Distinguished Lecturer Series "Leon the Mathematician" at the Department of Informatics, Aristotle University of Thessaloniki Greece (http://dls.csd.auth.gr) - CIS011 Greek IEEE Computational Intelligence Chapter

INVITED LECTURE

Professor Moncef Gabbouj (IEEE Fellow, Academy of Finland Professor, Department of Signal Processing, Tampere University of Technology, Tampere, Finland) is going to lecture on

Machine Learning Tools and Particle Swarm Optimization for Content-Based Search in Big Multimedia Databases

at the the **Auditorium III of Aristotle University Research Dissemination Center – ΚΕΔΕΑ ΑΠΘ** (September 3rd Ave., University Campus) on **Tuesday May, 20th , 2014** at **12:00.**

ABSTRACT

The talk deals with a new paradigm for multimedia search based on content. We present an alternative approach to classical search engines for information retrieval, which can be used for Big and generic multimedia repositories. We introduce an incremental evolution scheme within a collective network of (evolutionary) binary classifier (CNBC) framework. The proposed framework addresses the problems of feature/class scalability and achieves high classification and content-based retrieval performances over dynamic image repositories. The secret behind the success of CNBC is a novel design to implement the backbone of CNBC, namely the binary classifier. This is a special neural network, which is optimally designed using the recently developed evolutionary optimization algorithm called multi-dimensional particle swarm optimization.

Particle swarm optimization (PSO) is population based stochastic search and optimization process which was introduced in 1995 by Kennedy and Eberhart. The goal is to converge to the global optimum of some multi-dimensional fitness function. Two novel techniques, which extend the basic PSO algorithm, are presented. The first algorithm called multi-dimensional PSO (M-D PSO) deals with problems in which the dimension of the solution space is not known a priori. M-D PSO solves such a problem by introducing two interleaved PSO iteration processes, a positional PSO followed by a dimensional PSO in which the dimension of a particle is allowed to vary. In a multidimensional search space where the optimum dimension is unknown, swarm particles can seek both positional and dimensional optima.

Most content-based multimedia search engines available today rely heavily on low-level features. However, such features extracted automatically usually lack discrimination power needed for accurate description of the image content and may lead to poor retrieval performance. To address this problem, we propose an evolutionary feature synthesis technique, which seeks for the optimal linear and non-linear operations over optimally selected features so as to synthesize highly discriminative features. The optimality therein is sought through MD-PSO. The synthesized features are applied over only a minority of the original feature vectors and exhibit a major discrimination power between different classes and extensive CBIR experiments show that a significant performance improvement can be achieved.

About the Speaker:

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Dr. MONCEF GABBOUJ received his BS degree in electrical engineering in 1985 from Oklahoma State University, Stillwater, and his MS and PhD degrees in electrical engineering from Purdue University, West Lafayette, Indiana, in 1986 and 1989, respectively.

Dr. Gabbouj is an Academy Professor and Professor at the Department of Signal Processing at Tampere University of Technology, Tampere, Finland. He is currently a visiting professor at the Departments of Electronic and Computer Engineering and Computer Science and Engineering, Hong Kong University of Science and Technology, Hong Kong. Dr. Gabbouj was on sabbatical leave as a visiting scholar at the Viterbi School of Engineering, University of Southern California, Los Angeles, California, during spring 2012, a visiting professor at the School of Electrical and Computer Engineering of Purdue University, West Lafayette, Indiana during fall 2011, and a visiting professor at the American University of Sharjah, UAE in 2007-2008. He was Head of the Department during 2002-2007. Dr. Gabbouj was Senior Research Fellow of the Academy of Finland during 2007-2008 and 1997-1998. He is the co-founder and past CEO of SuviSoft Oy Ltd. From 1995 to 1998 he was a Professor with the Department of Information Technology of Pori School of Technology and Economics. From 1994 to 1995 he was an Associate Professor with the Signal Processing Laboratory of Tampere University of Technology, Tampere, Finland. From 1990 to 1993 he was a senior research scientist with the Research Institute for Information Technology, Tampere, Finland. His research interests include multimedia content-based analysis, indexing and retrieval; nonlinear signal and image processing and analysis; and video processing, coding and communications.

Dr. Gabbouj is an IEEE Fellow. He served as Distinguished Lecturer for the IEEE Circuits and Systems Society in 2004-2005, and Past-Chairman of the IEEE-EURASIP NSIP (Nonlinear Signal and Image Processing) Board. He was chairman of the Algorithm Group of the EC COST 211quat. He served as associate editor of the IEEE Transactions on Image Processing, and was guest editor of Multimedia Tools and Applications, the European journal Applied Signal Processing. He is the past chairman of the IEEE Finland Section, the IEEE Circuits and Systems Society, Technical Committee on Digital Signal Processing, and the IEEE SP/CAS Finland Chapter. He was also Chairman of CBMI 2005, WIAMIS 2001 and the TPC Chair of ISCCSP 2006 and 2004, CBMI 2003, EUSIPCO 2000, NORSIG 1996 and the DSP track chair of the 1996 IEEE ISCAS. He is also member of EURASIP Advisory Board and past member of AdCom. He also served as Publication Chair and Publicity Chair of IEEE ICIP 2005 and IEEE ICASSP 2006, respectively. Dr. Gabbouj is a Honorary Guest Professor of Jilin University, China (2005-2010).

Dr. Gabbouj was the Director of the International University Programs in Information Technology (1991-2007) and vice member of the Council of the Department of Information Technology at Tampere University of Technology. He is also the Vice-Director of the Academy of Finland Center of Excellence SPAG, Secretary of the International Advisory Board of Tampere International Center of Signal Processing, TICSP, and member of the Board of the Digital Media Institute. He served as Tutoring Professor for Nokia Mobile Phones Leading Science Program (2005-2007 and 1998-2001). He is a member of IEEE SP and CAS societies.

Dr. Gabbouj was recipient of the 2012 Nokia Foundation Visiting Professor Award, the 2005 Nokia Foundation Recognition Award, and co-recipient of the Myril B. Reed Best Paper Award from the 32nd Midwest Symposium on Circuits and Systems and the NORSIG Best Paper Award from the 1994 Nordic Signal Processing Symposium. He was also the supervisor of the main author receiving the Best Student Paper Award from IEEE International Symposium on Multimedia, ISM 2011. He is co-author of two books and over 550 publications.

Dr. Gabbouj has been involved in several past and current EU Research and education projects and programs, including ESPRIT, HCM, IST, COST, Tempus and Erasmus. He also served as Evaluator of IST proposals, and Auditor of a number of ACTS and IST projects on multimedia security, augmented and virtual reality, image and video signal processing.