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Latest Trends in Circuits, Systems, Signal Processing and Automatic Control

- Proceedings of the 5th International Conference on Circuits, Systems, Control, Signals (CSCS '14)
- Proceedings of the 2nd International Conference on Acoustics, Speech and Audio Processing (ASAP '14)

Salerno, Italy, June 3-5, 2014

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Plenary Lecture 1

Pseudospectral Structure of the Singular Vectors of Nonstationary Time Series

Profesor Alexander Milnikov
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Abstract: It is proved, that m principal singular vectors of a matrix , constructed on the base of a time series, contained m periodical deterministic components with additive white noise, have equal pseudospectrums and their pseuvdospectral structure is identical to the time series' one. Exact definitions of a conception of the pseuvdospectral structures are introduced, as well as a numerical criterion of their identity. Detecting of singular vectors having identical pseuvdospectral structures allows predefining the number of periodical deterministic components and separating principal and the other singular components from each other.

Brief Biography of the Speaker: A. Milnikov holds a Bs/Ms in Electronic Engineering, a PhD in Electric Engineering (1978) and a Doctor of Sciences in Applied Mathematics (2002) from the Technical University of Georgia.
He works as a full professor of: International Black Sea University (Tbilisi, Georgia) (1994-present), Technical University of Georgia (1999-present), Georgian Academy of Scineces, Institute of Applied Mechanics (1980-present), Academician (1980-1988), Leading Academician (1989-2005), Principal Academician (2005-present). Also he worked as a Dean of the Computer Technologies and Engineering Faculty at the International Black Sea University (1994-2008). His research interests include: the Electrical Circuits Theory, Modern Geometry (Differential Geometry and Tensorial Analysis), Statistics, Random Processes, Signals Theory and Digital Processing, Filters Design. He has more than 80 publications, qmong them 10 in impact journals, 15 proceedings in WSEAS and Other International Conferences.

Plenary Lecture 2

Robust Algorithms of Signal Processing

Professor Tõnu Trump
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Abstract: This talk concentrates on using the robust statistics in developing signal processing algorithms. Robust statistics continue to gain importance because of increasing amount of environments where noise is impulsive, not Gaussian. Impulsive noise can be seen as the reason of having outliers in the data and signal processing algorithms designed for Gaussian noise cannot cope with the impulsive noise well. The plenary talk breafly reviews the common teqhniques for estimation and detection designed for Gaussian noise. We then highlight the weeknesses of the ordinary technuques when used in the environment with impulsive noise. After that we introduce robust statistics and discuss several robust techniques for estimation and detection.

Brief Biography of the Speaker: Tõnu Trump received his Ph.D. degree from Tallinn University of Technology in 1993. He was from 1994 to 2006 with Ericsson AB in Stockholm Sweden, where he reached the position of expert in echo cancellation and voice enhancement devices. From 2002 to 2006 he was also the rapporteur of Question 17, Study Group 16 at International Telecommunication Union (ITU-T) in Geneva Switzerland. Since 2006 he has been the professor of Signal Processing at Tallinn University of Technology in Tallinn, Estonia.
Prof. Trump has published a number of scientific papers and is the author of more than 10 patents.

Plenary Lecture 3

Novel PDE-Based Image Denoising and Restoration Models

Professor Tudor Barbu
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Abstract: Over the last few decades, the mathematical models have been increasingly used in some traditionally engineering domains like signal and image processing, analysis, and computer vision. Numerous image processing and analysis methods making use of partial differential equation based algorithms and variational calculus have been developed recently. The PDE-based techniques have been widely used in these fields in the past years because of their modeling flexibility and some advantages of their numerical implementation. Image denoising and restoration represent an important image processing domain that has been successfully approached using the PDE-based models. The nonlinear PDE-based approaches are able to smooth the images while preserving their edges, also avoiding the localization problems of linear filtering. Since P. Perona and J. Malik introduced their influential anisotropic diffusion scheme in 1987, many nonlinear diffusion equation based image noise removal techniques have been proposed. In image processing it is very common to obtain the nonlinear PDEs from some variational problems. The variational models have important advantages in both theory and computation, compared with other techniques. An influential variational denoising and restoration model was developed by Rudin, Osher and Fetami in 1992. Their technique, named Total Variation (TV) denoising, is based on the minimization of the TV norm. We have proposed numerous PDE-based image denoising and restoration techniques in recent years. Thus, we have developed both diffusion-based filtering approaches and variational PDE denoising solutions. Both linear and nonlinear diffusion equation based techniques have been modeled. A novel linear anisotropic diffusion approach based on a modified Gaussian filter kernel will be described. Also, we present some robust nonlinear anisotropic diffusion based techniques, derived from and improving the Perona-Malik denoising scheme. Various diffusivity functions are used by these smoothing algorithms. Several novel variational PDE-based denoising and restoration approaches, based on some properly chosen minimization problems, will be also described.

Brief Biography of the Speaker: Dr. Tudor Barbu is currently Senior Researcher I at the Institute of Computer Science of the Romanian Academy, in Iasi, Romania. He is the coordinator of the Image and Video Processing and Analysis research collective of the institute and also member of the leading Scientific Council of this institute. Mr. Barbu has a PhD degree in Computer Science, awarded by the Faculty of Automatic Control and Computers of the University “Politehnica” of Bucharest. He published 2 books and 4 book chapters as main author. Also, dr. Tudor Barbu published more than 70 articles in prestigious international journals and volumes of international scientific events (conferences, symposiums and workshops). His scientific activity also includes more than 35 research reports, elaborated with the institute research team coordinated by him or related to various research projects. His scientific publications have got over 120 citations, according to Google-Academic. In recent years he also coordinated various research directions in 6 projects based on contracts/grants. Dr. Tudor Barbu received also several awards for his research results, the most important being the Romanian Academy Prize “Gheorghe Cartianu”, in the Information Science and Technology domain, awarded on December 18, 2008. He is member of several conference scientific committees and also member of scientific and technical committee and editorial review boards of some journals. He is the Editor in Chief of a book. His main scientific areas of interest are: digital media (audio, video and image) signal processing and analysis, pattern recognition, computer vision, multimedia information storage, indexing and retrieval, biometric authentication using voice, face and digital fingerprint recognition, and partial differential equations.

Plenary Lecture 4

A Comparative Study on Network Sensitivity Analysis by Using Some Kinds of Signal-Flow Graphs

Professor Georgi A. Nenov
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Abstract: The actual progress in the area of the efficient methods for electrical circuit analysis and synthesis is closely connected with the problems of sensitivity determination of the realized structures. Usually the proposed until now approaches for sensitivity calculation are directed to the obtaining of a symbolic form of searched expressions and to an avoiding the direct differentiation of the complicate expressions of network functions. This task often reaches its decision by using signal-flow graph representation of the network relationships. Interesting results in this topic are based on Mason's graphs, Coates's graphs and Chan-Mai's graphs. The matter of the paper presented consists in the comparison of some signal-flow graph methods for first- and higher order network symbolic sensitivity determination concerning their advantages and specific applicability.

Brief Biography of the Speaker: Georgi A. Nenov graduated from Technical University, Sofia, Bulgaria in 1962. He worked as an Assistant Professor in Technical University, Varna, Bulgaria (1963-1966), as a Scientific Researcher in Institute of Instrument Design in Sofia (1966-1974) and in Institute of Technical Cybernetics, Bulgarian Academy of Sciences in Sofia (1974-1980), as an Associate Professor in University "Prof. Dr Assen Zlatarov", Bourgas, Bulgaria (1980-1988) and as an Associate Professor (1988-1995) and Professor (1995) in Higher School of Transport "Todor Kableshkov, Sofia. Prof Nenov defend in 1973 a PhD dissertation on active circuit synthesis and in 1991, a Dr.Sc dissertation on analysis and synthesis of SC-networks. He is a Senior Member of IEEE and a member of Bulgarian Scientific Found. The research interests of Prof. Nenov are in the field of electrical network analysis and synthesis, network sensitivity and neural networks. He is an author and co-author of more than 120 journal and conference papers, 3 books and 1 invited book chapter.

Plenary Lecture 5

Performance Improvement Using Diversity Techniques in Wireless Communication Systems over Correlated Fading Channels

Professor Dragana Krstic
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Abstract: In wireless communications, fading is deviation of the attenuation affecting a signal over propagation media. The fading may vary with time, geographical position or frequency, and it is modeled as a random process. A fading channel is a communication channel containing fading. In wireless systems, fading may either be due to multipath propagation,called multipath fading, or due to shadowing from obstacles affecting the wave propagation. Various statistical models explain the nature of fading and several distributions describe the envelope of the received signal: Rayleigh, Rice, Nakagami-m, Hoyt, Weibull, a-m, k-m, … A log-normal or gamma distribution model the average power to account for shadowing.
Diversity technique is one of the most used methods for minimizing fading effects and increasing the communication reliability without enlarging either transmitting power or channel's bandwidth. In communication systems where antennas are sufficiently apart, it is considered there is no correlation between transmitted signals, as well as between interferences at the reception. However, it can not be always done in practice because there is insufficient antenna spacing when diversity is applied in small devices. Because of that, the performance of diversity systems in which there is a correlation between transmitted signals and between interferers have to be considered also.

Brief Biography of the Speaker: Dragana S. Krstic was born in Pirot, Serbia. She received the BSc, MSc and PhD degrees in electrical engineering from Department of Telecommunications, Faculty of Electronic Engineering, University of Nis, Serbia, in 1990, 1998 and 2006, respectively. Her field of interest includes telecommunications theory, wireless communication systems, satellite communication systems etc. She works at the Faculty of Electronic Engineering in Nis since 1990. She participated in more Projects which are supported by Serbian Ministry of Science. She has written or co-authored more then 170 papers, published in Journals and at the International/National Conferences. She has also reviewed many articles in IEEE Transactions on Communications; IEEE Communications Letters; ETRI journal; C&EE Journal; Elektronika ir Elektrotechnika and other prominent journals. She is the reviewer of the papers for many conferences and the member of technical program committees and international scientific committees of several scientific conferences. Also, she is the member of Editorial Board of International Journal on Advances in Telecommunications.

Plenary Lecture 6

DoS Attack Detection in Internet-Connected Vehicles

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Abstract: The new generations of the Intelligent Transportation Systems depend heavily on communication between vehicles and road-side equipment using IEEE 802.11P and to the Internet via Wi-Fi and cellular technologies. The topic of this presentation is limited to vehicles connected to the Internet via Wi-Fi technology using IEEE 802.11b. The growing list of vehicle manufacturers that include Wi-Fi capabilities to cars to enable the Internet access coupled with the government plans to expand Wi-Fi access to the roads raises the challenges to secure the wireless networks to combat malicious users. In this presentation, we present a method to detect and identify malicious users that attempt to capture the Wi-Fi channel. Malicious user aims to disrupt the communication in the physical range of the hotspot. The disruption of communications can jeopardize the safety of the commuters when real-time applications that require Internet connection, such as road conditions, incidents and traffic updates, are running.
We discuss a light weight technique to detect the Denial of Service (DoS) behavior applied by malicious users in Internet-connected vehicles using Wi-Fi to access the Internet via hotspots installed on the roads. Malicious nodes manipulate the IEEE 802.11 DCF standards to illegally gain extra throughput and increase the probability of having a successful packet transmission on the expense of the honest users that follow the protocol standards. The theoretical network throughput is derived using two-dimensional Markov Chain to determine the network capacity. Results obtained by the theoretical computations are validated by network simulation to determine the baseline for the maximum achievable throughput in the network under fair conditions where all nodes follow the IEEE standards. An approach is presented to enable all the nodes in IEEE 802.11 network with a mechanism to detect and identify the malicious nodes in a distributed environment. Results are presented to prove the effectiveness and feasibility of the proposed algorithm.

Brief Biography of the Speaker: TAREK N. SAADAWI received the B.Sc. and the M.Sc. from Cairo University Egypt in 1973 and 1975 respectively and the Ph.D. from the University of Maryland, College Park in 1980 (all in Electrical Engineering). Since 1980 he has been with the Electrical Engineering Department, The City University of New York, City College where he currently directs the Center of Information Networking and Telecommunications (CINT) and a Professor teaching courses in Network security, computer networks, local area network, communications systems and information theory. His current interests are telecommunications networks security, high-speed networks, multimedia networks, mobile ad-hoc networks and transport layer protocols. He has published extensively in the area of telecommunications networks. He is a co-editor of the book "Cyber Infrastructure Protection," Strategic Study Institute, volume 1, May 2011, and Volume 2 August 2013, and Co-author of the book, Fundamentals of Telecommunication Networks," John Wiley & Sons, 1994 (which has been translated into Chinese) and.
Dr. Saadawi is the co-Chair and co-Organizer of NSF Workshop on Cyber Security, Cairo-Egypt, May 27-30, 2013 and was a Member of the Consortium Management Committee for the Army Research Lab (ARL) Consortium on communications and networks; known as the Collaborative Technology Alliances on Communications and Networks, (1996 – 2011). He is a Senior Member of IEEE, former Technical Editor of IEEE Communications, and former Chairman of IEEE Computer Society of New York City (1986-87). He has received IEEE Region 1 Award, 1987, and the Nippon Telegraph and Telephone (NTT) of America for research on Broadband Telecommunication Networks. Dr Saadawi is a co-founder of IEEE Symposium on Computers and Commuications (ISCC is in its 18th series).
Dr Saadawi and has been invited and joined US Dept of Commerce Delegation to the Government of Algeria to address rural communications. He also led a group of US experts to provide a telecommunications master plan for the Government of Egypt under US AID funding.

Plenary Lecture 7

The Use of Meta-Optimization for Parameter Selection in Machine Learning

Professor Filippo Neri
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Abstract: The process of identifying the optimal parameters for an optimization algorithm or a machine learning one is a computationally expensive one and it usually requires the search of a large, possibly infinite, space of candidate parameter sets. This process does not have any guarantee of optimality. Various attempts have been made to automate this process. I will describe my current research in the field by describing a methodological approach of using a simple genetic algorithm to approximate the optimal parameter setting for machine learning system on given datasets.

Brief Biography of the Speaker: Prof. Filippo Neri is currently with the Dept. of Electrical Engineering and Computer Science at University of Naples Federico II, Italy. Prof. Filippo Neri is currently Editor in Chief of WSEAS Transactions on Systems. Prof. Filippo Neri has wide experience in the area of artificial intelligence, machine learning, and software agent simulation. He had the opportunity to work both in academic and industrial environments including Ericsson's and Unlever's R&D centers and across three countries in the European Union (Italy, Ireland and UK). He has studied and visited at several important academic institutions including Carnegie Mellon University, Imperial College London, University of Milano, University of Torino, University of Malta. He is a Marie Curie Fellow and a ADI associate, the Italian PhD association. Finally he has served in the program committees and as reviewer at several international conferences.

Plenary Lecture 8

The Emulation of Non-Linear Acoustic Devices

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Abstract: The emulation of audio devices (as valve amplifier, musical instruments, etc) represents an important research topic. The most important method utilised to obtain information about an audio system is based on the measurement of its impulse response (IR). Once the IR has been caught, it is possible to recreate, by the use of linear convolution, the output signal that the audio system will generate when it is physically driven by any input signal. This method gives great results if the system is linear and time-invariant (environments behaviour is much linear and therefore its reverberant effect can be faithfully recreated using IRs) but not satisfactory in other cases, such as the emulation of tube preamps (mainly nonlinear), musical instruments and valve amplifiers. By using Hammerstein or Wiener series it is possible to represent the input-output relationship of nonlinear systems. These two methods could be generalised using Volterra model. It uses a set of impulse responses to describe the system and not only one as before. By an enhanced impulse response measurement method it is possible to obtain this set of impulses and then with Volterra series it would be possible to have the output of the audio system driven by any input.
A special numerical tool has been developed to recreate the system behaviour by using this method. Finally, satisfactory results have been obtained in comparison with the traditional linear convolution based approach, and will be shown during the lecture.

Brief Biography of the Speaker: Dr Lamberto Tronchin is Associate Professor in Environmental Physics from the University of Bologna and is recognised internationally as a leading authority on the subject of sound and acoustics. A pianist himself, with a diploma in piano from the Conservatory of Reggio Emilia, Dr Tronchin's principal area of research has been musical acoustics, room acoustics and signal processing. He is Associate Editor of the Journal of AES, and the author of more than 190 papers and was Chair of the Musical Acoustics Group of the Italian Association of Acoustics from 2000 to 2008. Dr Tronchin is a member of the Scientific Committee of the CIARM, the Inter- University Centre of Acoustics and Musical research, has chaired sessions of architectural and musical acoustics during several international symposiums, been a referee for a number of International journals and is Chair of Organising and Scientific Committees of IACMA (International Advanced Course on Musical Acoustics).
He was a visiting researcher at the University of Kobe in Japan, a visiting professor at the University of Graz in Austria and Special honored International Guest at the International Workshop, ‘Analysis, Synthesis and Perception of Music Signals', at Jadavpur University of Kolkata, India in 2005. He has chaired the International Advanced Course on Musical Acoustics (IACMA), organised with the European Association of Acoustics, which was held in Bologna, in 2005. In 2008 and 2009 he gave plenary lectures at International Congresses on Acoustics in Vancouver, Prague, Bucharest, Santander, Kos, Malta, Paris and Cambridge (UK). He designed theatres and other buildings, as acoustic consultant, in collaboration with several Architects, among them Richard Meier and Paolo Portoghesi.