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
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

Scientific Co-Organizer: Scientific Sponsor:

Recent Advances in Computer Engineering Series | 21

ISSN: 1790-5109
Editor:
Prof. Jerzy Balicki, Gdańsk University of Technology, Poland

Committee Members-Reviewers:

Krzysztof Goczyła
Janusz Górski
Zdzisław Kowalczyk
Lotfi Zadeh
Leon Chua
Michio Sugeno
Dimitri Bertsekas
Demetri Terzopoulos
Georgios B. Giannakis
George Vachtsevanos

Abraham Bers
David Staelin
Brian Barsky
Aggelos Katsaggelos
Josef Sifakis
Hisashi Kobayashi
Kinshuk
Leonid Kazovsky
Narsingh Deo
Kamisetty Rao
Anastassios Venetsanopoulos
Steven Collicott
Nikolaos Paragios
Nikolaos G. Bourbakis
Stamatisios Kartalopoulos
Nikos E. Mastorakis
Irwin Sandberg
Michael Sebek
Hashem Akbari
Yuriy S. Shmaliy
Lei Xu
Paul E. Dimotakis
M. Pelikan
Patrick Wang
Wasfy B Mikhael
Sunil Das
Panos Pardalos
Nikolaos D. Katopodes
Bimal K. Bose
Janusz Kacprzyk
Sidney Burrus
Biswa N. Datta
Mihai Putinar
Wlodzislaw Duch
Tadeusz Kaczorek
Michael N. Katehakis
Pan Agathoklis
P. Demokritou
P. Razeloas
Subhas C. Misra
Martin van den Toorn
Malcolm J. Crocker
S. Dafermos
Urszula Ledzewicz

Jerzy Stefanowski
Andrzej Czyżewski
Chin-Liang Chang
Waldemar Koczkodaj
Jose Luis Verdegay
Bruno Apolloni
Ping-Feng Pai
Anca Croitoru
Ning Xiong
Imre J. Rudas
Boris Kovalerchuk
Pierre Borne
Michelle Quirk
Marek Reformat
Miin-Shen Yang
Zeki Ayag
Alexander Gregov
Petia Georgieva
Adel M. Alimi
Katsuhiro Honda
B. M. Mohan
Kemal Kilic
Soheil Salahshour
Alexandre Galvao Patriota
Hwa-Young (Michael) Jeong
Kaan Yetilmezsoy
Ozgur Kisi
Rustom M. Mamlook
Gia Sirbiladze
Paramartha Dutta
Wojciech Jędruch
Józef Korbicz
Jim Austin
Thomas Wennekers
Dominic Palmer-Brown
Yi Ming Zou
Alessandro Di Nuovo
Claudio Mirasso
Gunther Palm
Giorgio Valentini
Zhiyuan Luo
Alessio Micheli
Sebastian Pannasch
Yutaka Maeda
Andreas Koenig
Jiann-Ming Wu
Paolo Gastaldo
Friedhelm Schwenker
Juan Ignacio Arribas
Tienfuan Kerh
Florin Gorunescu
Francesco Camasta
Kyong Joo Oh
Francesco Marcelloni
Preface

When one reads through the current literature on computer science, artificial intelligence, bioscience, and bioinformatics a common conclusion is: “the field of these 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
## Table of Contents

**Plenary Lecture 1: Brain Computer Interface (BCI) Using Tensor Decompositions Technology**  
Andrzej Cichocki  

**Plenary Lecture 2: New JIT, New Management Technology Principle**  
Kakuro Amasaka  

**Plenary Lecture 3: Nano- and Bio-Structured Materials and Their Photorefractive Features**  
Natalia V. Kamanina  

**Plenary Lecture 4: Migrating Birds Optimization Method and Its Application on Different Areas**  
Mitat Uysal  

**Plenary Lecture 5: Metatheory of Tableau Systems**  
Tomasz Jarmużek  

**Fast Algorithms for Mining Periodic Patterns**  
Marcin Zimniak, Wolfgang Benn, Janusz R. Getta  

**Pipe Network Analysis for Demand Estimation in Water Distribution Network**  
Teruji Sekozawa, Kazuaki Masuda, Tomohiro Murata  

**Degraded Number Plate Image Recognition for CCTV Surveillance**  
Jinho Kim  

**Reverse Abstraction of Database Drivers**  
Alexander Adam, Sebastian Leuoth, Wolfgang Benn  

**Fixed Point of Generalized Eventual Cyclic Gross in Fuzzy Norm Spaces for Contractive Mappings**  
S. A. M. Mohsenialhosseini  

**A Simulation Study of Active Control of Acoustic Noise by Magnetic Resonance Imaging**  
Hirofumi Nagashino  

**Neural Networks, Support Vector Machine and Genetic Algorithms for Autonomous Underwater Robot Support**  
Jerzy Balicki, Jan Masiejczyk, Piotr Przybylek, Marcin Zadroga  

**Hybrid Algorithm of Application of Artificial Neuronets for an Evaluation of Rate Constants of Radical Bimolecular Reactions**  
V. E. Tumanov  

**A Multilayer Neural Network for Classification of Frequency Information Dominant Patterns**  
Tan Loc Nguyen, Jung-Ja Kim, Se-Yeol Yang, Yonggwan Won
Studying Interaction Dynamics of Chaotic Systems Within a Non-Linear Prediction Method: Application to Neurophysiology
Alexander V. Glushkov, Olga Yu. Khetselius, Svetlana V. Brusentseva, Pavel A. Zaichko, Valentin B. Ternovsky

Knowledge Base Suitable for Answering Questions in Natural Language
Tomasz Boinski, Adrian Ambrozewicz, Julian Szymanski

Nano- and Bio-Structured Materials and Their Photorefractive Features. Part II: Inorganic System
Natalia V. Kamanina, Pavel V. Kuzhakov, Alexander A. Kukharchik, Patrice Baldeck, Chantal Andraud

Speech Recognition Based on SIMD Parallel Optimization
Lina You, Lu Liu, N. E. Mastorakis, Xiaodong Zhuang

How Specific Can We Be with k-NN Classifier?
Karol Draszawka, Julian Szymanski

Using Artificial Neural Networks for the Construction of Contour Maps of Thermal Conductivity
Soteris A. Kalogirou, Paul Christodoulides, Georgios A. Florides, Panayiotis D. Pouloupatis, Iosifina Iosif-Stylianou

Assessment of Maximum Explosive Charge Used Per Delay in Surface Mines
Manoj Khandelwal, Nikos Mastorakis

Web & Social Media Dynamics, and Evolutionary and Adaptive Branding: Theories and a Hybrid Intelligent Model
Shuliang Li, Jim Zheng Li

Disguised Face Identification Based Gabor Feature and SVM Classifier
Kyekyung Kim, Sangseung Kang, Yun Koo Chung, Sooyoung Chi

Multi-Robot Traffic Planning Using ACO
Anupam Shukla, Sanyam Agarwal

The Improvement of Reinforcement Learning with the Meta-Heuristic Search in Ant Colony Optimization
Hui Zhu, N. E. Mastorakis

Accelerometer-based Human Activity Recognition and the Impact of the Sample Size
Adam Harasimowicz, Tomasz Dziubich, Adam Brzeski

Probabilistic Grammatical Inference System for Finite State Automata - The P-GIFSA System
Chafia Kara-Mohamed, Arwa Albelahi, Muneera Al-Shamri, Re’am Al-Hussan, Aboubekeur Hamdi-Cherif

Chaos-Geometric Attractor and Quantum Neural Networks Approach to Simulation Chaotic Evolutionary Dynamics During Perception Process
Alexander V. Glushkov, Andrey A. Svinarenko, Vasily V. Buyadzhi, Valentin B. Ternovsky, Pavel A. Zaichko
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Impact of GOP Pattern and Packet Loss on the Video Quality of H.264/AVC Compression Standard</td>
<td>150</td>
</tr>
<tr>
<td>Miroslav Uhrina, Jaroslav Frnda, Lukáš Ševčík, Martin Vaculík</td>
<td></td>
</tr>
<tr>
<td>Social Systems in Terms of Self-Organized Oscillations and Coherent Order: Conceptual Scope</td>
<td>158</td>
</tr>
<tr>
<td>Darius Plikynas</td>
<td></td>
</tr>
<tr>
<td>Design and Implementation of PI and PIFL Controllers for Continuous Stirred Tank Reactor System</td>
<td>168</td>
</tr>
<tr>
<td>A. Albagul, M. Saad, Y. Abujeela</td>
<td></td>
</tr>
<tr>
<td>A Multi-Sensory Service System Using Modular Dynamic Bayesian Networks and Utility Function</td>
<td>174</td>
</tr>
<tr>
<td>Kyon-Mo Yang, Sung-Bae Cho</td>
<td></td>
</tr>
<tr>
<td>Methods of Artificial Intelligence for Prediction and Prevention Crisis Situations in Banking Systems</td>
<td>180</td>
</tr>
<tr>
<td>Jerzy Balicki, Piotr Przybyłek, Marcin Zadroga, Marcin Zakidalski</td>
<td></td>
</tr>
<tr>
<td>An Improved Recommendation Models on Grade Point Average Prediction and Postgraduate Identification Using Data Mining</td>
<td>186</td>
</tr>
<tr>
<td>Kanokwan Watkins</td>
<td></td>
</tr>
<tr>
<td>GA Assisted DFE-ANFIS Framework for Stochastic MIMO Channel Modeling</td>
<td>195</td>
</tr>
<tr>
<td>Kandarpa Kumar Sarma, Nikos Mastorakis</td>
<td></td>
</tr>
<tr>
<td>Scalar and Vector Fuzzy Integrals for Vector Multifunctions</td>
<td>202</td>
</tr>
<tr>
<td>Cristina Stamate, Anca Croitoru</td>
<td></td>
</tr>
<tr>
<td>Intrusion Detection using Fuzzy Clustering and Artificial Neural Network</td>
<td>209</td>
</tr>
<tr>
<td>Shraddha Surana</td>
<td></td>
</tr>
<tr>
<td>Discussion Summarization Based On Cross-Document Relation Using Model Selection Technique</td>
<td>218</td>
</tr>
<tr>
<td>Ibrahim Almahy, Naomie Salim, Yogan Jaya Kumar, Ameer Tawfik</td>
<td></td>
</tr>
<tr>
<td>Neural Rule Extraction: More Precision in Learning</td>
<td>226</td>
</tr>
<tr>
<td>Lasaad Smirani, Jihane Abdelkarim Boulahia</td>
<td></td>
</tr>
<tr>
<td>Reengineering HR Appraisal Legacy System to BI Platform</td>
<td>230</td>
</tr>
<tr>
<td>Ghazi Alkhatib</td>
<td></td>
</tr>
<tr>
<td>Authors Index</td>
<td>239</td>
</tr>
</tbody>
</table>
Plenary Lecture 1

Brain Computer Interface (BCI) Using Tensor Decompositions Technology

Professor Andrzej Cichocki
Senior Team Leader and Head of
Laboratory for Advanced Brain Signal Processing
Riken, Brain Science Institute
JAPAN
E-mail: a.cichocki@riken.jp

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/
Plenary Lecture 2

New JIT, New Management Technology Principle

Professor Kakuro Amasaka
Graduate School of Science and Engineering
Aoyama Gakuin University
Japan
E-mail: kakuro_amasaka@ise.aoyama.ac.jp

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 JIT contains 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 divisions for 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 companies has 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, 2001 and 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).
Plenary Lecture 3

Nano- and Bio-Structured Materials and Their Photorefractive Features

Dr. Sci., PhD Natalia V. Kamanina
Vavilov State Optical Institute
&
Prof. at Saint-Petersburg Electrotechnical University (LETI)
Russia
E-mail: nvkamanina@mail.ru

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".
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.

Metatheory of Tableau Systems

Professor Tomasz Jarmużek
Departament of Logic
Nicolaus Copernicus University
Toruń, Poland
E-mail: jarmuzek@umk.pl

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.