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Proceedings of the 19th International Conference on Computers (part of CSCC '15)

Zakynthos Island, Greece, July 16-20, 2015

Recent Advances in Computer Science

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Plenary Lecture 1

Error Estimation in the Decoupling of Ill-Defined and/or Perturbed Nonlinear Processes

Professor Pierre Borne (IEEE Fellow)
Co-authors Amira Gharbi, Mohamed Benrejeb
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Abstract: This lecture deals with the definition of the attractors characterizing the precision of decoupling control laws for a nonlinear process in presence of uncertainties and/or bounded perturbations. This approach is based on the use of aggregation techniques and the definition of a comparison system of the controlled process.

Brief Biography of the Speaker: Pierre BORNE received the Master degree of Physics in 1967 and the Master of Electrical Engineering, the Master of Mechanics and the Master of Applied Mathematics in 1968. The same year he obtained the Diploma of "Ingenieur IDN" (French "Grande Ecole"). He obtained the PhD in Automatic Control of the University of Lille in 1970 and the DSc in physics of the same University in 1976. Dr BORNE is author or co-author of about 200 Publications and book chapters and of about 300 communications in international conferences. He is author of 18 books in Automatic Control, co-author of an english-french, french-english « Systems and Control » dictionary and co-editor of the "Concise Encyclopedia of Modelling and Simulation" published with Pergamon Press. He is Editor of two book series in French and co-editor of a book series in English. He has been invited speaker for 40 plenary lectures or tutorials in International Conferences. He has been supervisor of 76 PhD Thesis and member of the committee for about 300 doctoral thesis . He has participated to the editorial board of 20 International Journals including the IEEE, SMC Transactions, and of the Concise Subject Encyclopedia . Dr BORNE has organized 15 international conferences and symposia, among them the 12th and the 17 th IMACS World Congresses in 1988 and 2005, the IEEE/SMC Conferences of 1993 (Le Touquet – France) and of 2002 (Hammamet - Tunisia) , the CESA IMACS/IEEE-SMC multiconferences of 1996 (Lille – France) , of 1998 (Hammamet – Tunisia) , of 2003 (Lille-France) and of 2006 (Beijing, China) and the 12th IFAC LSS symposium (Lille France, 2010) He was chairman or co-chairman of the IPCs of 34 international conferences (IEEE, IMACS, IFAC) and member of the IPCs of more than 200 international conferences. He was the editor of many volumes and CDROMs of proceedings of conferences. Dr BORNE has participated to the creation and development of two groups of research and two doctoral formations (in Casablanca, Morocco and in Tunis, Tunisia). twenty of his previous PhD students are now full Professors (in France, Morocco, Tunisia, and Poland). In the IEEE/SMC Society Dr BORNE has been AdCom member (1991-1993 ; 1996-1998), Vice President for membership

(1992-1993) and Vice President for conferences and meetings (1994-1995, 1998-1999). He has been associate editor of the IEEE Transactions on Systems Man and Cybernetics (1992-2001). Founder of the SMC Technical committee « Mathematical Modelling » he has been president of this committee from 1993 to 1997 and has been president of the « System area » SMC committee from 1997 to 2000. He has been President of the SMC Society in 2000 and 2001, President of the SMC-nomination committee in 2002 and 2003 and President of the SMC-Awards and Fellows committee in 2004 and 2005. He is member of the Advisory Board of the "IEEE Systems Journal" . Dr. Borne received in 1994, 1998 and 2002 Outstanding Awards from the IEEE/SMC Society and has been nominated IEEE Fellow the first of January 1996. He received the Norbert Wiener Award from IEEE/SMC in 1998, the Third Millennium Medal of IEEE in 2000 and the IEEE/SMC Joseph G. Wohl Outstanding Career Award in 2003. He has been vice president of the "IEEE France Section" (2002-2010) and is president of this section since 2011. He has been appointed in 2007 representative of the Division 10 of IEEE for the Region 8 Chapter Coordination sub-committee (2007-2008) He has been member of the IEEE Fellows Committee (2008- 2010) Dr BORNE has been IMACS Vice President (1988-1994). He has been co-chairman of the IMACS Technical Committee on "Robotics and Control Systems" from 1988 to 2005 and in August 1997 he has been nominated Honorary Member of the IMACS Board of Directors. He is since 2008 vice-president of the IFAC technical committee on Large Scale Systems. Dr BORNE is Professor "de Classe Exceptionnelle" at the "Ecole Centrale de Lille" where he has been Head of Research from 1982 to 2005 and Head of the Automatic Control Department from 1982 to 2009. His activities concern automatic control and robust control including implementation of soft computing techniques and applications to large scale and manufacturing systems. He was the principal investigator of many contracts of research with industry and army (for more than three millions €) Dr BORNE is "Commandeur dans l'Ordre des Palmes Acad?miques" since 2007. He obtained in 1994 the french " Kulman Prize". Since 1996, he is Fellow of the Russian Academy of Non-Linear Sciences and Permanent Guest Professor of the Tianjin University (China). In July 1997, he has been nominated at the "Tunisian National Order of Merit in Education" by the Republic of Tunisia. In June 1999 he has been nominated « Professor Honoris Causa » of the National Institute of Electronics and Mathematics of Moscow (Russia) and Doctor Honoris Causa of the same Institute in October 1999. In 2006 he has been nominated Doctor Honoris Causa of the University of Waterloo (Canada) and in 2007 Doctor Honoris Causa of the Polytechnic University of Bucharest (Romania). He is "Honorary Member of the Senate" of the AGORA University of Romania since May 2008 He has been Vice President of the SEE (French Society of Electrical and Electronics Engineers) from 2000 to 2006 in charge of the technical committees. He his the director of publication of the SEE electronic Journal e-STA and chair the publication committee of the REE Dr BORNE has been Member of the CNU (French National Council of Universities, in charge of nominations and promotions of French Professors and Associate Professors) 1976-1979, 1992-1999, 2004-2007 He has been Director of the French Group of Research (GDR) of the CNRS in Automatic Control from 2002 to 2005 and of a "plan pluriformations" from 2006 to 2009. Dr BORNE has been member of the Multidisciplinary Assessment Committee of the "Canada Foundation for Innovation" in 2004 and 2009. He has been referee for the nominations of 24 professors in USA and Singapore. He is listed in the "Who is Who in the World" since 1999.

Plenary Lecture 2

Applications of Linear Algebra in Signal Processing, Wireless Communications and Bioinformatics

Professor Erchin Serpedin
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Abstract: In this talk, we will review some of the most important applications of linear algebra in signal processing, wireless communications and bioinformatics, and then outline some of the major open problems which might benefit by the usage of linear algebra concepts and tools.

Brief Biography of the Speaker: Dr. Erchin Serpedin is currently a professor in the Department of Electrical and Computer Engineering at Texas A&M University in College Station. He is the author of 2 research monographs, 1 textbook, 9 book chapters, 105 journal papers and 175 conference papers. Dr. Serpedin serves currently as associate editor for the Physical Communications Journal (Elsevier) and EURASIP Journal on Advances in Signal Processing, and as Editor-in-Chief of the journal EURASIP Journal on Bioinformatics and Systems Biology edited by Springer. He is an IEEE Fellow and his research interests include signal processing, biomedical engineering, bioinformatics, and machine learning.

Plenary Lecture 3

Reliability Life Cycle Management for Engineered Systems

Professor George Vachtsevanos
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Abstract: Engineered systems are becoming more complex and by necessity more unreliable resulting in detrimental events for the system itself and its operator. There is evidence to support the contention that industrial and manufacturing processes, transportation and aerospace systems, among many others, are subjected to severe stresses, external and internal, that contribute to increased cost, operator workload, frequent and catastrophic mishaps that require the development and application of new and innovative technologies to improve system reliability, safety, availability and maintainability. These requirements are not true only for strictly engineered systems but are often discussed in business and finance, biological systems and social networks. We introduce in this talk a systematic and verifiable methodology to improve system reliability, reduce operating costs and optimize system design or maintenance practices. The enabling technologies build upon modeling tools to represent critical system functions, a prognostic strategy to predict the long-term behavior of systems under stress, reliability analysis methods exploiting concepts of probabilistic design and an optimization algorithm to arrive at optimum system design for improved reliability. We demonstrate the efficacy of the approach with examples from the engineering domain.

Brief Biography of the Speaker: Dr. George Vachtsevanos is currently serving as Professor Emeritus at the Georgia Institute of Technology. He served as Professor of Electrical and Computer Engineering at the Georgia Institute of Technology from 1984 until September, 2007. Dr Vachtsevanos directs at Georgia Tech the Intelligent Control Systems laboratory where faculty and students began research in diagnostics in 1985 with a series of projects in collaboration with Boeing Aerospace Company funded by NASA and aimed at the development of fuzzy logic based algorithms for fault diagnosis and control of major space station subsystems. His work in Unmanned Aerial Vehicles dates back to 1994 with major projects funded by the U.S. Army and DARPA. He has served as the Co-PI for DARPA's Software Enabled Control program over the past six years and directed the development and flight testing of novel fault-tolerant control algorithms for Unmanned Aerial Vehicles. He has represented Georgia Tech at DARPA's HURT program where multiple UAVs performed surveillance, reconnaissance and tracking missions in an urban environment. Under AFOSR sponsorship, the Impact/Georgia Team is developing a biologically-inspired micro aerial vehicle. His research work has been supported over the years by ONR, NSWC, the MURI Integrated Diagnostic

program at Georgia Tech, the U,S. Army's Advanced Diagnostic program, General Dynamics, General Motors Corporation, the Academic Consortium for Aging Aircraft program, the U.S. Air Force Space Command, Bell Helicopter, Fairchild Controls, among others. He has published over 300 technical papers and is the recipient of the 2002-2003 Georgia Tech School of ECE Distinguished Professor Award and the 2003-2004 Georgia Institute of Technology Outstanding Interdisciplinary Activities Award. He is the lead author of a book on Intelligent Fault Diagnosis and Prognosis for Engineering Systems published by Wiley in 2006.

Plenary Lecture 4

Augmented Reality: The Emerging Trend in Education

Professor Minjuan Wang
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Abstract: Augmented Reality (AR) is the layering of virtual information over the real, 3-D world to produce a blended reality. AR has been considered a significant tool in education for many years. It adds new layers of interactivity, context, and information for learners which can deepen and enrich the learning experience. The combination of real and virtual allows the student to engage in learning about a topic from multiple perspectives and data sources at levels that are not always available in traditional classroom settings and interactions.
As the usage of mobile devices in formal settings continues to rise, so does the opportunity to harness the power of augmented reality (AR) to enhance teaching and learning. Many educators have experimented with AR, but has it proven to improve what students grasp and retain? Is AR just another fun way to engage students, with little transformation of learning? This plenary speaking will introduce augmented reality as an emerging trend in education, provide an overview of its current development, explore examples of curriculum integration, and also suggest approaches for success.

Brief Biography of the Speaker: Dr. Minjuan Wang (Professor of San Diego State University; Distinguished Research Professor of Shanghai International Studies University)
Homepage: http://www.tinyurl.com/minjuan
Minjuan is Professor of Learning, Design, and Technology at San Diego State University (California, USA), and distinguished professor of Shanghai International Studies University (Shanghai, China). She was recently selected as the "Oriental Scholar" by the Municipal Educational Committee of Shanghai). In addition, she and her American colleagues obtained a four-year 1.3 million grant to study environment protection (including the Golden monkeys) in Fanjingshan, Guizhou province.
Minjuan's work has been highly interdisciplinary, covering the field of education, technology, computer science, geography, and communication. In her 14 years at SDSU, she teaches Designing and Developing Learning for the Global Audience, Mobile Learning Development, Technologies for Course Delivery, and Methods of Inquiry. Her research specialties focus on online learning, mobile learning, Cloud Learning, and intelligent learning (as part of the Intelligent Camps initiative launched by British Telecom). Minjuan is the Editor-in-Chief of a newly established journal-- EAI Transactions on Future Intelligent Educational Environments. She also serves on the editorial boards for four indexed journals: Open Education Research,

International Journal on E-Learning (IJEL), the Open Education Journal, and Journal of Information Technology Application in Education.

As a winner of several research awards, Minjuan is recognized as one of the high impact authors in blended and mobile learning. She has more than 80 peer-reviewed articles published in indexed journals, such as Educational Technology Research and Development, IEEE Transactions on Education, and British Journal of Educational Technology. She was a keynote and invited speaker to 11 international conferences. In addition, she is also an accomplished creative writer and an amateur flamenco dancer. Her recent Novel--Walking in this Beautiful World—has inspired many young people around the world.

Plenary Lecture 5

Application of Multivariate Empirical Mode Decomposition in EEG Signals for Subject Independent Affective States Classification

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Abstract: Physiological signals, EEG in particular, are inherently noisy and non-linear in nature which are challenging to work with using conventional linear signal processing methods. In this paper, we are adopting a new signal processing method, Multivariate Empirical Mode Decomposition, as a preprocessing method to reconstruct EEG signals according to its instantaneous frequencies. To test its effectiveness, we applied this signal reconstruction technique to analyze EEG signals for a 2-dimensional affect states classification application. To evaluated the proposed EEG signal processing system, a three-class classification experiment were carried out on the "Emobrain" dataset from eNTERFACE'06 with K-nearest neighbors (KNN) and Linear Discriminate Analysis (LDA) as classifiers. A leave-one-subject out cross validation process were used and an averaged correct classification rate of 90.77% were achieved. Another main contribution of this paper was inspired by the growth of non-medical grade EEG headsets and its potential in advanced human-computer interface design. However, to reduce cost and invasiveness, consumer grade EEG headsets have far less number of electrodes. In this paper, we used emotion recognition as a case study, and applied Genetic Algorithm to systematically select the critical channels (or sensor locations) for this application. The results of this study will shed lights on the sensor configuration challenges faced by most consumer-grade EEG headset design projects.

Brief Biography of the Speaker: Konstantinos N. (Kostas) Plataniotis received his B. Eng. degree in Computer Engineering from University of Patras, Greece and his M.S. and Ph.D. degrees in Electrical Engineering from Florida Institute of Technology Melbourne, Florida. He was with the Computer Science Department at Ryerson University, Ontario, Canada from July 1997 to June 1999. Dr. Plataniotis is currently a Professor with The Edward S. Rogers Sr. Department of Electrical and Computer Engineering at the University of Toronto in Toronto, Ontario, Canada, where he directs the Multimedia Laboratory. He is a founding member and the inaugural Director – Research of the Identity, Privacy and Security Institute, IPSI, (www.ipsi.utoronto.ca). Kostas was the Director (January 2010- June 2012) of the Knowledge Media Design Institute, KMDI, (www.kmdi.utoronto.ca) at the University of Toronto.
Dr. Plataniotis was the Guest Editor for the March 2005 IEEE Signal Processing Magazine special issue on "Surveillance Networks and Services", and the Guest Editor for the EURASIP Applied

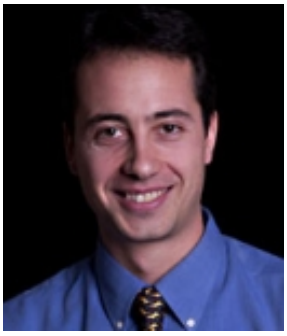
Signal Processing Journal's special issue on "Advanced Signal Processing & Pattern Recognition Methods for Biometrics". He is a member of the IEEE Periodicals Review and Advisory Committee (2011-2013); he has served as a member of the 2008 IEEE Educational Activities Board; he chaired of the IEEE EAB Continuing Professional Education Committee, and he served as the 2008 representative of the Computational Intelligence Society to the IEEE Biometrics Council. Dr. Plataniotis chaired the 2009 Examination Committee for the IEEE Certified Biometrics Professional (CBP) Program (www.ieeebiometricscertification.org) and he served on the Nominations Committee for the IEEE Council on Biometrics. He was a member of the Steering Committee for the IEEE Transaction on Mobile Computing, an Associate Editor for the IEEE Signal Processing Letters as well as the IEEE Transactions on Neural Networks and Adaptive Systems and he has served as the Editor-in-Chief for the IEEE Signal Processing Letters from January 1, 2009 to December 31, 2011. Dr. Plataniotis chaired the IEEE Toronto Signal Processing and Applications Toronto Chapter from 2000 to 2002, he was the 2004-05 Chair of the IEEE Toronto Section and a member of the 2006 as well as 2007 IEEE Admissions & Advancement Committees. He served as the Technical Program Committee Co-Chair for the 2013 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP 2013) and he is the Vice President – Membership for the IEEE Signal Processing Society (2014-2016).

Dr. Plataniotis is a Fellow of IEEE, Fellow of the Engineering Institute of Canada, a registered professional engineer in the province of Ontario, and a member of the Technical Chamber of Greece.

The recipient of numerous grants and research contracts as the principal investigator, he speaks internationally and writes extensively in his field and he has been a consultant to a number of companies. He has served as lecturer in 12 short courses to industry and continuing education programs; he is a contributor to seventeen books, the co-author of "Color Image Processing and Applications", Springer Verlag, 2000, (ISBN-3-540-66953-1) and "WLAN Positioning Systems: Principles & applications in Location-based Services", Cambridge University Press, 2012 (ISBN 978-0-521-9185-2), "Multi-linear Subspace Learning: Reduction of multi-dimensional data}, CRC Press, 2013, (ISBN: 978-14398557243). He is the co-editor of "Color Imaging: Methods and Applications", CRC Press, September 2006, (ISBN 084939774X) and the Guest Editor of the IEEE/Wiley Press volume on "Biometrics: Theory, Methods and Applications" published in October 2009 (ISBN: 9780470247822). Dr. Plataniotis has published more than 400 papers in refereed journals and conference proceedings. In 2005 he became the recipient of the IEEE Canada Engineering Educator Award for "contributions to engineering education and inspirational guidance of graduate students". Dr. Plataniotis is the joint recipient of the "2006 IEEE Trans. on Neural Networks Outstanding Paper Award" for the published in 2003 "Face recognition using kernel direct discriminant analysis algorithms", IEEE Trans. on Neural Networks, Vol. 14, No 1, 2003.

Plenary Lecture 6

State of the Art and Recent Progress in Uncertainty Quantification for Electronic Systems (i.e. Variation-Aware or Stochastic Simulation)



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Abstract: On-chip and off chip fabrication process variations have become a major concern in today's electronic systems design since they can significantly degrade systems' performance. Existing commercial circuit and MEMS simulators mostly rely on the well known Monte Carlo algorithm in order to predict and quantify such performance degradation. However during the last decade a large variety of more sophisticated and efficient alternative approaches have been proposed to accelerate such critical task. This talk will first review the state of the art of most modern uncertainty quantification techniques including intrusive and sampling-based ones. It will be shown in particular how parameterized model order reduction, and low-rank tensor based representations can be used to accelerate most uncertainty quantification tools and to handle the curse of dimensionality. Examples will be presented including amplifiers, mixers, voltage controlled oscillators with tunable micro-electro-mechanical capacitors and phase locked loops.

Brief Biography of the Speaker: Luca Daniel is an Associate Professor in the Electrical Engineering and Computer Science Department of the Massachusetts Institute of Technology (MIT). Prof. Daniel received the Ph.D. degree in Electrical Engineering from the University of California, Berkeley, in 2003. In 1998, he was with HP Research Labs, Palo Alto. In 2001, he was with Cadence Berkeley Labs.

Dr. Daniel research interests include development of integral equation solvers for very large complex systems, stochastic field solvers for large number of uncertainties, and automatic generation of parameterized stable compact models for linear and nonlinear dynamical systems. Applications of interest include simulation, modeling and optimization for mixed-signal/RF/mm-wave circuits, power electronics, MEMs, nanotechnologies, materials, MRI, and the human cardiovascular system.

Prof. Daniel has received the 1999 IEEE Trans. on Power Electronics best paper award; the 2003 best PhD thesis awards from both the Electrical Engineering and the Applied Math departments at UC Berkeley; the 2003 ACM Outstanding Ph.D. Dissertation Award in Electronic Design Automation; 5 best paper awards in international conferences, 8 additional nominations for best paper award; the 2009 IBM Corporation Faculty Award; and the 2010 IEEE Early Career Award in Electronic Design Automation.