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Advances in Neural Networks, Fuzzy Systems *and* Artificial Intelligence

- Proceedings of the 13th International Conference on Artificial Intelligence, Knowledge Engineering and Data Bases (AIKED '14)
- Proceedings of the 15th International Conference on Fuzzy Systems (FS '14)
- Proceedings of the 15th International Conference on Neural Networks (NN '14)

Gdansk, Poland, May 15-17, 2014

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Preface

When one reads through the current literature on computer science, artificial intelligence, bioscience, and bioinformatics a common conclusion is: “the field of theses sciences is too young to be well defined, and its scope and limitations are still unknown”. So, this book grew out of a intense and fruitful discussion related to some observations from our volume about theory and practice of modern and advanced approaches. We realized that despite the interest in data bases, software engineering, distributed systems, knowledge engineering, neural networks, fuzzy systems as evident in the major scientific journals, there were no conferences of this subject in one place to intense exchange recent models, problems and techniques between scientists.

Moreover, the question of finite differences, finite elements, finite volumes, boundary elements is experiencing rapid development, which is manifested by a powerful increase in the number of applications in this field. It should be mentioned that mathematical, computational and statistical sciences complete themselves.

During
- the 15th International Conference on Neural Networks (NN '14)
- 15th International Conference on Fuzzy Systems (FS '14)
- 13th International Conference on Artificial Intelligence, Knowledge Engineering and Data Bases (AIKED '14)
- 13th International Conference on Software Engineering, Parallel and Distributed Systems (SEPADS '14)
- 7th International Conference on Finite Differences, Finite Elements, Finite Volumes, Boundary Elements (F-and-B '14)
- 2nd International Conference on Mathematical, Computational and Statistical Sciences (MCSS '14)
- 5th International Conference on Bioscience and Bioinformatics (ICBB '14)

in Gdańsk University of Technology, Poland in 2014, an extensive collection of models, methods, applications and instances were presented due to many benefits, including information technology, engineering, medicine, and education. This is particularly contemplated in this volume.

We do not claim this text is going to answer all questions about above sciences. Indeed, we see this very much as a first attempt and hopefully not the last one. We hope it will help to mature the field and inspire researches to gain a better understanding of such a new, rich, and exciting research area.

We would like to express our appreciation to all participants our conferences who contributed to this work. We are deeply grateful to professors from twenty five countries for creating a friendly atmosphere and favorable conditions during plenary lectures. Special thanks and appreciations go to supervisors of PhD students for supporting the work of them. Many valuable suggestions and proposals, which also contributed to enrich the content of this work, we have received from researchers during fruitful discussion.

To give the final shape of the work contributed some insightful and valuable comments from reviewers. Taking into account the shortcomings identified certainly allowed the authors of individual chapters for a fuller presentation of the test subject.

We do wish to thank our families for their great support during preparation of this work.

Jerzy Balicki
Gdańsk, May 2014

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Plenary Lecture 1

Brain Computer Interface (BCI) Using Tensor Decompositions Technology

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Abstract: In this talk we will review several promising paradigms for Brain Computer Interface, (including P300/N170 ERPs, SSVEP, and motor imagery-MI paradigms) and novel multi-way (tensor) signal processing tools for EEG-BCI and analysis of brain to brain couplings/interactions (BBC/I). We will discuss how tensor (multiway arrays) can be applied for classification and recognition of evoked and event related potentials (EP/ERP). We illustrate this by Multiway Canonical Correlation Analysis (MCCA) which is applied to improve recognition rate of Steady State Visual Evoked Potentials (SSVEP). Furthermore, we will present affective brain-computer interfaces (aBCI) based on oddball paradigm using visual stimuli with emotional facial images and short video-clips. Our experiments confirmed that the face-sensitive event-related potential (ERP) components N170 and vertex positive potential (VPP) have reflected early structural encoding of emotional faces and allows us to improve performance and reliability of BCI. The developed multiway (tensor) signal processing tools are very promising not only for BCI but also for near-real time neurofeedback (NF) and EEG hyper-scanning to investigate human emotions, social interactions, brain to brain couplings/interactions and big data analysis in brain science.

Brief Biography of the Speaker: http://www.open.brain.riken.jp/~cia/

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Plenary Lecture 2

New JIT, New Management Technology Principle

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Abstract: To be successful in the future a global marketer must develop an excellent management technology that can impress consumers (customers) and continuously provide high value products in a timely manner through corporate management for manufacturing in the 21st century. Because of that realization, the author proposes a “New JIT, New Management Technology Principle” which realizes the simultaneous achievement of QCD (Quality, Cost and Delivery) into effective management strategy. New JITcontains hardware and software systems, as next generation technical principles, for transforming management technology into a management strategy. The hardware system consists of the “Total Development System, TDS”, “Total Production System, TPS”, and “Total Marketing System, TMS” as a hardware system. These are the three core elements required for establishing new management technologies in the engineering, manufacturing, and marketing divisionsfor transforming management technology. To improve the work process quality of all divisions concerned with development, production, and sales, the author hereby proposes TQM-S(TQM by utilizing “Science SQC, New Quality Control Principle”) called “Science TQM, New Quality Management Principle” as a software system. In addition as a management technology strategy that enables sustainable growth, the author has proposed the “Strategic Stratified Task Team Model”, “Eco-making Innovation in the Work Environment Model”, “Partnering Performance Measurement Model”, and “Strategic Employment on the Patent Appraisal Method” that will become the driving force of New JIT. Furthermore, as the key to global manufacturing strategy of New JIT, the author believes that the effectiveness of New JIT using High Linkage Model “Advanced TDS, TPS & TMS” for the innovative deployment of global management technology in advanced companieshas been demonstrated as described herein based on the author’s verification conducted in this plenary lecture.

Brief Biography of the Speaker: Dr. Amasaka became a professor of the School of Science and Engineering, and the Graduate School of Science and Engineering at Aoyama Gakuin University, Tokyo, Japan in April 2000. His specialties include: production engineering (Just in Time, JIT and Toyota Production System, TPS), multivariate statistical analysis and, reliability engineering.. Recent research conducted includes: “Science SQC, new quality control principle”, "Science TQM, new quality management principle”, "New JIT, new management technology principle”, “Customer Science”, “Kansei Engineering”, and numerical simulation (Computer Aided Engineering, CAE).
Positions in academic society and important posts: He is the author of a number of papers on strategic total quality management, as well as the convener of JSQC, JOMSA, and other publications (e.g. POMS in USA and EurOMA in Europe). He has been serving as the vice chairman of JSPM (2003-2007) and JOMSA (2008-2010), the director of JSQC (2001-2003), and the commissioner of the Deming Prize judging committee (2002-2013).Now, he is inaugurated as the vice chairman (2009-2010), the chairman of JOMSA (2011-2012), and the representatives of JOMSA establishment (2008-present).
Patents and prizes: He acquired 72 patents concerned with quality control systems, production systems, and production engineering and measurement technology. He is a recipient of the Aichi Invention Encouragement Prize (1991), Nikkei Quality Control Literature Prizes (1992, 2000, 2001and 2010), Quality Technological Prizes (JSQC, 1993 and 1999), SQC Prize (JUSE, Union of Japanese Scientists and Engineers, 1976),Kansei Engineering Society Publishing Prize (2002), and others (e.g. Outstanding Paper Award, ICMIS-2013).

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Plenary Lecture 3

Nano- and Bio-Structured Materials and Their Photorefractive Features

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&
Prof. at Saint-Petersburg Electrotechical University (LETI)
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Abstract: The spectral and photorefractive parameters of some organic materials, including the liquid crystal (LC) ones, doped with nano- and bio-particles have been studied using optical limiting and holographic recording techniques in the visible . Some evidences of the influence of the nanoobjects doping on the self-assembling and wetting phenomena have been established. The area of application of the materials to be used in the optoelectronics and biomedicine has been discussed.

Brief Biography of the Speaker: Dr. Sci. PhD. Natalia Vladimirovna Kamanina was born in Kaliningrad, Russian Federation, 1957. She graduated with an Honor Diploma from Leningrad Polytechnical Institute (1981), St. Petersburg, Russia, and received a PhD (Physics & Mathematics) at Vavilov State Optical Institute, St.-Petersburg, Russia (1995), as well as a Dr. Sci. (Physics & Mathematics) at the same institution (2001). She is currently a Head of the Lab for “Photophysics of media with nanoobjects” at Vavilov State Optical Institute St.-Petersburg, Russia and has been involved in collaboration research with many researchers and scientists all over the world since 1995, publishing about 190 technical papers in the area of Laser-Matter Interaction and Nanotechnology. Parallel to her scientific activity, she has also been lecturing from 2001 up to now, as a Professor of Quantum Electronics and Opto-Electron Device at St. Petersburg Electrotechnical University (“LETI”), and a Professor of the Optical Physics and Modern Natural Science (2002-2013) at St. Petersburg Technical University “IFMO”.

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Plenary Lecture 4

Migrating Birds Optimization Method and Its Application on Different Areas

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Abstract: We propose a new nature inspired metaheuristic approach based on the V flight formation of the migrating birds which is proven to be an effective formation in energy saving. Its performance is tested on quadratic assignment problem instances arising from a real life problem and very good results are obtained. The quality of the solutions we report are better than simulated annealing, tabu search, genetic algorithm, scatter search, particle swarm optimization, differential evolution and guided evolutionary simulated annealing approaches. The proposed method is also tested on a number of benchmark problems obtained from the QAPLIB and in most cases it was able to obtain the best known solutions. These results indicate that our new metaheuristic approach could be an important player in metaheuristic based optimization.

Brief Biography of the Speaker: http://www.dogus.edu.tr/en/cv/akademik.asp?perid=muysal

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Plenary Lecture 5

Metatheory of Tableau Systems

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Abstract: Tableau proofs have a number of advantages in comparison to other proof methods. They can often be conducted automatically and countermodels are often delivered by failed proofs. The advantages are most evident in comparison to standard axiomatic proofs. The chief disadvantage of the tableau method is its intuitiveness, which is extremely problematic in proving soundness and completeness of tableau consequence systems with respect to some semantic consequence relation.

In our talk a perfectly formal account is presented of the question of the tableaux as well as tableau proofs. The approach we propose turns out to be quite successful in dealing with such metalogical problems as soundness and completeness, which will be demonstrated. The account we present extends ideas described in such works as [5], [6], [7]. And we especially extrapolate the tableau method for modal logic, delivered in the work [6] on other kinds of sentential calculi as well as calculi of names.

We begin with a logic, which is to be identified with a particular consequence relation, described semantically. The outcome is a collection of tableau rules that determine together with a concept of tableau proof a tableau consequence relation. Such a collection is called a tableau system. Hence, tableau proofs are regarded a syntactical concept, even if the tableau procedure requires some extensions of the formal language in question. All the tableau concepts we construct are set-theoretical, the graph concept of tableau proof turns out merely didactic presentation of purely formal concepts. And we define generally formal concepts: (a) tableau rule, (b) open, closed and maximal branch, (c) open, closed and complete tableau and (d) branch consequence relation.

By means of such general, formal concepts we are in a position to deliver exact conditions to be satisfied by collections of tableau rules defining tableau systems. In the general metatheory of tableaux we deliver the proofs of metatheorems are included to the effect that equality of the semantical consequence relation and the tableau consequence relation follows from those conditions to be satisfied.

The above mentioned theorem is to be applied to constructions of tableau systems, if the systems are to be sound and complete with respect to a semantical structure. When describing a tableau systems we simply apply general concepts and make sure the rules we formulate meet the formal conditions. If it is the case we immediately obtain a sound and complete calculus.

The theory we deliver covers sentential calculi as well as calculi of names. In our talk we present main metatheoretical concepts, the chief metatheoretical theorem and show some instructive examples of application.

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