Editor

Constantin Buzatu

Modern Computer Applications in Science and Education

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- ✸ **Proceedings of the 14th International Conference on Applied Computer Science (ACS '14)**

- ✸ **Proceedings of the 2nd International Conference on Computer Supported Education (COSUE '14)**

Cambridge, MA, USA, January 29-31, 2014

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Preface
This year the 14th International Conference on Applied Computer Science (ACS '14) and the 2nd International Conference on Computer Supported Education (COSUE '14) were held in Cambridge, MA, USA, in January 29-31, 2014. The conferences provided a platform to discuss programming languages, software methodologies, software engineering, project management, databases, parallel computing systems, advanced educational software and hardware, best practices and case studies, continuing education, distributed learning environments etc. with participants from all over the world, both from academia and from industry.

Their success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of these conferences are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as these can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

Rhythm Analysis of the "Sonorous Continuum": Representations and Algorithms for Symbolic Musical Data

Professor Michele Della Ventura
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Music Academy "Studio Musica"
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Abstract: Music is the meeting place par excellence for arts and sciences and within this meeting, mathematics plays an essential and central role. The relations between Music and Mathematics are very close both at elementary and more complex levels. These relations are easily comprehensible even for the uninitiated, for instance with respect to note durations (double or half, quarter and so on): rhythm is a number, it is the precise measure of time. Rhythm is an element that confers a musical piece a special physiognomy and while listening to it, it allows the listener to perform a segmentation of the sonorous continuum, seizing in it contrasts and consonances: sound clusters are collocated in rhythmic and melodic schemata, in which themes, motifs, repetitions, variations emerge. The musical content, therefore, does not exhaust itself into the mere acoustic and perceptual fact, but has a meaning that emerges from the structural properties of the piece, cognitively elaborated by the listener and traced back to conceptual structures.
This study presents a model of rhythm analysis able to explore progressively the symbolic level of the musical text, identifying the rhythmic cells on the basis of the information that every single one of them carries. The efficiency of the model was checked analyzing various musical pieces by different authors and of different times, trying to range over different styles by means of a single analysis methodology.

Brief Biography of the Speaker: Michele Della Ventura defined his professional training, since high school, within the framework of two distinct areas of study: music and mathematics.
He brilliantly graduated in piano and he graduated in technology disciplines with the highest honors and distinction, obtaining a scholarship, defending the thesis entitled "Study on the implementation of algorithms for the melodic operators in the symbolic text segmentation and conjoint evaluation of musical entropy".
His dual formation, in Information Technology and music, drives him into carrying out research activities on the relation between Music and Mathematics. The development of education-related technologies draw him to focus his attention on the innovations of information technology associated to musical programming languages and to attend a Post-Graduate Master's Degree on E-Learning (E-Learning: methods, techniques and applications) at the University Tor Vergata of Rome, graduating from it with the highest marks with the thesis "Learning and new technologies".
His research activity continues within the framework of computer-aided musical analysis, publishing articles and holding national and international conferences and seminars on "Music and new technologies".
He combines his research and IT consultant activity with the position of Music informatics Professor at Music Academies and Conservatories and the position of Musical Technologies Teacher in High Schools specializing in Music.

Plenary Lecture 2

Visualization of the DNA Sequences Using Self Organizing Maps

Associate Professor Hiroshi Dozono
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Japan
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Abstract: Next generation sequencing (NGS) has recently produced large amounts of sequencing data that require more efficient methods for assembly and analysis. The produced sequences have applications in many areas of genomic science. Metagenome analysis and comparative genome analysis are examples of such applications. Metagenome analysis uses a mixture of genomes from multiple species, and the composition of species-specific sequences or expressed sequences is analyzed. Comparative genome analysis, on the other hand, infers evolutional relations and species diversity. For both applications, a global comparison of DNA sequences among species is required.

For a global comparison of DNA sequences, a Self-Organizing Map (SOM) is often used. SOM is an artificially constructed neural network. SOMs use the architecture of feed forward networks and are trained by unsupervised learning. A set of input vectors is provided, vector similarity is analyzed, and the SOM maps the input vectors on a 2-dimensional plane.

We have developed SOM algorithms which based on the N-tuples of DNA probes, frequency of the N-tuples, context of DNA sequences, Hidden Markov Model(HMM) of DNA sequences and correlation coefficients of nucleotides. In this speech, the algorithm of SOM for the analysis of DNA sequences, and the results of the analysis will be presented.

Brief Biography of the Speaker: Hiroshi Dozono graduated from Kyoto University, Japan in 1984, and graduated Doctor cource of Kyoto Univeristy in 1989. He worked in Tokushima University for two years, and in Kumamoto University for three years and currently works in Saga University as Associate Professor. His research area is Object Oriented System, Knowledge Engineering, Control Theory, Artificial Intelligence, Evolutional Algotithm Neural Networks. Recently, he specialized in application of Self Organizing Maps to Bioinformatics, Security Systems, and Control systems. He is author of about 50 papers published in international journals and conference proceedings.

Plenary Lecture 3

Compressive Sensing: A Novel Tool for Signal and Image Processing

Professor Hector Perez-Meana
National Polytechnic Institute of Mexico
Mexico
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Abstract: Compressive sensing, also called compressive sampling, is a novel research area that has attracted the attention since it was introduces in 2006, becoming a key concept in several areas of computer science, electrical engineering and related fields. This is due to the fact that compressive sensing allows us to go beyond Shannon limit, by exploiting sparsity structure of the signal. Thus compressive sensing allows us to capture and represent compressive signal at a rate significantly below the Nyquist rate and reconstruct such high dimensional signals, with sparse representation by using a suitable basis o dictionary, from what can be consider as a highly incomplete linear measurements by using efficient algorithms.
This talk presents a review of the basic theory underlying compressive sensing, the sampling step that employs non adaptive linear projections that preserve the structure of the signal; as well as the requirements to achieve an accurately recover a high dimensional signal from a small set of measurements by viewing the decoding step as a linear inverse problem, using some convex optimization methods.
Several successful applications of compressive sensing related with speech enhancement, audio and speech coding, image processing, face recognition are also discussed.

Brief Biography of the Speaker: Hector Perez-Meana received his M.S: Degree on Electrical Engineering from the Electro-Communications University of Tokyo Japan in 1986 and his Ph. D. degree in Electrical Engineering from the Tokyo Institute of Technology, Tokyo, Japan, in 1989. From March 1989 to September 1991, he was a visiting researcher at Fujitsu Laboratories Ltd, Kawasaki, Japan. From September 1991 to February 1997 he was with the Electrical Engineering Department of the Metropolitan University of Mexico City where he was a Professor. In February 1997, he joined the Graduate Studies and Research Section of The Mechanical and Electrical Engineering School, Culhuacan Campus, of the National Polytechnic Institute of Mexico, where he is now The Dean. In 1991 he received the IEICE excellent Paper Award, and in 2000 the IPN Research Award and the IPN Research Diploma. In 1998 he was Co-Chair of the ISITA'98, and in 2009 he was General Chair of The IEEE Midwest Symposium on Circuit and Systems (MWSCAS). Prof. Perez-Meana has published more that 100 papers and two books. He also has directed 17 PhD theses and more than 35 Master theses. He is a Senior member of the IEEE, member of The IEICE, The Mexican Researcher System and The Mexican Academy of Science. His principal research interests are adaptive systems, image processing, pattern recognition watermarking and related fields.

Plenary Lecture 4

The Emergence and Grand Challenges of Computing

Professor Matthew He
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Abstract: Historically, computing as a discipline was described as being at the intersection of mathematical, engineering, and empirical/scientific traditions. In recent scientific and technological advances, physical and biological, ecological and environmental, social and behavioral, cognitive sciences, engineering, and other emerging sciences, engineering and information technologies share a common need for efficient algorithms, system software, information systems and architecture, and efficient computing solutions to address large computational and interdisciplinary problems. Many boundaries among science, engineering and social systems are cross-linked in the face of combinations of knowledge and tools as demonstrated in the areas of computational mathematics, scientific computing, network computing, cloud computing, bio-molecular computing, quantum computing, soft computing, most recently perceptual computing. It is the time when the physical, biological and social sciences are joining forces with information computing sciences. It is the time when we will make extraordinary advances in the history of mankind through the field of computing. This talk covers the key elements of computing foundation, current development and landscape of computing, and grand challenges in computing research and its applications.

Brief Biography of the Speaker: Matthew He, Ph.D., is Full Professor and Director of the Division of Math, Science, and Technology of Nova Southeastern University, Florida, USA. He is Full Professor and Grand Ph.D. from the World Information Distributed University in 2004. He has been awarded as an academician of European Academy of Informatization since 2004. He received the World Academy of Sciences Achievement Award in recognition of his research contributions in the field of computing in 2003 and 2010.

Matthew He received his Ph. D. in Mathematics from University of South Florida in 1991. He was a research associate at the Department of Mathematics and Theoretical Physics, Cambridge University, Cambridge, England in 1986 and at the Department of Mathematics, Eldgenossische Technische Hochschule, Zurich, Switzerland in 1987. He was also a visiting professor at National Key Research Lab of Computational Mathematics of Chinese Science of Academy and University of Rome, Italy in 1998.

Dr. Matthew He has authored/edited 10 books and published over 100 research papers in the areas of mathematics, bioinformatics, computer vision, information theory, mathematics and engineering techniques in medical and biological sciences. He is an editor of International Journal of Software Science and Computational Intelligence, International Journal of Cognitive Informatics and Natural Intelligence, International Journal of Biological Systems, and International Journal of Integrative Biology. He is an invited series editor of Biomedical and Life Sciences of Henry Stewart Talk "Using Bioinformatics in Exploration in Genetic Diversity". He is a Chairman of International Society of Symmetry in Bioinformatics and a member of International Advisory Board of "International Symmetry Association (ISA). He is a member of American Mathematical Society (AMS), Association of Computing Machinery (ACM), IEEE Computer Society, World Association of Science Engineering (WASE), and International Advisory Board member of Bioinformatics Group of International Federation for Information Processing (IFIP). He was an international scientific committee co-chair of International Conference of Bioinformatics and its Applications (ICBA 2004), a general co-chair of International Conference of Bioinformatics Research and Applications (ISBRA 2009), a general co-chair of IEEE International Conference on Bioengineering and Computer Sciences (ICBECS 2010 and 2011) and a keynote speaker of many international conferences in the areas of mathematics, bioinformatics, and information science and engineering.

Plenary Lecture 5

Telemedicine: The Present and Its Future

Professor Evangelos A. Yfantis
Director of the ICIS Laboratory
Professor of Computer Science
Computer Science Department
Engineering College of the University of Nevada
USA
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Abstract: A big part of the population in the USA, Canada, and European countries is over fifty and starts to put an increasing burden in the health care system of their countries. The number of hospital beds is not enough to provide long care to the patients. Furthermore smaller hospitals in rural areas do not have all the specialties needed. Thus doctors of needed specialties visit these hospitals on a need basis, perform the necessary procedures and monitor their patients remotely. Often times military personnel traveling overseas are in need of medical attention by specialists from large medical centers in the United States. These special medical professionals provide guidance to the operating Doctors in the overseas military hospitals, real time, and they guide them to perform the operation successfully. Telemedicine is a new way for monitoring patient's progress, helping perform medical procedures remotely and successfully, moving patients early from the hospital back to their home and monitor their progress remotely, transmitting video audio, cardio and other needed data, obtained real time with the help of monitoring devices attached to the patient. Telemedicine has the potential to be big business, where large successful medical centers could provide their services real time to smaller hospitals, and guide the medical professionals of those smaller hospitals to successfully operate on patients with very challenging health problems.

Brief Biography of the Speaker: E. A. Yfantis, is the director of the ICIS lab, and a full professor of Computer Science, which is part of the Engineering College at the Unversity of Nevada, Las Vegas. Dr. Yfantis is the author of over 200 reseach papers and technical reports in the areas of Computer Science, Information theory, Internet Intelligence, Signal Processing, Communication, Statistical Pattern Recognition, Probability theory, Statistics, Ocean Engineering, Aerodynamics, Electrical Engineering, Medicine, Visualization, Enviromental Protection, and Chemometrics. He has been a consultant for NASA, Los Alamos Scientific Laboratory, Sandia Laboratories, Lawrence Livermore Laboratories, EG&G, Naval Ocean System Center in Santiego California, Corps of Engineers U.S. Army, Lockheed Engineering and Aerospace, Northrop, NSTeC, U.S. EPA, U.S. Department of Energy, SGI, Exxon Corporation, Shell Oil Company, Bendix Corporation, Nevada Gaming Control Board, and many other companys in the US and Canada. His Education includes: Computer Science, Mathematics, Signal Processing, Statistics, Aeronautics, Ocean Engineering, and Electrical Engineering. He was educated at the Universities of: Athens Greece, Rutgers University in New Brunswick, N.J. U.S.A., New Jersey Institute of Technology, Newark, N.J., Fairleigh Dickinson University, Teaneck, N.J., U.S.A., University of Wyoming, Laramie, U.S.A., Columbia University in N.Y., N.Y., U.S.A, the University of Delaware, Newark, Delaware, U.S.A., School of Aeronautics in Teteboro N.J., U.S.A. He holds a Pilot's License, and is a certified Scuba Diver by PADI. Hi current research interests are Computer-Robot Vision, Machine Vision, Machine Intelligence, Statistical Pattern Recognition, and Multimedia Communication.

Plenary Lecture 6

Addressing Big Data Problems Using Natural Language Understanding: Applications in Intelligent Search, Question & Answer System, Business Intelligence and More

Professor Emdad Khan
InternetSpeech, USA
Southern University, USA
Imam University, Saudi Arabia
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Abstract: The need to solve the key problems related to Big Data in a practical and effective way is becoming very important as the data is growing very fast - already exceeding the exabyte range. In this Information Age, information is growing very fast. Internet is a classic example. The data growth on the Internet during last 15 years is phenomenal. There are various other key sources for data growth – e.g. scanners, sensors, mobile phones, smart meters, social media platforms, credit cards, digital medical records, satellite imagery and the like. Such data sources generate both unstructured and structured data. Such data are also getting integrated on the Internet and Intranet. With the growth of data, the nature of its usage is changing fast. E.g. the field of astronomy is changing from where taking pictures of the sky was a large part of an astronomer's job to one where the pictures are all in a database already and the astronomer's task is to find interesting objects and phenomena in the database. In the biological sciences, there is now well established tradition of depositing scientific data into a public repository, and also creating public database to be used by other scientists. In the business world, Business Intelligence (BI) has already become an important field to extract key business data from large volume of data.

There are multiple problems with big data including storage, search, transfer, sharing, analysis, processing, viewing, and deriving meaning / semantics. Such problems are mainly due to the 4 Vs i.e. Volume, Velocity, Variety and Variability. We propose Semantic Engine (SE) and associated Natural Language Understanding (NLU) based approach to address the key problems of big data. Our approach resembles human Brain-Like and Brain-Inspired algorithms as humans can significantly compress the data by representing with a few words or sentences using the semantics of the information while at the same time preserve the meaning of the content.

Brief Biography of the Speaker: Dr. Emdad Khan is the Founder of InternetSpeech. He founded the company in 1998 with the vision to develop innovative technology for accessing information on the Internet anytime, anywhere, using just an ordinary telephone and the human voice. As a pioneer in the Internet voice space, Khan is a frequent speaker at Natural Language, Big Data, Voice-Recognition, Internet applications, bridging the Digital and Language Divides and other academia & industry conferences and trade shows. He holds 23 patents and has published more than 50 journal & conference papers on the advent of voice technology on the Internet, content rendering, Natural Language Processing/Understanding, Big Data, neural nets, fuzzy logic, intelligent systems, VLSI and optics. Khan's acute technical knowledge and keen understanding of emerging markets has played an important role in the development of InternetSpeech's first product/service netECHO, the only product available today that delivers complete Internet access using voice and any telephone.

During his career, Khan invented, defined, developed and deployed worldwide new intelligent software products for micro-controller-based home appliances. He has also created and deployed speech recognition based Internet applications. He has 20 years of experience with large semi-conductor companies, including Intel and National.

Khan is active in research. His current major interest is to use brain-like and brain-inspired algorithms to solve some open problems, especially, NLU (Natural Language Understanding) and Big Data, which is very well aligned with InternetSpeech's next generation products & services to allow users (especially bottom of the pyramid people) to interact with the Internet using their natural language and thus help their economic, social and other developments.

He is the author of the book "Internet for Everyone: Reshaping the Global Economy by Bridging the Digital Divide".

He holds a doctorate in computer science, masters of science degrees in electrical engineering and engineering management, and a bachelor of science degree in electrical engineering.

Khan is currently on leave from InternetSpeech and a faculty at the Computer Science department of Imam University, Riyadh, Saudi Arabia. Khan is also a visiting Research Professor at the Southern University in Baton Rouge, Louisiana, USA.

Plenary Lecture 7

Extension of the Architecture of Software Systems with Artificial Intelligence Elements

Professor Zurab Bosikashvili
Georgian Technical University
Georgia
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Abstract: Any changes in the functional requirements for the modern software systems usually requires extra development for adding new or modify existing functional modules. This is caused due to limitations of the system architecture that does not provide the ease of expandability. To solve the problem, the system architecture should have a module or subsystem that reflects changes in the system without. Here, we propose a knowledge management engine, module (KME) which extends the architecture of the software system. The KME consists of a kernel, functional sub-modules and adapters. The kernel provides mechanisms for representing knowledge and reasoning. The functional sub-modules perform such intellectual tasks as a system configuration, data validation and others. Knowledge is represented as an ontological model. Implementations of ontology are characterized by a multilayer structure. Each layer is represented in variety of languages and tools, and complicates implementation of such scheme. The paper proposes a representation of ontology in the form of a universal syntactic and semantic schemes by "if - then" rules, which provides a simple and powerful mechanism for making proofing.

Brief Biography of the Speaker: Zurab Bosikashvili graduated from the Polytechnic Institute of Georgia (GPI), Tbilisi 1973. In the 1977s he completed post-graduate courses in the GPI and awarded Ph.D in Computer Science. In the 1993s he defended his doctoral dissertation in the area Artificial Intelligence in Georgian technical University (GTU). From 1977 to the present time he works in the GTU. He is a professor of Software Development and Artificial Intelligence at Information System Department, Georgian Technical University, Georgia. His area of expertise is the automatization of problem solving, pattern recognition, design of programming system and software development methodology. He authored or co-authored more than 70 scientific papers published in reviewed journals or presented at local and international conferences. He has participated more than 30 projects in IT area of Georgia. Recently, he specialized in rule based systems development. He is a consultant and system architect in the software development company UGT.

Plenary Lecture 8

Noise-Robust Speech Analysis

Professor Tetsuya Shimamura
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Abstract: Digital signal processing and speech processing have evolved hand in hand over the last 50 years. Current speech processing techniques rely on advanced digital signal processing theories and algorithms. Especially, for speech analysis, this is true. In this plenary talk, speech analysis in noise, being a hot topic in speech processing, is discussed. Fundamental frequency (or pitch) estimation, formant frequency estimation and spectrum envelope estimation are considered. In a noise-free environment, these tasks are achieved by using autocorrelation function, cepstrum, linear prediction and so on. In a noisy environment, however, the performance of such speech analysis algorithms degrades suddenly. To solve the problem, new algorithms have been developed recent years. In this plenary talk, some of them are introduced. For fundamental frequency estimation, autocorrelation-based and modified autocorrelation-based approaches are shown. In such approaches, average magnitude difference function or cepstrum or both are effectively combined depending on the noisy situation. For formant and spectrum envelope estimation, noise compensation and pitch synchronous analysis approaches for linear prediction are shown. In such approaches, an iterative algorithm can be utilized to enhance the noise robustness. The performance of each algorithm will be demonstrated for synthetic and real speech data, in which a variety of noise conditions will be considered.

Brief Biography of the Speaker: Tetsuya Shimamura received the B.E., M.E., and Ph. D. degrees in electrical engineering from Keio University, Yokohama, Japan, in 1986, 1988, and 1991, respectively. In 1991, he joined Saitama University, Saitama City, Japan, where he is currently a Professor. During this, he joined Loughborough University, UK, and The Queen's University of Belfast, UK, in 1995 and 1996, respectively, as a visiting Professor. He is an author or co-author of 6 books, and a member of the organizing committee of several international conferences. His interests are in digital signal processing and its applications to speech, image and communication systems. He received a Gold Paper Award at IEEE Pacific Rim Conference on Communications, Computers and Signal Processing in 2011. He also received a Best Paper Award from Research Institute of Signal Processing Japan in 2013.

Plenary Lecture 9

Numerical Modelling of Trajectory of High Altitude Missions

Professor Nicolae Jula
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Military Technical Academy – Bucharest
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Abstract: This paper shows several stratospheric flights performed with weather balloons both in Romania and Australia.

A typical 6 DOF model is presented for the payload in order to allow a future implementation of controlled payload recovery through the usage of a steerable parafoil.

Also an ascent rate calculation model is presented that takes into account a standard US 1976 atmosphere model as well as the thermodynamics of the lifting gas inside the weather balloon.

We present the typical payload used as well as the APRS communication package used for tracking and telemetry real-time as well as the photo and video equipment used for flight imaging.

Altitude and trajectory are presented as functions of time and discussion is done regarding the best GPS installation position in order to ensure GPS coverage data for most of the flight, including the burst. Various flight dynamics characteristics are described including the ascent and descent rates as well as a detailed description on how to achieve a desired ascent rate.

Future aerosol detection mission is proposed in the framework of the next generation of satellites aimed at actively detecting aerosol pollution in the atmosphere. High altitude balloon platforms are proposed to provide calibration and validation of satellite data in various regions of interest worldwide.

Brief Biography of the Speaker: Nicolae Jula was born on December 14th, 1945 in Hunedoara County, Romania. He received the degree in electrical engineering in 1969 from Bucharest Polytechnic Institute and Ph.D. in 1986. During 1969 – 1978, he was scientific researcher at National Institute for Aerospace Research, Bucharest and he participated in the international project for research, design and production of the military aircraft YUROM versions IAR – 93 and ORAO – 2. He was in charge with development of electrical installations, special installations and board equipment for the military aircraft. Since 1978, he has been working within Military Technical Academy Bucharest and he hold all university positions available within the Academy. Currently he is PhD thesis advisor within the Military Technical Academy Bucharest – Faculty of Military Electronic and Information Systems.

He also holds the position of full professor at the University South-East Europe "Lumina" teaching the course "Sensors and measurement equipment". His present research interest includes sensor interface systems, analogue circuit design, signal processing, transducers and electrical servomotors, measurement theory and low-frequency measurements. He has published more 195 technical papers and 20 books and he was involved in numerous national research projects out of which he had Project Coordination responsibilities in 11 projects. The national projects were developed on the following programs: AEROSPATIAL, SECURITATE, CALIST, RELANSIN and CEEX. Currently he has research interests in the field of monitoring of energy losses in strategic infrastructures (powerlines, oil pipes) through the application of IT capabilities and unmanned aerial vehicles.

Out of the international contracts in which he is involved, an important project is FP7-CEARS project which was finished in 2010. The main objective of the project is to enhance regional cooperation in aeronautical research and development among different universities and research centers from the Central European region involving: Austria, Bulgaria, Czech Republic, Estonia, Herzegovina, Latvia, Lithuania, Poland, Romania, Serbia, Slovakia and Hungary. He is full member of the Aero-Astronautics Committee from the Technical Division of the Romanian Academy since 2002. He is also Vicepresident of the Academy of Cybernetics "Stefan Odobleja" founded in 1982 and registered in Switzerland in Lugano.

Plenary Lecture 10

Formal Verification with Programming-Like Tools

Professor Stefan D. Bruda
Bishop's University in Sherbrooke
Quebec, Canada
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Abstract: Computing systems are constructed using programming languages which feature invocations of potentially recursive modules (such as functions or procedures). Many systems are formally verified after they are constructed. At this stage they are considered reactive systems, meaning that their internal structure becomes immaterial and the only feature of interest is their interaction with the environment.

Formal verification is traditionally accomplished by using a finite-state model of the system under test. The inherent recursive nature of the system (given by the programming language used to build it in the first place) is lost. The reason for this simplification is the fact that finite-state models are particularly "nice" mathematical objects, but the consequence of the simplification is that the number of states that need to be explored in the verification process grows quickly, which makes formal verification of complex systems impractical. Increased complexity of computing systems is however a fact of life, and so traditional, finite-state formal methods are slowly reaching their limits.

Those systems under test were however programs at the beginning, and so they are most naturally represented using pushdown models. Such models are however not suitable for formal verification because they lack various closure properties. The quest for a model that combines the expressiveness of pushdown automata and the nice mathematical properties of finite-state automata has started relatively recently. This talk will present this quest. We start with the simple, immediate models to see their shortcomings. We then continue to visibly pushdown formalisms, which are the first full pushdown models. We show however that some practical shortcomings are still present. We finally present our new effort that attempts to eliminate these shortcomings.

Brief Biography of the Speaker: Stefan D. Bruda is Professor of Computer Science with Bishop's University in Sherbrooke, Quebec, Canada. His research resulted in over 50 conference and journal papers and spans at least four major areas (formal languages and automata, formal methods, parallel computation, artificial intelligence). He has been continuously funded by a major federal funding agency (the National Science and Engineering Research Council of Canada) since the start of his professional career. Currently Dr. Bruda's main interest lies in the area of grammatical approaches to parallelism, with applications in context-free formal methods.

Plenary Lecture 11

Cloud Technology-Based Education with Special Emphasis on Using Virtual Environment

Professor Imre J. Rudas
Óbuda University
Budapest, Hungary
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Abstract: Cloud Computing as an emerging technology is a new paradigm in Information Technology and can dramatically change our everyday life.

The presentation summarizes the basics of cloud computing, namely the main idea, the definition, the cloud model composed of essential characteristics, service models and deployment models. The concept of Cloud Technology as a generalization of cloud computing is introduced.

In the second part of the presentation the new perspectives of cloud technology based education are discussed. Some higher educational institutions do not have sufficient hardware or software to provide the students full learning environment and experience. This problem is particularly important in various fields of Engineering Education. Cloud Technologyprovides services which allow the students to access the latest technologies with a low budget.

The next part of the presentation summarizes the results and ideas of a new generation internet and Cloud Technology based Virtual Collaboration Arena (VirCA) developed in Hungary and some of its application possibilities in education.

VirCA provides a platform where users can build, share and manipulate 3D content, and collaboratively interact with real-time processes in a 3D context, while the participating hardware and software devices can be spatially and/or logically distributed and connected together via IP network. The 3D content and processes in VirCA can be synchronized with the real world, which allows the combination of reality and virtual world in the collaboration arena.

Brief Biography of the Speaker: Prof. Dr. Imre J. Rudas graduated from Bánki Donát Polytechnic, Budapest in 1971 and received the Master Degree in Mathematics from the Eötvös Loránd University, Budapest while the Ph.D. in Robotics from the Hungarian Academy of Sciences in 1987. He is active as the President of Obuda University and as a professor of John von Neumann Faculty of Informatics.

Prof. Rudas is a Fellow of IEEE, Administrative Committee member of the Industrial Electronics Society, member of the International Board of the Robotics & Automation Society, Chairman of the joint Hungarian Chapter of these Societies, and RAS and IES Chapter Coordinator of Region 8. He is also a registered expert of the United Nations Industrial Development Organization and the EU.

He is the President of the Hungarian Fuzzy Association and Steering Committee Member of the Hungarian Robotics Association and the John von Neumann Computer Society.

Prof. Rudas serves as an associate editor of IEEE Transactions on Industrial Electronics, member of editorial board of Journal of Advanced Computational Intelligence and Control Engineering Practice, member of various national and international scientific committees. He is the founder of the IEEE International Conference Series on Intelligent Engineering Systems Prof. Rudas was the General Co-chair of ICAR2001, and also serves as General Chairman and Program Chairman of numerous scientific international conferences.

His present areas of research activity are: Robot Control, Soft Computing, Computed Aided Process Planning, Fuzzy Control and Fuzzy Sets. Prof. Rudas has published more than 280 papers in various journals and international conference proceedings.

Plenary Lecture 12

Multimedia Literacy in Preschool and Primary Education

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Abstract: Multimedia literacy represents a set of skills enabling individuals to effectively find, interpret, use, evaluate and even create multimedia. It encompasses abilities needed to process and exploit all components of multimedia: text, sound, image, animation, video and interactivity.

According to UNESCO, alphabetic literacy (the ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts) is a human right and the foundation of all learning. It is also a skill that begins in infancy and continues to grow over the lifetime.

But, today's children are not limited to written materials; they are frequentconsumers of multimedia, surrounded by video games and dynamic media with a high level of interactivity. They prefer the content presented by graphics, sound and video more than written materials and are impatient for the traditional slow systematic transfer of the learning content. Therefore, they must be taught to construct meaning from multiple modes of presentation of the learning content and to evaluate the multimedia.

The first part of the lecture summarizes the necessary elements of multimedia literacy education, its key stakeholders and emphasizes its role in the early years of life.

Parents, caregivers and educators all play a role in building the foundation for multimedia literacy. The need for multimedia literacy education puts forward new requirements to caregivers, parents and educators, who are expected to become multimedia literate lifelong learners. On the other hand, preschool and primary school literacy education still tends to focus on alphabetic literacy and traditional approach that does not take into account the wealth of knowledge children acquire through everyday contact with constantly evolving multimedia environments.

In the second part of the lecture, a new paradigm implied by multimedia competencies will be discussed.

Although they recognize the importance of children to be multimedia literate, a large percentage of preschool and primary school systems in the developed world still does not include multimedia literacy into the obligatory curriculum. If a curriculum combines multiple instructional tools (text, sound, video and images), it is possible to attract children' attention and deepen their learning experience.

Therefore, the last part of the lecture will summarize approaches, similarities, differences, advantages and issues of introducing multimedia literacy education in preschools and primary schools in different countries of the world.

Brief Biography of the Speaker: Nives Mikelić Preradović is assistant professor at the Department of Information Sciences, Faculty of Humanities and Social Sciences, University of Zagreb. She obtained her MA in Croatian language and literature and Information sciences at the University of Zagreb andher MPhil in Natural Language Processing at Cambridge University, UK. She obtained her PhD in 2008 at the Zagreb University on the development of the Croatian Valency Lexicon – Crovallex and accentual-derivational models for Croatian nouns and adjectives as well as accentual-conjugational model for verbs. In 2006 she spent a semester doing teaching and research at Georgetown University, USA. She published a book, 22 journal papers, 15 book chapters and about 12 scientific papers in conference proceedings, part of them in WSEAS conferences. She was the editor of 2 WSEAS conference proceedings. Her research interests include developing multilingual valency lexicons, morphosyntactic annotation, sentiment analysis (opinion mining), computer-assisted language learning, multimedia, text summarization and service learning (community-based learning).

Prof. Mikelić Preradović participated in several international and national projects: ACCURAT (Analysis and evaluation of Comparable Corpora for Under Resourced Areas of machine Translation), CESAR (CEntral and South-east europeAn Resources), Abu-MaTran (Automatic Building of Machine Translation), Typology of Knowledge and Information Processing Methods and Design and Management of Public Knowledge in the Information Space.

Plenary Lecture 13

Educational Potential in the new Input Devices

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Abstract: Innovative input devices are providing revolution in the making a brand new type of interaction with computers. All those new devices own significant potential to support education. The future input devices would be addressed and educational functions would be illustrated. Practically, gesture control would be focused and demonstrated. Educational potential would be organized according to both learning subjects/activities and communicating with computers. The primary task of human-computer interaction is to carry information between the user and the silicon world of the computer. Educators even take the opportunity of users' purposeful behavior and information responded from computer for users to recognize and enhance users' learning. Progress in this area attempts to increase the useful bandwidth across that interface by seeking faster, more natural, and more convenient means for users to transmit information to computers, as well as efficient, salient, and pleasant mechanisms to provide feedback to the user. On the user's side of the communication channel, interaction is controlled by the nature of human attention, cognition, and perceptual-motor skills and abilities; on the computer side, it is controlled only by the technologies and methods that we can invent. Research in input and output is centered on the two ends of this channel. First, the devices and techniques computers can use for communicating with people. Second, the perceptual abilities, processes, and organs people can use for communicating with computers. It then attempts to find the common ground through which the two can be related by studying new modes of communication that could be used for human-computer interaction (HCI) and developing devices and techniques to use such modes. Basic research seeks theories and principles that inform us of the parameters of human cognitive and perceptual facilities, as well as models that can predict or interpret user performance in computing tasks. Advances can be driven by the need for new modalities to support the unique requirements of specific application domains, by technological breakthroughs that HCI researchers attempt to apply to improving or extending the capabilities of interfaces, or by theoretical insights suggested by studies of human abilities and behaviors, or even problems uncovered during careful analyses of existing interfaces. These approaches complement one another, and all have their value and contributions to the field.

Brief Biography of the Speaker: Prof. Dr. Hung-Jen Yang got master of industrial technology from University of North Dakota USA in 1989 and Ph.D. of Industrial education and technology from the Iowa State University, USA in 1991. From 1991 to 1994, he worked as an associate professor in Ping-Tong University of Education and was in charge of computer center to promote computer assist instruction and internet-working service. After 1994, he is working for the department of industrial technology education in the National Kaohsiung Normal University. National Science Council in Taiwan had contracted with Dr. Yang for more than twenty research projects in last twenty years. He also supports Ministry of Education by creating information system of teacher in-service education. Technology education and teacher education are two major educational research areas focused by Dr. Yang. Other than educational research, he is also involved deeply with topics of knowledge engineering, communication technology, electronic engineering, and automation technology.

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