IEEE ICASSP2016 – Workshop on Sensor Array and Communications

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Xidian University

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Location: Xi'an is an ancient but vibrant city. Delegates can join the local tours to visit the famous UNESCO World Heritage Site of Terracotta Warriors and Horses (兵马俑) and other historical sites including the City Wall (明长城), Qian Tomb (乾陵), Big Wild Goose Pagoda (大雁塔), Famen Temple (法门寺), Hua Qing Palace (华清池), etc., leaving you with unforgettable memories of Xi'an.

Date: **March 28, 2016** （Connected with IEEE ICASSP2016）

Venue: **International Conference Center, NPU, Xi'an， China**

Invited Speakers:

Speaker	University	Country
Prof. Louis Scharf	**Colorado State University**	**USA**
Prof. Georgios B. Giannakis	**University of Minnesota**	**USA**
Prof. Jian Li	**University of Florida**	**USA**
Prof. Geert Leus	**Delft University of Technology**	**The Netherlands**
Prof.Israel Cohen	**Technion-Isrel Institute of Technology**	**Israel**
Prof. Martin Haardt	**Ilmenau University of Technology**	**Germany**

Technical Co-Sponsors：

National Key Laboratory of Underwater Information Processing and Control, NPU

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National Key Laboratory of Integrated Services Networks, Xidian University

Shaanxi provincial key lab of speech and image information processing, NPU

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Center of Intelligent Acoustics and Immersive Communication, NPU

Registration:

All attendees need register with free of charge in order to guarantee the serve of activities. Please send the email to the secretary Dr. Chengbing He.

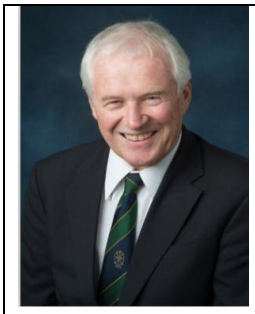
Secretary: Dr. Chengbing He, NPU, China

hcb@nwpu.edu.cn

Workshop Program

The opening Ceremony: 8:30 - 9:00，28 March 2016

6 Academic Speeches: 9:00 - 17:00, 28 March 2016

<table>
<tr><td rowspan="4">  </td><td>Title: Coherence as an Organizing Principle in Statistical Signal Processing</td></tr>
<tr><td>Author: Prof. Louis Scharf</td></tr>
<tr><td>University : Department of Mathematics ,
Colorado State University, USA</td></tr>
<tr><td>Time :9:00-10:00</td></tr>
<tr><td>Abstract</td><td>The concepts of coherence and interference are central to optics, electromagnetics, communication, and control. Perhaps they are central to statistical signal processing, as well. In this talk we shall explore this suggestion by examining the extent to which Generalized Coherence may be used as an organizing principle in detection, estimation, and time series analysis. In so doing, we shall establish the geometries and invariances of generalized coherence, and then apply it to the analysis of several new and old problems in statistical signal processing. Of particular note is the application of generalized coherence to array processing, and a logical derivation of what may be called broadband multi-channel coherence, a statistic whose finite sample distribution is the distribution of a product of independent beta random variables.</td></tr>
<tr><td>Biography</td><td>Louis Scharf is Research Professor of Mathematics and Emeritus Professor of Electrical and Computer Engineering at Colorado State University, Fort Collins, CO. His research interests are in statistical signal processing, as it applies to wireless communication, adaptive array processing for radar and sonar, and modal analysis for electric power monitoring. He has made original contributions to matched and adaptive subspace detection, invariance theories for signal processing, and reduced-rank signal processing in canonical coordinate systems. He has co-authored the books, L.L. Scharf, "Statistical Signal Processing: Detection, Estimation, and Time Series Analysis," Addison-Wesley, 1991, and P.J. Schreier and L.L. Scharf, "Statistical Signal Processing of Complex-Valued Data: The Theory of Improper and Noncircular Signals," Cambridge University Press, 2010.
Professor Scharf has received several awards for his professional service and his contributions to statistical signal processing, including an IEEE Distinguished Lectureship; an IEEE Third Millennium Medal; the Technical Achievement and Society Awards from the IEEE Signal Processing Society (SPS); and the 2016 IEEE Jack S. Kilby Medal for Signal Processing. He is a Life Fellow of IEEE.</td></tr>
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Title: Resource Allocation for Green Coordinated Multipoint Systems

Author: Prof. Georgios B. Giannakis

University: Dept. of Electrical and Computer Engineering,

The University of Minnesota, USA

Time :10:00-11:00

Abstract

Coordinated multi-point (CoMP) communication systems offer a promising solution for efficient interference management in future 5G wireless standards. As the number of base stations in CoMP networks grows aggressively, future communication systems must be both energy efficient as well as sustainable to deal with the resultant high electricity bills, but also with concerns of global warming. Fortunately, recent advances in smart grid technology line up well with green communication systems. In this context, this talk introduces a green CoMP system model integrating two-way energy trading, renewable energy sources, and (possibly imperfect) energy storage devices. To account for unknown dynamics of channel and energy parameters, we first develop robust resource allocation schemes for smart-grid powered CoMP systems. Leveraging stochastic approximation techniques, we also put forthsingle- and multi-timescale stochastic optimization formulations, along with low-complexity real-time solvers to obtain communication and energy schedules "on-the-fly". The proposed algorithms are provably convergent and adaptive to uncertainties of prices, renewables, and channels. Their efficacies are tested using both synthetic and real data.

Biography

Georgios B. Giannakis received his Diploma in Electrical Engr. from the Ntl. Tech. Univ. of Athens, Greece, 1981. From 1982 to 1986 he was with the Univ. of Southern California (USC), where he received his MSc. in Electrical Engineering, 1983, MSc. in Mathematics, 1986, and Ph.D. in Electrical Engr., 1986. Since 1999 he has been a professor with the Univ. of Minnesota, where he now holds an ADC Chair in Wireless Telecommunications in the ECE Department, and serves as director of the Digital Technology Center. His general interests span the areas of communications, networking and statistical signal processing – subjects on which he has published more than 390 journal papers, 660 conference papers, 20 book chapters, two edited books and two research monographs (h-index 115). Current research focuses on big data analytics, wireless cognitive radios, network science with applications to social, brain, and power networks with renewables. He is the (co-) inventor of 22 patents issued, and the (co-) recipient of 8 best paper awards from the IEEE Signal Processing (SP) and Communications Societies, including the G. Marconi Prize Paper Award in Wireless Communications. He also received Technical Achievement Awards from the SP Society (2000), from EURASIP (2005), a Young Faculty Teaching Award, the G. W. Taylor Award for Distinguished Research from the University of Minnesota, and the IEEE Fourier Technical Field Award (2015). He is a Fellow of the IEEE and EURASIP, and has served the IEEE in a number of posts including that of a Distinguished Lecturer for the IEEE-SPS.

Title: Robust Adaptive Beamforming and Its Applications

Author: Prof. Jian Li

University : Department of Electrical and Computer Engineering, University of Florida, USA

Time :11:00-12:00

Abstract

The standard Capon beamformer (SCB) has better resolution and much better interference rejection capability than the data-independent beamformer, provided that the array steering vector corresponding to the signal of interest (SOI) is accurately known. However, whenever the knowledge of the SOI steering vector is imprecise (as is often the case in practice), the performance of the Capon beamformer may become worse than that of the data-independent beamformer. Most of the early suggested robust adaptive methods are rather ad hoc in that the choice of their parameters are not directly related to the uncertainty of the steering vector. Only recently have some methods with a clear theoretical background been proposed to directly address the uncertainty of the steering vector. We provide a comprehensive review of our robust Capon beamformer (RCB) to show its enhanced performance over SCB. To avoid the need to know the uncertainty of the array steering vector, which is often not available in practice, we also introduce a user parameter free RCB that can be used easily in practical applications. We will compare the performances of aforementioned adaptive beamformers using a real-world example.

Biography

Jian Li received the M.Sc. and Ph.D. degrees in electrical engineering from The Ohio State University, Columbus, in 1987 and 1991, respectively. She is currently a Professor in the Department of Electrical and Computer Engineering, University of Florida, Gainesville. Her current research interests include spectral estimation, statistical and array signal processing, and their applications to radar, sonar, and biomedical engineering. Dr. Li's publications include Robust Adaptive Beamforming (2005, Wiley), Spectral Analysis: the Missing Data Case (2005, Morgan & Claypool), MIMO Radar Signal Processing (2009, Wiley), and Waveform Design for Active Sensing Systems -- A Computational Approach (2011, Cambridge University Press).

Dr. Li is a Fellow of IEEE and a Fellow of IET. She received the 1994 National Science Foundation Young Investigator Award and the 1996 Office of Naval Research Young Investigator Award. She was a member of the Editorial Board of the IEEE Signal Processing Magazine from 2010 to 2012. She is currently a member of the Sensor Array and Multichannel Technical Committee of the IEEE Signal Processing Society. She is a co-author of the paper that has received the M. Barry Carlton Award for the best paper published in IEEE Transactions on Aerospace and Electronic Systems in 2005. She is also a co-author of a paper published in IEEE Transactions on Signal processing that has received the Best Paper Award in 2013 from the IEEE Signal Processing Society.

Title: Sparse Sensing for Statistical Inference

Author: Prof. Geert Leus

University :The Faculty of Electrical Engineering, Mathematics and Computer Science , The Delft University of Technology, The Netherlands

Time :14:00-15:00

Abstract

Ubiquitous sensors generate prohibitively large data sets. Large volumes of such data are nowadays generated by a variety of applications such as imaging platforms and mobile devices, surveillance cameras, social networks, power networks, to list a few. In this era of data deluge, it is of paramount importance to gather only the data that is informative for a specific task in order to limit the required sensing cost, as well as the related costs of storing, processing, or communicating the data. The main goal of this talk is therefore to present topics that transform classical sensing methods, often based on Nyquist-rate sampling, to more structured low-cost sparse sensing mechanisms designed for specific inference tasks, such as estimation, filtering, and detection. More specifically, we present fundamental tools to achieve the lowest sensing cost with a guaranteed performance for the task at hand. Applications can be found in the areas of radar, multi-antenna communications, remote sensing, and medical imaging.

Biography

Geert Leus received the MSc and PhD degree in Applied Sciences from the Katholieke Universiteit Leuven, Belgium, in June 1996 and May 2000, respectively. Currently, Geert Leus is an "Antoni van Leeuwenhoek" Full Professor at the Faculty of Electrical Engineering, Mathematics and Computer Science of the Delft University of Technology, The Netherlands. His research interests are in the area of signal processing for communications. Geert Leus received a 2002 IEEE Signal Processing Society Young Author Best Paper Award and a 2005 IEEE Signal Processing Society Best Paper Award. He is a Fellow of the IEEE and a Fellow of EURASIP. Geert Leus was the Chair of the IEEE Signal Processing for Communications and Networking Technical Committee, and an Associate Editor for the IEEE Transactions on Signal Processing, the IEEE Transactions on Wireless Communications, the IEEE Signal Processing Letters, and the EURASIP Journal on Advances in Signal Processing. Currently, he is a Member-at-Large to the Board of Governors of the IEEE Signal Processing Society and a member of the IEEE Sensor Array and Multichannel Technical Committee. He finally serves as the Editor in Chief of the EURASIP Journal on Advances in Signal Processing.

<table>
<tr><td rowspan="4">  </td><td>Title: Real-time microphone selection in noisy reverberant environments for teleconferencing systems</td></tr>
<tr><td>Author: Prof. Israel Cohen</td></tr>
<tr><td>University : Department of Electrical Engineering,
Technion-Israel Institute of Technology, Israel</td></tr>
<tr><td>Time : 16:00-17:00</td></tr>
<tr><td>Abstract</td><td>In a teleconferencing application, it is sometimes desired to use more than one microphone for audio pickup in order to cover larger room setting. A major challenge is to monitor the perceived quality of each microphone signal and select, at any given point in time, the microphone with the best reception.

In this talk, I will present a real-time system that comprises a few microphone clusters and a main audio unit to identify comparative features of output signals for each of the microphone clusters. The microphone selection contains two stages. The first stage is local: for each microphone cluster we compute some features of the local signals. The second stage is global: we select the least reverberant signal based on the features of the local signals. We show that local power and local power-ratio are reliable attributes which are sufficient for selecting at each time-frequency bin the microphone with the best reception amongst randomly placed microphones.</td></tr>
<tr><td>Biography</td><td>Israel Cohen is a Professor of electrical engineering at the Technion - Israel Institute of Technology, Haifa, Israel, and a Visiting Professor at Northwestern Polytechnical University, Xi’an, Shaanxi, China. He is a Fellow of the IEEE for contributions to the theory and application of speech enhancement. He received the B.Sc. (Summa Cum Laude), M.Sc. and Ph.D. degrees in electrical engineering from the Technion- Israel Institute of Technology, Haifa, Israel, in 1990, 1993 and 1998, respectively.
From 1990 to 1998, he was a Research Scientist with RAFAEL Research Laboratories, Haifa, Israel Ministry of Defense. From 1998 to 2001, he was a Postdoctoral Research Associate with the Computer Science Department, Yale University, New Haven, CT, USA. In 2001 he joined the Electrical Engineering Department of the Technion.
He was a recipient of the Alexander Goldberg Prize for Excellence in Research, and the Muriel and David Jacknow Award for Excellence in Teaching. He serves as a member of the IEEE Audio and Acoustic Signal Processing Technical Committee and the IEEE Speech and Language Processing Technical Committee. He served as Associate Editor of the IEEE Transactions on Speech and Audio Processing and IEEE Signal Processing Letters. He is a coeditor of the Multichannel Speech Processing Section of the Springer Handbook of Speech Processing (Springer, 2008), a coauthor of Noise Reduction in Speech Processing (Springer, 2009), a Coeditor of Speech Processing in Modern Communication: Challenges and Perspectives (Springer, 2010), and a General Cochair of the 2010 International Workshop on Acoustic Echo and Noise Control.</td></tr>
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Title: Efficient Two-Way Relaying Schemes for Amplify and Forward Relays with Multiple Antennas and Hybrid Beamforming Concepts for Massive MIMO

Author: Prof. Martin Haardt

University : Ilmenau University of Technology, Germany

Time :15:00-16:00

Abstract

Relaying is an important component of future mobile communication systems, especially if higher carrier frequencies are employed. In particular, two-way relaying is known to exploit the radio resources in a very efficient manner as it allows for the bidirectional exchange of information in only two time slots while all nodes operate in half-duplex mode. In this overview presentation, we first focus on two-way relaying with amplify-and-forward (AF) relays that have multiple antennas. Compared to decode-and-forward (DF) relays, AF relays incur less transmission delay, are transparent to the underlying modulation and coding schemes, and require less hardware complexity. Therefore, we present various approaches to design the relay amplification matrix in such a setting. We discuss simple algebraic designs that are in general sub-optimal. Yet, they demonstrate a very good performance in numerical simulations. Such algebraic designs are quite relevant in practice, where tedious computations need to be avoided due to hardware constraints in terms of processing power of the relay nodes. In the second part of the talk, we extend the discussion to the case of multiple communication partners that exchange data bi-directionally via a shared relay with multiple antennas in a two way relaying fashion using the same spectrum. Such a scenario is, for instance, present in the context of voluntary physical resource sharing between several operators. For such a system we develop a projection based separation of multiple operators (ProBaSeMO) relay transmit strategy, which is a closed-form algebraic solution. ProBaSeMO is generic and can be easily adapted for different system settings, e.g., single or multiple-antenna user terminals. Compared to an orthogonal spectrum sharing approach, ProBaSeMO achieves a significant sharing gain in terms of system sum rate. Moreover, it suffers only a small loss compared to the optimal solution and has a significantly lower computational complexity. In the third part of the talk, we study a hybrid precoding design for frequency selective massive MIMO channels, e.g., massive MIMO systems operating in the millimeter wave (mmWave) range. Hybrid analog-digital MIMO schemes are proposed for such systems due to the high cost and power consumption of the RF chains. In this case, the RF analog precoding is implemented using only phase shift networks that impose constant modulus constraints on the RF precoding and decoding matrices. Moreover, there is just one common equivalent RF beamforming matrix for all subcarriers. The resulting sum rate maximization problem is non-convex. Therefore, we introduce two suboptimal solutions, a truncated higher order SVD (HOSVD) based design and the sequential low rank unimodular approximation (SeLoRUA). Simulation results show that both approaches outperform a simple extension of a state-of-the-art compressed sensing based algorithm to the multi-carrier case.

Biography	**Martin Haardt** has been a Full Professor in the Department of Electrical Engineering and Information Technology and Head of the Communications Research Laboratory at Ilmenau University of Technology, Germany, since 2001. He has also served as an Honorary Visiting Professor in the Department of Electronics at the University of York, United Kingdom, since 2012. After studying electrical engineering at the Ruhr-University Bochum, Germany, and at Purdue University, USA, he received his Diplom-Ingenieur (M.S.) degree from the Ruhr-University Bochum in 1991 and his Doktor-Ingenieur (Ph.D.) degree from Munich University of Technology in 1996. In 1997 he joint Siemens Mobile Networks in Munich, Germany, where he was responsible for strategic research for third generation mobile radio systems. From 1998 to 2001 he was the Director for International Projects and University Cooperations in the mobile infrastructure business of Siemens in Munich, where his work focused on mobile communications beyond the third generation. During his time at Siemens, he also taught in the international Master of Science in Communications Engineering program at Munich University of Technology. Martin Haardt has received the 2009 Best Paper Award from the IEEE Signal Processing Society, the Vodafone (formerly Mannesmann Mobilfunk) Innovations-Award for outstanding research in mobile communications, the ITG best paper award from the Association of Electrical Engineering, Electronics, and Information Technology (VDE), and the Rohde & Schwarz Outstanding Dissertation Award. In the fall of 2006 and the fall of 2007 he was a visiting professor at the University of Nice in Sophia-Antipolis, France, and at the University of York, UK, respectively. His research interests include wireless communications, array signal processing, high-resolution parameter estimation, as well as numerical linear and multilinear algebra. Prof. Haardt has served as an Associate Editor for the IEEE Transactions on Signal Processing (2002-2006 and since 2011), the IEEE Signal Processing Letters (2006-2010), the Research Letters in Signal Processing (2007-2009), the Hindawi Journal of Electrical and Computer Engineering (since 2009), the EURASIP Signal Processing Journal (since 2011), and as a guest editor for the EURASIP Journal on Wireless Communications and Networking. He has also served as an elected member of the Sensor Array and Multichannel (SAM) technical committee of the IEEE Signal Processing Society (since 2011), as the technical co-chair of the IEEE International Symposiums on Personal Indoor and Mobile Radio Communications (PIMRC) 2005 in Berlin, Germany, as the technical program chair of the IEEE International Symposium on Wireless Communication Systems (ISWCS) 2010 in York, UK, as the general chair of ISWCS 2013 in Ilmenau, Germany, and as the general co-chair of the 5-th IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP) 2013 in Saint Martin, French Antilles, the 19-th Intern. Workshop on Smart Antennas (WSA) in Ilmenau, the 9-th IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM) 2016 in Rio de Janeiro, Brazil, as well as CAMSAP 2017 in Curacao, Dutch Antilles.