthur Martella, John Murray, Sundar Ramalingam, Christopher A Rath, Shu Shi, Rich Wright, Avi Zahavi, AT&T Labs, United States*
- ESP-P1.7 RADIO SHOT: THROUGH-THE-WALL HUMAN RECOGNITION**  
*Qinyi Xu, University of Maryland College Park, United States; Yan Chen, University of Electronic Science and Technology of China, China; Beibei Wang, K.J. Ray Liu, University of Maryland College Park, United States*
- ESP-P1.8 LOW COMPLEXITY ALGORITHMS TO INDEPENDENTLY AND JOINTLY ESTIMATE THE LOCATION AND RANGE OF TARGETS USING FMCW**  
*Sajid Ahmed, Seifallah Jardak, Mohamed-Slim Alouini, King Abdullah University of Science and Technology, Saudi Arabia*

### General Symposium Poster: Detection and Tracking

Session Chair: Phillip Regalia, Catholic University of America

- GS-P3.1 POLYLINE-DRIVEN STOP SIGN DETECTION**  
*Qi Li, Western Kentucky University, United States; Yongyi Gong, Guangdong University of Foreign Studies, China*
- GS-P3.2 RECOVERY FROM TRACKING FAILURE**  
*Ke He, Ningning Li, Borui Mo, Bo Yang, Aidong Men, Beijing University of Posts and Telecommunications, China*
- GS-P3.3 FACE SPOOFING ATTACK DETECTION BASED ON THE BEHAVIOR OF NOISES**  
*Hoai Phuong Nguyen, Université de Reims Champagne-Ardenne, France; Florent Reira, Université de Technologie de Troyes, France; Frédéric Morain-Nicolier, Agnès Delahaies, Université de Reims Champagne-Ardenne, France*
- GS-P3.4 ROBUST ONLINE MULTI-OBJECT TRACKING BASED ON KCF TRACKERS AND REASSIGNMENT**  
*Huiling Wu, Weihai Li, the University of Science and Technology of China, China*
- GS-P3.5 SIMULTANEOUS DISTRIBUTED BEAMFORMING AND NULLFORMING WITH ADAPTIVE POSITIONING**  
*Shahab Farazi, Kim Chinkidjakarn, D. Richard Brown III, Worcester Polytechnic Institute, United States*

### Storage Management and Demand Response

Session Chair: Vassilis Kekatos, Virginia Tech

- SGI-P1.1 REAL-TIME OPERATION OF HETEROGENEOUS ENERGY STORAGE UNITS**  
*Sarthak Gupta, Vassilis Kekatos, Virginia Tech, United States*
- SGI-P1.2 DEMAND RESPONSE AGGREGATORS IN MICROGRID ENERGY TRADING**  
*Maria Gregori, Javier Matamoros, David Gregoratti, CTTC, Spain*
- SGI-P1.3 AGGREGATE LOAD MODELS FOR DEMAND RESPONSE: EXPLORING FLEXIBILITY**  
*Kari Hreinsson, Anna Scaglione, Vijay Vittal, Arizona State University, United States*
- SGI-P1.4 ADMM APPROACH TO ASYNCHRONOUS DISTRIBUTED FREQUENCY-BASED LOAD CONTROL**  
*Chia-Wei Wu, National Taiwan University of Science and Technology, Taiwan; Tsung-Hui Chang, The Chinese University of Hong Kong, Shenzhen, China*
- SGI-P1.5 DECENTRALIZED TEMPERATURE CONTROL VIA HVAC SYSTEMS IN ENERGY EFFICIENT BUILDINGS: AN APPROXIMATE SOLUTION PROCEDURE**  
*Xuan Zhang, Wenbo Shi, Xiwang Li, Bin Yan, Ali Malkawi, Na Li, Harvard University, United States*

### Signal and Information Processing Over Networks Poster I

Session Chair: Benjamin Girault, University of Southern California

- SPN-P1.1 RECONSTRUCTION OF EUCLIDEAN EMBEDDINGS IN DENSE NETWORKS**  
*Sarah Costrell, Subhrajit Bhattacharya, Robert Ghrist, University of Pennsylvania, United States*
- SPN-P1.2 2-DIMENSIONAL FINITE IMPULSE RESPONSE GRAPH-TEMPORAL FILTERS**  
*Elvin Isufi, Geert Leus, Paolo Banelli, TU Delft, Netherlands*
- SPN-P1.3 NEIGHBORHOOD-PRESERVING TRANSLATIONS ON GRAPHS**  
*Nicolas Grelier, Bastien Pasdeloup, Jean-Charles Vialatte, Vincent Gripon, Télécom Bretagne, France*
- SPN-P1.4 TRUSTABLE SERVICE RATING IN SOCIAL NETWORKS: A PEER PREDICTION METHOD**  
*Jun Du, Chunxiao Jiang, Jian Wang, Tsinghua University, China; Shui Yu, Deakin University, Australia; Yong Ren, Tsinghua University, China*
- SPN-P1.5 APPROXIMATION OF NETWORK LINEAR OPERATORS USING SIMILARITY SHIFT FILTERS**  
*Cassiano Becker, Sergio Pequito, George Pappas, Victor Preciado, University of Pennsylvania, United States*
- SPN-P1.6 CONSENSUS AND MULTIPLEX APPROACH FOR COMMUNITY DETECTION IN ATTRIBUTED NETWORKS**  
*Yuming Huang, Han Wang, North Carolina State University, United States*
- SPN-P1.7 GREEDY APPROACHES TO FINDING A SPARSE COVER IN A SENSOR NETWORK WITHOUT LOCATION INFORMATION**  
*Terrence Moore, U.S. Army Research Lab, United States*
- SPN-P1.8 A SCALABLE SMOOTH GRAPH LEARNING METHOD BASED ON BERNOULLI-GAUSSIAN MODEL**  
*Jun Sun, Zaiyue Yang, Xiufang Shi, Zhejiang University, China*



**Adventures in Learning and Sparse Modeling for Bio-imaging****Yoram Bresler, University of Illinois, Urbana-Champaign**

Adapting sparse image modeling to the data has been shown to provide improved image reconstruction in several imaging modalities. However, synthesis or analysis dictionary learning involves approximations of NP-hard sparse coding, and expensive learning steps. Recently, sparsifying transform learning (STL) received interest for its cheap and exact closed-form solutions to iteration steps. We describe the evolution of this framework and several variations as applied to biomedical imaging, including online STL for dynamic and big data; learning a union of transforms model for greater representation power; and a filter bank STL that provides more degrees of freedom in modeling by acting on entire images rather than on patches.

**Decentralized Probabilistic Learning for Sensor Network****Sejong Yoon, The College of New Jersey**

Distributed machine learning and large scale optimization methods are starting to play an increasing central role in wireless sensors networks and particularly in data-adaptive and data-driven contexts such as the cognitive radio. In this work we present a review of state-of-the-art machine learning techniques used in sensor network. In particular, we focus on distributed and decentralized machine learning and optimization methods for wireless sensor network and cognitive radio devices. We also introduce a series of recent developments and applications of the alternating direction method of multipliers (ADMM) approaches on the decentralized machine learning problems that can potentially be used for related cognitive radio problems.



**Massive MIMO: It Really Works!**

**Thomas L. Marzetta, Nokia Bell Labs**

Recent Massive MIMO experiments have convincingly demonstrated the soundness of the underlying concept. Massive MIMO is poised to deliver spectacular improvements over 4G wireless technologies.



Massive MIMO creates virtual parallel circuits, each occupying the full spectral bandwidth, between a multiplicity of single-antenna terminals and an array of individually controlled antennas. Area spectral efficiency improvements over 4G technologies may range from ten to one-thousand, depending on the mobility of the terminals. Other benefits include energy efficiency gains in excess of one-thousand, and simple and effective power control that yields uniformly great service throughout the cell.

Cellular deployment of Massive MIMO in the prime sub-5GHz bands will be both hugely beneficial and highly disruptive, requiring either new TDD spectrum, or the reassignment of existing FDD spectrum, and the replacement of all base station and user equipment. There are less disruptive, but still exciting, applications of Massive MIMO, including small cell backhaul and fixed wireless access to homes, for which there are no back compatibility issues.

**Non-commutativity in Signal Processing**

**Al Hero, University of Michigan**



Non-commutativity arises in many places in statistical signal processing including information fusion, graphical models and distributed estimation. Any problem where the model or the processing lacks symmetry, permutation invariance or revocable actions will have non-commutativity. This talk will discuss several signal processing areas where non-commutativity is manifested and some challenges and opportunities.

Friday, December 9

10:00 - 11:00

Keynote Session

SPN-K2

Salon A

### Statistical Signal Processing on Graphs

**Alejandro Ribeiro, University of Pennsylvania**

A network can be understood as a complex system formed by multiple nodes, where global network behavior arises from local interactions between connected nodes. Often, networks have intrinsic value and are themselves the object of study. In other occasions, the network defines an underlying notion of proximity or dependence, but the object of interest is a signal defined on top of the graph. This is the matter addressed in the field of graph signal processing (GSP). Graph-supported signals appear in many engineering and science fields such as gene expression patterns defined on top of gene networks and the spread of epidemics over social networks. Transversal to the particular application, the philosophy behind GSP is to advance the understanding of network data by redesigning traditional tools originally conceived to study signals defined on regular domains and extend them to analyze signals on the more complex graph domain. In this talk, we will introduce the main building blocks of GSP and illustrate the utility of these concepts through real-world applications. Our focus will be on the definition of stationary graph signals and the inference of underlying graph structures from graph signal observations.



Friday, December 9

10:00 - 11:00

Keynote Session

SSPC-K1

Salon C

### Sparsity and Low Rank for Inference of Cognitive Network States

**Georgios B. Giannakis, University of Minnesota**

Viewed through a statistical inference lens, many network analytics challenges boil down to (non-) parametric regression and classification, dimensionality reduction, or clustering. Adopting such a vantage point, this keynote presentation will put forth novel learning approaches for comprehensive situation awareness of cognitive radio (CR) networks that includes spatio-temporal sensing via RF spectrum and channel gain cartography, flagging of network anomalies, prediction of network processes, and dynamic topology inference. Key emphasis will be placed on parsimonious models leveraging sparsity, low-rank or low-dimensional manifolds, attributes that are instrumental for complexity reduction.



### Big Data Analysis and Challenges in Medical Imaging III

Session Chair: Anubha Gupta, IIIT-Delhi

- BDMI-3.1**  
11:00  
**ERROR PROBABILITY ANALYSIS FOR LDA-BAYESIAN BASED CLASSIFICATION OF ALZHEIMER'S DISEASE AND NORMAL CONTROL SUBJECTS**  
*Zhe Wang, Tianlong Song, Yuan Liang, Tongtong Li, Michigan State University, United States*
- BDMI-3.2**  
11:20  
**EPILEPTOGENIC BRAIN CONNECTIVITY PATTERNS USING SCALP EEG**  
*Panuwat Janwattanapong, Mercedes Cabrerizo, Hoda Rajaei, Florida International University, United States; Alberto Pinzon-Ardila, Baptist Hospital of Miami, United States; Sergio Gonzalez-Arias, Malek Adjouadi, Florida International University, United States*
- BDMI-3.3**  
11:40  
**SUPERVISED HEART RATE TRACKING USING WRIST-TYPE PHOTOPLETHYSMOGRAPHIC (PPG) SIGNALS DURING PHYSICAL EXERCISE WITHOUT SIMULTANEOUS ACCELERATION SIGNALS**  
*Mahmoud Essalat, Mahdi Boloursaz Mashhadi, Farokh Marvasti, Advanced Communications Research Institute (ACRI), Iran*

### Machine Learning for Characterization of Cognitive Communications and Radar II

Session Chair: Silvija Kokalj-Filipovic, Naval Research Laboratory

- CCR-2.1**  
11:00  
**LEARNING STRUCTURAL PROPERTIES OF WIRELESS AD-HOC NETWORKS NON-PARAMETRICALLY FROM SPECTRAL ACTIVITY SAMPLES**  
*Silvija Kokalj-Filipovic, Michael Pepe, Crystal Bertoncini Acosta, Naval Research Laboratory, United States*
- CCR-2.2**  
11:20  
**A ROBUST APPLICATION DETECTOR FOR INTELLIGENT WIRELESS COLLABORATION**  
*Kevin Pietsch, Sean Mason, Lockheed Martin, United States*
- CCR-2.3**  
11:40  
**LEARNING EQUILIBRIA FOR POWER ALLOCATION GAMES IN COGNITIVE RADIO NETWORKS WITH A JAMMER**  
*Raghd El-Bardan, Syracuse University, United States; Vinod Sharma, Indian Institute of Science, India; Pramod K. Varshney, Syracuse University, United States*

Friday, December 9 11:00 - 12:20  
Lecture Session DT5G-4 Salon B

### Transceiver Algorithms

Session Chair: Ville Syrjälä, Tampere University of Technology

**DT5G-4.1 PILOT DECONTAMINATION VIA DOPPLER PSD ALIGNMENT**  
11:00  
*Xiliang Luo, Xiaoyu Zhang, Penghao Cai, Fuqian Yang, ShanghaiTech University, China*

**DT5G-4.2 BLIND DIGITAL MODULATION CLASSIFICATION BASED ON M-TH POWER NONLINEAR TRANSFORMATION**  
11:20  
*Vincent Gouldieff, Jacques Palicot, CentraleSupélec/IETR, France; Steredenn Daumont, Zodiac Data Systems, France*

**DT5G-4.3 EFFICIENT TIME-DOMAIN PHASE NOISE MITIGATION IN CM-WAVE WIRELESS COMMUNICATIONS**  
11:40  
*Ville Syrjälä, Toni Levanen, Mikko Valkama, Tampere University of Technology, Finland; Eeva Lähetkangas, Nokia Bell Labs, Finland*

**DT5G-4.4 METHODS FOR PHASE NOISE MITIGATION FOR DFT-S-OFDM WAVEFORMS**  
12:00  
*Ville Syrjälä, Toni Levanen, Mikko Valkama, Tampere University of Technology, Finland*

Friday, December 9 11:00 - 12:20  
Lecture Session GS-2 Salon K

### General Symposium: Statistical Signal Processing and Estimation

Session Chair: Hang Liu, Catholic University of America

**GS-2.1 MAXIMUM-LIKELIHOOD CHANNEL ESTIMATION IN PRESENCE OF IMPULSIVE NOISE FOR PLC SYSTEMS**  
11:00  
*Deep Shrestha, Xavier Mestre, Miquel Payaro, Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain*

**GS-2.2 ON THE SUM OF GAMMA-GAMMA VARIATES WITH APPLICATION TO THE FAST OUTAGE PROBABILITY EVALUATION OVER FADING CHANNELS**  
11:20  
*Chaouki Ben Issaid, Nadhir Ben Rached, Abla Kammoun, Mohamed-Slim Alouini, Raul Tempone, King Abdullah University of Science and Technology, Saudi Arabia*

**GS-2.3 SIGNAL PROCESSING ENABLES THE FIRST LOCALIZATION OF GAMMA RAYS FROM SUPERMASSIVE BLACK HOLES**  
11:40  
*Anna Barnacka, Harvard University, United States*

**GS-2.4 OPTIMAL BAYESIAN FEATURE SELECTION WITH MISSING DATA**  
12:00  
*Ali Foroughi Pour, Lori Dalton, The Ohio State University, United States*

Friday, December 9 11:00 - 12:20  
Lecture Session SGI-6 Salon C

### Power Line and Smart Grid Communications

Session Chair: Nikolaos Gatsis, University of Texas at San Antonio

- SGI-6.1** 11:00 **POWER LINE DETECTION VIA BACKGROUND NOISE REMOVAL**  
*Chaofeng Pan, Xianbin Cao, Beihang University, China; Dapeng Wu, University of Florida, United States*
- SGI-6.2** 11:20 **DIFFERENTIAL MODULATION DIVERSITY COMBINING FOR HYBRID NARROWBAND-POWERLINE/WIRELESS SMART GRID COMMUNICATIONS**  
*Mostafa Sayed, Naofal Al-Dhahir, University of Texas at Dallas, United States*
- SGI-6.3** 11:40 **A FREQUENCY-SHIFT-FILTERING APPROACH TO CYCLOSTATIONARY NOISE MODELING IN MIMO NB-PLC**  
*Mahmoud Elgenedy, Mostafa Sayed, Naofal Al-Dhahir, University of Texas at Dallas, United States*
- SGI-6.4** 12:00 **TRANSMISSION TIME MINIMIZATION OF AN ENERGY HARVESTING COGNITIVE RADIO SYSTEM**  
*Peter He, Lian Zhao, Xavier Fernando, Ryerson University, Canada*

Friday, December 9 11:00 - 12:20  
Lecture Session SPN-3 Salon A

### Signal and Information Processing Over Networks III

Session Chair: Gonzalo Mateos, University of Rochester

- SPN-3.1** 11:00 **GRAPH TOPOLOGY INFERENCE BASED ON TRANSFORM LEARNING**  
*Stefania Sardellitti, Sergio Barbarossa, Sapienza University of Rome, Italy; Paolo Di Lorenzo, University of Perugia, Italy*
- SPN-3.2** 11:20 **MORPHOLOGICAL PDES ON GRAPHS FOR ANALYZING UNORGANIZED DATA IN 3D AND HIGHER**  
*Abderrahim Elmoataz, University of Caen Normandy, GREYC Laboratory, Image Team / Université de Paris-Est Marne-La-Valée, Laboratoire LIGIM, France; François Lozes, University of Caen Normandy, GREYC Laboratory, Image Team, France; Hugues Talbot, Groupe ESIEE Paris, laboratoire A2SI, France*
- SPN-3.3** 11:40 **INTERSECTION AND CONVEX COMBINATION IN MULTI-SOURCE SPECTRAL PLANTED CLUSTER DETECTION**  
*Benjamin Miller, Rajmonda Caceres, Steven Smith, MIT Lincoln Laboratory, United States*
- SPN-3.4** 12:00 **SPECTRAL RADIUS AND NETWORK PROCESSES WITH SPONTANEOUS INFECTION/FAILURE RATE**  
*June Zhang, Centers for Disease Control and Prevention, United States; José M.F. Moura, Carnegie Mellon University, United States*

Friday, December 9 14:00 - 15:40  
Lecture Session CCR-3 Salon H

### Machine Learning for Characterization of Cognitive Communications and Radar III

Session Chair: George Stantchev, Naval Research Laboratory

- CCR-3.1 BLIND CHANNEL GAIN CARTOGRAPHY**  
14:00 *Daniel Romero, Donghoon Lee, Georgios B. Giannakis, University of Minnesota, United States*
- CCR-3.2 USING DEPENDENT COMPONENT ANALYSIS FOR BLIND CHANNEL ESTIMATION IN DISTRIBUTED ANTENNA SYSTEMS**  
14:20 *Janis Nötzel, Universitat Autònoma de Barcelona, Spain; Christian Arendt, BMW Group, Germany*
- CCR-3.3 SENSITIVITY OF L-1 REGULARIZATION ON SUBSPACE-BASED SIMO BLIND CHANNEL IDENTIFICATION IN SAMPLE CHANNEL MEASUREMENTS**  
14:40 *Kareem Bonna, Predrag Spasojevic, Rutgers University, United States*
- CCR-3.4 A SEQUENTIAL DETECTION APPROACH TO INDOOR POSITIONING USING RSS-BASED FINGERPRINTING**  
15:00 *Negar Etemadyrad, Jill K. Nelson, George Mason University, United States*

Friday, December 9 14:00 - 15:40  
Lecture Session DT5G-5 Salon B

### Massive MIMO Systems

Session Chair: Antti Tölli, University of Oulu

- DT5G-5.1 DOWNLINK PERFORMANCE OF SUPERIMPOSED PILOTS IN MASSIVE MIMO SYSTEMS IN THE PRESENCE OF PILOT CONTAMINATION**  
14:00 *Karthik Upadhyay, Sergiy Vorobyov, Aalto University, Finland; Mikko Vehkaperä, The University of Sheffield, United Kingdom*
- DT5G-5.2 LOW-DENSITY SPATIAL RS DESIGN AND CHANNEL ESTIMATION FOR FDD MASSIVE FULL-DIMENSIONAL MIMO SYSTEMS**  
14:20 *Wendong Liu, Zhaocheng Wang, Xudong Zhu, Tsinghua University, China*
- DT5G-5.3 LOW COMPLEXITY MRC AND EGC BASED RECEIVERS FOR SC-FDE MODULATIONS WITH MASSIVE MIMO SCHEMES**  
14:40 *David Borges, Paulo Montezuma, Rui Dinis, FCT-UNL, Portugal*

Friday, December 9 14:00 - 15:40  
Lecture Session GS-3 Salon J

### General Symposium: Speech Processing

Session Chair: Phillip Regalia, Catholic University of America

- GS-3.1**  
14:00 **A QUANTITATIVE ANALYSIS OF HANDS-FREE SPEECH ENHANCEMENT USING REAL AUTOMOBILE DATA**  
*Sam Tabaja, Sai-Prithvi Gadde, Nabih Jaber, Philip Olivier, Lawrence Technological University, United States; Mahdi Ali, Rakan Chabaan, Scott Bone, Hyundai America Technical Center Incorporated, United States*
- GS-3.2**  
14:20 **DETECTION OF SPOKEN WORDS IN NOISE: COMPARISON OF HUMAN PERFORMANCE TO MAXIMUM LIKELIHOOD DETECTION**  
*Mohsen Zareian Jahromi, Jan Østergaard, Jesper Jensen, Aalborg university, Denmark*
- GS-3.3**  
14:40 **SPEAKER SIMILARITY SCORE BASED FAST PHONEME CLASSIFICATION BY USING NEIGHBORHOOD COMPONENTS ANALYSIS**  
*Muhammad Rizwan, David V. Anderson, Georgia Institute of Technology, United States*
- GS-3.4**  
15:00 **IDENTIFYING RALE SOUNDS IN CHICKENS USING AUDIO SIGNALS FOR EARLY DISEASE DETECTION IN POULTRY**  
*Muhammad Rizwan, Brandon T. Carroll, David V. Anderson, Georgia Institute of Technology, United States; Wayne Daley, Simeon Harbert, Douglas F. Britton, Georgia Tech Research Institute, United States; Mark W. Jackwood, University of Georgia, Athens, United States*
- GS-3.5**  
15:20 **A LANDMARK-BASED APPROACH TO AUTOMATIC VOICE ONSET TIME ESTIMATION IN STOP-VOWEL SEQUENCES**  
*Stephan R. Kuberski, Stephen J. Tobin, Adamantios I. Gafos, University of Potsdam, Germany*

Friday, December 9 14:00 - 15:40  
Lecture Session NCTA-1 Salon K

### Non-Commutative Theory and Applications I

Session Chair: Negar Kivayash, University of Illinois Urbana-Champaign

- NCTA-1.1**  
14:00 **GRAPH-BASED ACTIVE LEARNING: A NEW LOOK AT EXPECTED ERROR MINIMIZATION**  
*Kwang-Sung Jun, Robert Nowak, University of Wisconsin-Madison, United States*
- NCTA-1.2**  
14:20 **ACTIVE INFORMATION ACQUISITION AND SENSORY AUGMENTATION**  
*Sung-En Chiu, Tara Javidi, University of California, San Diego, United States*
- NCTA-1.3**  
14:40 **DIFFEOMORPHISM LEARNING VIA RELATIVE ENTROPY CONSTRAINED OPTIMAL TRANSPORT**  
*Todd Coleman, Justin Tantiongloc, Alexis Allegra, Diego Mesa, Dae Kang, Marcela Mendoza, University of California, San Diego, United States*



### Electric Vehicles

Session Chair: Meng Wang, Rensselaer Polytechnic Institute

- SGI-7.1** 14:00 **ADAPTIVE CHARGING NETWORK FOR ELECTRIC VEHICLES**  
*George Lee, PowerFlex Systems, United States; Ted Lee, California Institute of Technology, United States; Zhi Low, Cornell University, United States; Steven Low, Christine Ortega, California Institute of Technology, United States*
- SGI-7.2** 14:20 **DISTRIBUTED COOPERATIVE CHARGING FOR PLUG-IN ELECTRIC VEHICLES: A CONSENSUS+INNOVATIONS APPROACH**  
*Javad Mohammadi, Soumya Kar, Carnegie Mellon University, United States; Gabriela Hug, ETH Zurich, United States*
- SGI-7.3** 14:40 **IMPACT OF CHARGING INTERRUPTIONS IN COORDINATED ELECTRIC VEHICLE CHARGING**  
*Akshay Malhotra, Nuh Erdogan, University of Texas at Arlington, United States; Giulio Binetti, Polytechnic University of Bari, United States; Ioannis Schizas, Ali Davoudi, University of Texas at Arlington, United States*
- SGI-7.4** 15:00 **ELECTRIC VEHICLE CONSUMPTION MARKETS: AN ECONOMIC ANALYSIS**  
*Mohammad Sadegh Nourbakhsh, Mohammad Hossein Manshaei, Isfahan University of Technology, Iran; Mohammad Ashiqur Rahman, Tennessee Tech, United States; Walid Saad, Virginia Tech, United States*
- SGI-7.5** 15:20 **A DISTRIBUTED SMART PEV CHARGING ALGORITHM BASED ON FORECASTED MOBILITY ENERGY DEMAND**  
*Mithat Kisacikoglu, University of Alabama, United States; Fatih Erden, Atilim University, Turkey; Nuh Erdogan, University of Texas at Arlington, United States*

### Signal and Information Processing Over Networks IV

Session Chair: Antonio G. Marques, King Juan Carlos University

- SPN-4.1** 14:00 **TRACKING DYNAMIC PIECEWISE-CONSTANT NETWORK TOPOLOGIES VIA ADAPTIVE TENSOR FACTORIZATION**  
*Yanning Shen, Brian Baingana, Georgios B. Giannakis, University of Minnesota, United States*
- SPN-4.2** 14:20 **ESTIMATING THE NUMBER OF INFECTION SOURCES IN A TREE**  
*Feng Ji, Wee Peng Tay, Nanyang Technological University, Singapore; Lav R. Varshney, University of Illinois at Urbana-Champaign, United States*
- SPN-4.3** 14:40 **LINEAR SYSTEMS ON GRAPHS**  
*Oguzhan Teke, P. P. Vaidyanathan, California Institute of Technology, United States*
- SPN-4.4** 15:00 **RETHINKING SKETCHING AS SAMPLING: EFFICIENT APPROXIMATE SOLUTION TO LINEAR INVERSE PROBLEMS**  
*Fernando Gama, University of Pennsylvania, United States; Antonio Marques, King Juan Carlos University, Spain; Gonzalo Mateos, University of Rochester, United States; Alejandro Ribeiro, University of Pennsylvania, United States*
- SPN-4.5** 15:20 **SIGNAL DETECTION ON GRAPHS: BERNOULLI NOISE MODEL**  
*Siheng Chen, Yaoqing Yang, Aarti Singh, Jelena Kovacevic, Carnegie Mellon University, United States*

### Compressed Sensing, Deep Learning Poster II

- CSDL-P2.1 LOW-LATENCY SOUND SOURCE SEPARATION USING DEEP NEURAL NETWORKS**  
*Gaurav Naithani, Giambattista Parascandolo, Tom Barker, Tampere University of Technology, Finland; Niels Henrik Pontoppidan, Oticon A/S, Denmark; Tuomas Virtanen, Tampere University of Technology, Finland*
- CSDL-P2.2 END-TO-END RADIO TRAFFIC SEQUENCE RECOGNITION WITH RECURRENT NEURAL NETWORKS**  
*Timothy J. O'Shea, Seth Hitefield, Virginia Tech, United States; Johnathan Corgan, Corgan Labs, United States*
- CSDL-P2.3 ATOMIC NORM MINIMIZATION BASED RANGE-DIRECTION INDICATION FOR FREQUENCY DIVERSE ARRAY: A MATRIX COMPLETION PERSPECTIVE**  
*Lei Wang, Yimin Liu, Tsinghua University, China*
- CSDL-P2.4 SPARSE RECOVERY IN WIGNER-D BASIS EXPANSION**  
*Arya Bangun, Arash Behboodi, Rudolf Mathar, RWTH Aachen University, Germany*
- CSDL-P2.5 DICTIONARY LEARNING FOR SPARSE REPRESENTATION USING WEIGHTED L1-NORM**  
*Haoli Zhao, Shuxue Ding, Yujie Li, Zhenni Li, Xiang Li, Benying Tan, School of Computer Science and Engineering, Japan*

### Massive MIMO and mmWave

Session Chair: Yuan-Hao Huang, National Tsing Hua University

- DT5G-P2.1 A PROBABILISTIC INTERFERENCE DISTRIBUTION MODEL ENCOMPASSING CELLULAR LOS AND NLOS MMWAVE PROPAGATION**  
*Hussain Elkotby, Mai Vu, Tufts University, United States*
- DT5G-P2.2 BEAM TRACKING FOR MOBILE MILLIMETER WAVE COMMUNICATION SYSTEMS**  
*Vutha Va, Haris Vikalo, Robert W. Heath Jr., The University of Texas at Austin, United States*
- DT5G-P2.3 A LOW-COMPLEXITY PARTIALLY UPDATED BEAM TRACKING ALGORITHM FOR MMWAVE MIMO SYSTEMS**  
*Che-Chuan Yeh, Kai-Neng Hsu, Yuan-Hao Huang, National Tsing Hua University, Taiwan*
- DT5G-P2.4 IMPACT OF TRAINING ON MMWAVE MULTI-USER MIMO DOWNLINK**  
*Gilwon Lee, Jungho So, Youngchul Sung, KAIST, Korea (South)*
- DT5G-P2.5 THIRD DIMENSION FOR MEASUREMENT OF MULTI USER MASSIVE MIMO CHANNELS BASED ON LTE ADVANCED DOWNLINK**  
*Saeid Aghaeinezhadfirouzja, Hui Liu, Bin Xia, Shanghai Jiao Tong University, China; Qun Luo, Weibin Guo, Shenzhen Institute of Radio Testing, China*
- DT5G-P2.6 ENERGY-EFFICIENT JOINT TRANSMIT BEAMFORMING AND SUBARRAY SELECTION WITH NON-LINEAR POWER AMPLIFIER EFFICIENCY**  
*Oskari Tervo, University of Oulu, Finland; Le-Nam Tran, Maynooth University, Ireland; Markku Juntti, University of Oulu, Finland*
- DT5G-P2.7 ACHIEVING HIGH THROUGHPUT WITH PREDICTIVE RESOURCE ALLOCATION**  
*Chuting Yao, Jia Guo, Chenyang Yang, Beihang University, China*

Friday, December 9	14:00 - 15:40	Friday, December 9	16:10 - 17:30
Poster Session	SSPC-P1	Lecture Session	BDMI-4
	Salon DEFG		Salon J

### Sparse Signal Processing for Communications Poster I

Session Chair: Farokh Marvasti, Sharif University of Technology

- SSPC-P1.1 ON A MUTUAL COUPLING AGNOSTIC MAXIMUM LIKELIHOOD ANGLE OF ARRIVAL ESTIMATOR BY ALTERNATING PROJECTION**  
*Ahmad Bazzi, EURECOM / RW-CEVA, France; Dirk Slock, EURECOM, France; Lisa Meilhac, RW-CEVA, France*
- SSPC-P1.2 A MUTUAL COUPLING RESILIENT ALGORITHM FOR JOINT ANGLE AND DELAY ESTIMATION**  
*Ahmad Bazzi, EURECOM / RW-CEVA, France; Dirk Slock, EURECOM, France; Lisa Meilhac, RW-CEVA, France*
- SSPC-P1.3 FAST METHODS FOR RECOVERING SPARSE PARAMETERS IN LINEAR LOW RANK MODELS**  
*Ashkan Esmaeili, Arash Amini, Farokh Marvasti, Sharif University of Technology, Iran*
- SSPC-P1.4 A STUDY ON MIXING SEQUENCES IN MODULATED WIDEBAND CONVERTERS**  
*Jehyuk Jang, Nam Yul Yu, Heung-No Lee, Gwangju Institute of Science and Technology, Korea (South)*
- SSPC-P1.5 A FAST CHANNEL ESTIMATION APPROACH FOR MILLIMETER-WAVE MASSIVE MIMO SYSTEMS**  
*Yue Wang, Hisilicon Technologies Co. Ltd., United States; Zhi Tian, George Mason University, United States; Shulan Feng, Philipp Zhang, Hisilicon Technologies Co. Ltd., China*
- SSPC-P1.6 REGULARIZED VSSNLMS-BASED ITERATIVE CHANNEL ESTIMATION FOR MC-IDMA SYSTEMS**  
*Olutayo Oyeyemi Oyerinde, University of the Witwatersrand, South Africa*
- SSPC-P1.7 OVERSAMPLING-BASED ALGORITHM FOR EFFICIENT RF INTERFERENCE EXCISION IN SIMO SYSTEMS**  
*Tilahun Melkamu Getu, École de Technologie Supérieure (ÉTS) and Université du Québec À Montréal (UQÀM), Canada; Wessam Ajib, Université du Québec À Montréal (UQÀM), Canada; René Jr. Landry, École de Technologie Supérieure (ÉTS), Montréal, QC, Canada, Canada*
- SSPC-P1.8 GENERALIZED APPROXIMATE MESSAGE PASSING FOR ONE-BIT COMPRESSED SENSING WITH AWGN**  
*Osman Musa, Gabor Hannak, Norbert Goertz, Technische Univesitaet Wien, Austria*

### Big Data Analysis and Challenges in Medical Imaging IV

Session Chair: Ramy Hussein, University of British Columbia

- BDMI-4.1 L1-REGULARIZATION BASED EEG FEATURE LEARNING FOR DETECTING EPILEPTIC SEIZURE**  
 16:10  
*Ramy Hussein, Z. Jane Wang, Rabab Ward, University of British Columbia, Canada*
- BDMI-4.2 EFFICIENT ESTIMATION OF COMPRESSIBLE STATE-SPACE MODELS WITH APPLICATION TO CALCIUM SIGNAL DECONVOLUTION**  
 16:30  
*Abbas Kazemipour, Ji Liu, Patrick Kanold, Min Wu, Behtash Babadi, University of Maryland, United States*

Friday, December 9 16:10 - 17:30  
Lecture Session DT5G-6 Salon B

### Full Duplex, Transceiver and RF Technologies

Session Chair: Lauri Anttila, Tampere University of Technology

- DT5G-6.1** 16:10 **LOCATION-BASED BIDIRECTIONAL USER SCHEDULING AND MODE SELECTION IN FULL-DUPLEX SYSTEM**  
*Jing Zhao, Shengqian Han, Chenyang Yang, Beihang University, China; Yong Teng, Naizheng Zheng, Nokia Networks, China*
- DT5G-6.2** 16:30 **REFERENCE RECEIVER ENABLED DIGITAL CANCELLATION OF NONLINEAR OUT-OF-BAND BLOCKER DISTORTION IN WIDEBAND RECEIVERS**  
*Jaakko Marttila, Markus Allén, Tampere University of Technology, Finland; Marko Kosunen, Kari Stadius, Jussi Ryyänen, Aalto University School of Electrical Engineering, Finland; Mikko Valkama, Tampere University of Technology, Finland*
- DT5G-6.3** 16:50 **ACTIVE RF CANCELLATION OF NONLINEAR TX LEAKAGE IN FDD TRANSCEIVERS**  
*Adnan Kiayani, Lauri Anttila, Mikko Valkama, Tampere University of Technology, Finland*
- DT5G-6.4** 17:10 **DIGITAL PREDISTORTION FOR MITIGATING TRANSMITTER-INDUCED RECEIVER DESENSITIZATION IN CARRIER AGGREGATION FDD TRANSCEIVERS**  
*Mahmoud Abdelaziz, Lauri Anttila, Mikko Valkama, Tampere University of Technology, Finland*

Friday, December 9 16:10 - 17:30  
Lecture Session NCTA-2 Salon K

### Non-Commutative Theory and Applications II

Session Chair: Negar Kivayash, University of Illinois Urbana-Champaign

- NCTA-2.1** 16:10 **ANALYSIS OF A PRIVACY-PRESERVING PCA ALGORITHM USING RANDOM MATRIX THEORY**  
*Lu Wei, University of Michigan-Dearborn, United States; Anand Sarwate, Rutgers University, United States; Jukka Corander, University of Oslo, Norway; Alfred Hero, University of Michigan, Ann Arbor, United States; Vahid Tarokh, Harvard University, United States*
- NCTA-2.2** 16:30 **LEARNING CAUSAL INFORMATION FLOW STRUCTURES IN MULTI-LAYER NETWORKS**  
*Basak Guler, Aylin Yener, The Pennsylvania State University, United States; Ananthram Swami, Army Research Laboratory, United States*
- NCTA-2.3** 16:50 **VIDEO PROCESSING OF COMPLEX ACTIVITY DETECTION IN RESOURCE-CONSTRAINED NETWORKS**  
*Noor Felemban, Zongqing Lu, Tom La Porta, The Pennsylvania State University, United States; Kevin Chan, U.S. Army Research Laboratory, United States*

Friday, December 9 16:10 - 17:30  
Poster Session CSDL-P3 Salon DEFG

### Compressed Sensing, Deep Learning Poster III

Session Chair: Yuantao Gu, Tsinghua University

**CSDL-P3.1 SPACEBORNE SAR ANTENNA SIZE REDUCTION ENABLED BY COMPRESSIVE SAMPLING**

*Xiaqing Yang, Vishal M. Patel, Athina P. Petropulu, Rutgers University, United States*

**CSDL-P3.2 SPARSE REPRESENTATION OF HUMAN AUDITORY SYSTEM**

*Mohammad Edalatian, Ali Asghar Soltani, Neda Faraji, Imam Khomeini International University, Iran*

**CSDL-P3.3 OUT-OF-LABEL SUPPRESSION DICTIONARY LEARNING WITH CLUSTER REGULARIZATION**

*Xiudong Wang, Yuantao Gu, Tsinghua University, China*

Friday, December 9 16:10 - 17:30  
Poster Session GS-P4 Salon DEFG

### General Symposium Poster: Signal Processing for Communications

Session Chair: Phillip Regalia, Catholic University of America

**GS-P4.1 NON-COHERENT SYMBOL-BY-SYMBOL DETECTION OF MSK SIGNALS UNDER IMPULSIVE NOISE**

*Guosheng Yang, Jun Wang, Guangrong Yue, Shaoqian Li, University of Electronic Science and Technology of China, China*

**GS-P4.2 COHERENT SEQUENCE DETECTION OF MSK SIGNALS UNDER IMPULSIVE NOISE**

*Guosheng Yang, Jun Wang, Guangrong Yue, Shaoqian Li, University of Electronic Science and Technology of China, China*

**GS-P4.3 DETECTION DIVERSITY OF SPATIO-TEMPORAL DATA USING PITMAN'S EFFICIENCY FOR LOW SNR REGIMES**

*Prashant Khanduri, Syracuse University, United States; Vinod Sharma, Indian Institute of Science, India; Pramod K. Varshney, Syracuse University, United States*

**Signal and Information Processing Over Networks Poster II**

Session Chair: Alejandro Ribeiro, University of Pennsylvania

- SPN-P2.1 A NEW PERSPECTIVE ON RANDOMIZED GOSSIP ALGORITHMS**  
*Nicolas Loizou, Peter Richtarik, The University of Edinburgh, United Kingdom*
- SPN-P2.2 GRAPH TRANSFORMATION FOR KEYPOINT TRAJECTORY CODING**  
*Dong Tian, Huifang Sun, Anthony Vetro, Mitsubishi Electric Research Labs, United States*
- SPN-P2.4 A SPECTRAL GRAPH WIENER FILTER IN GRAPH FOURIER DOMAIN FOR IMPROVED IMAGE DENOISING**  
*Ali Can Yagan, Mehmet Tankut Ozgen, Anadolu University, Turkey*
- SPN-P2.5 IMPROVED ZERO-FORCING LINEAR PRECODER THROUGH TONE SUPPRESSION**  
*Shailendra Singh, Qualcomm Atheros Inc, United States; Surendra Prasad, IIT Delhi, India, India*
- SPN-P2.6 DISTRIBUTED INTERFERENCE ALIGNMENT FOR MIMO CELLULAR NETWORK VIA CONSENSUS ADMM**  
*Sandeep Kumar, Ketan Rajawat, Indian Institute of Technology Kanpur, India*
- SPN-P2.7 OUTAGE BOTTLENECK FOR RELIABLE MOBILE COMPUTATION OFFLOADING: TRANSMISSION OR COMPUTATION?**  
*Di Han, Bo Bai, Wei Chen, Tsinghua University, China*
- SPN-P2.8 THE VALUE STRENGTH AIDED INFORMATION DIFFUSION IN ONLINE SOCIAL NETWORKS**  
*Jingjing Wang, Chunxiao Jiang, Tsinghua University, China; Tony Q. S. Quek, Singapore University of Technology and Design, Singapore; Yong Ren, Tsinghua University, China*

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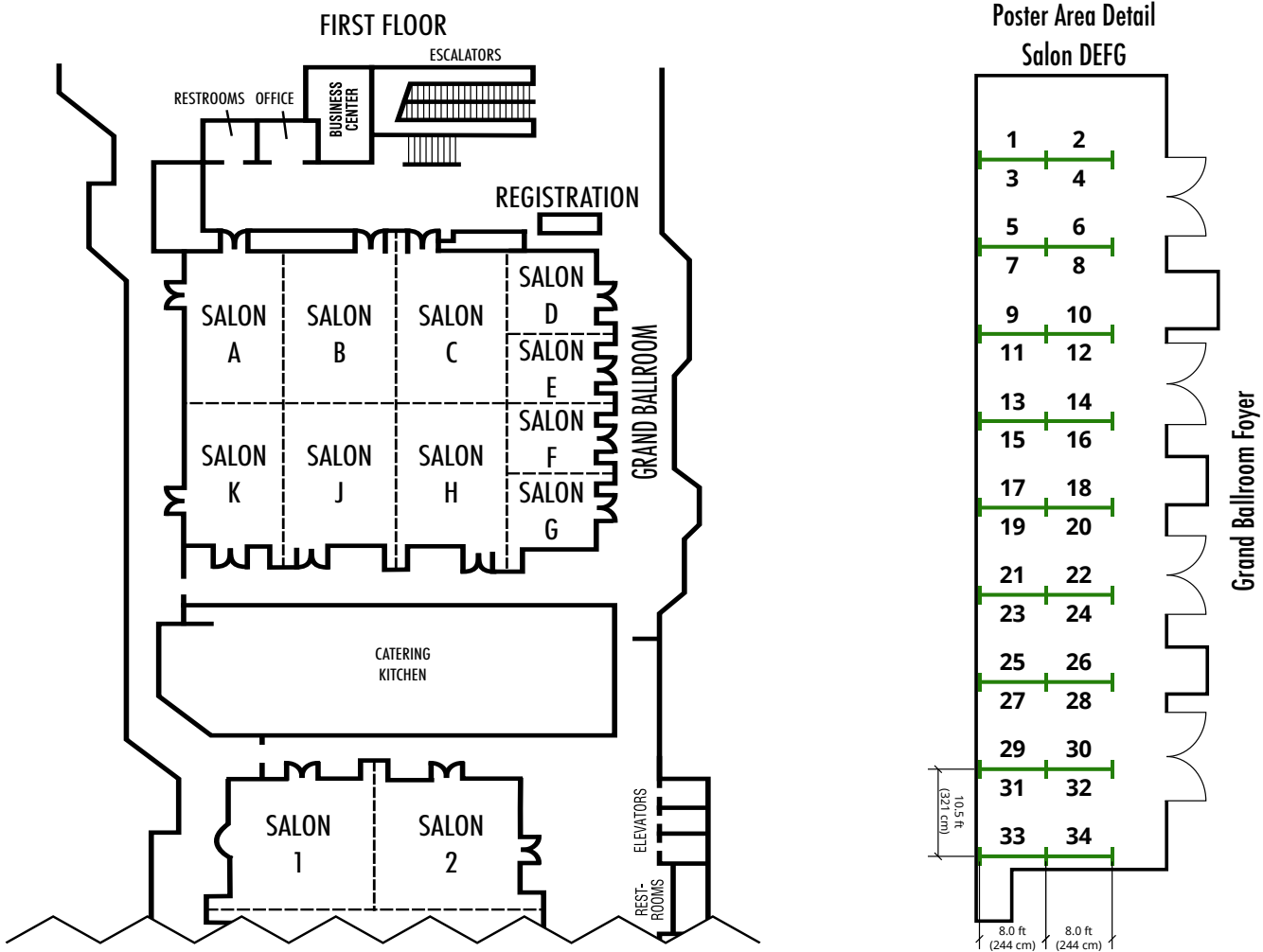
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**\* Second Floor contains Rosslyn I & II**

## SYMPOSIA GUIDE

GS	General Symposium
CSDL	Symposium on Compressed Sensing, Deep Learning
SPN	Symposium on Signal and Information Processing Over Networks
RMN	Symposium on Distributed Information Processing, Optimization, and Resource Management over Networks
DT5G	Symposium on Transceivers and Signal Processing for 5G Wireless and mm-Wave Systems
SGI	Symposium on Signal and Information Processing for Smart Grid Infrastructures
ITSP	Symposium on Information Theoretic Approaches to Security and Privacy
ESP	Symposium on Emerging Signal Processing Applications
CCR	Symposium on Machine Learning for Characterization of Cognitive Communications and Radar
BDMI	Symposium on Big Data Analysis and Challenges in Medical Imaging
UCD	Symposium on Signal Processing for Understanding Crowd Dynamics
SPBD	Symposium on Signal Processing of Big Data
NCTA	Symposium on Non-Commutative Theory and Applications
SSPC	Symposium on Sparse Signal Processing for Communications