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Khalid Saeed · Władysław Homenda (Eds.)

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15th IFIP TC8 International Conference, CISIM 2016
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Proceedings

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Preface

CISIM 2016 was the 15th of a series of conferences dedicated to computer information systems and industrial management applications. The conference was supported by IFIP TC8 Information Systems. This year it was held during September 14–16, 2016, in Vilnius, Lithuania, at The Faculty of Economics and Informatics in Vilnius, a Branch of the University of Białystok, Poland.

About 90 papers were submitted to CISIM by researchers and scientists from universities around the world. Most of the papers were of high quality. Each paper was assigned to three referees initially, and the decision to accept was taken after receiving two positive reviews. In cases of conflicting decisions, another expert's review was sought for a number of papers. In total, about 218 reviews were collected from the referees for the submitted papers. Because of the strict restrictions of *Springer's Lecture Notes in Computer Science* series, the number of accepted papers was limited. Furthermore, a number of electronic discussions were held between the Program Committee (PC) chairs and members to decide about papers with conflicting reviews and to reach a consensus. After the discussions, the PC chairs decided to accept for publication in the proceedings book about 68 % of the papers submitted.

The main topics covered by the chapters in this book are biometrics, security systems, multimedia, classification and clustering with application, and industrial management. Besides these, the reader will find interesting papers on computer information systems as applied to wireless networks, computer graphics, and intelligent systems.

There were also three workshops and special sessions on Rough Set Methods for Big Data Analytics (organizer: Prof. Jarosław Stepaniuk), Scheduling in Manufacturing and Other Applications (organizers: Profs. Ewa Skubalska-Rafajłowicz and Wojciech Bożejko), and Intelligent Distributed Systems IDS (organizer: Prof. Jerzy Balicki).

We are grateful to the five esteemed speakers for their keynote addresses. The authors of the keynote talks were Profs. Mirosława El Fray (West Pomeranian University of Technology, Poland), Jaap van den Herik (Leiden University, The Netherlands), Nobuyuki Nishiuchi (Tokyo Metropolitan University, Japan), Andrzej Skowron (Polish Academy of Sciences), and Qiang Wei (Tsinghua University in Beijing, China). Also Prof. Bohdan Macukow from Warsaw University submitted a very interesting invited paper. All the keynote and invited abstracts have been included in the proceedings.

We would like to thank all the members of the PC and the external reviewers for their dedicated efforts in the paper selection process. We also thank the honorary chairs of the conference, Profs. Ryszard Tadeusiewicz and Witold Pedrycz. Special thanks are extended to the members of the Organizing Committee, both the international and the local ones, and the Springer team for their great efforts to make the conference a success. We are also grateful to Andrei Voronkov, whose EasyChair system eased the submission and selection process and greatly supported the compilation of the

proceedings. The proceedings editing was managed by Jiří Dvorský (Technical University of Ostrava, Czech Republic), to whom we are indeed very grateful.

We hope that the reader's expectations will be met and that the participants enjoyed their stay in the beautiful city of Vilnius.

September 2016

Khalid Saeed
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Keynotes

Nanotechnology for Medical Biosensing

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Abstract. Nanotechnology is rapidly developing field with numerous potential applications in health care. Recent developments in carbon-nanomaterials – graphene in particular – offer a great deal of promise in achieving fast and affordable platform for biosensing. Among dirrefent nanomaterials, graphene has received worldwide attention due to high surface area, excellent electrical conductivity, strong mechanical strength, good thermal conductivity, high charge carrier mobility, good optical transparency and ease of biological as well as chemical functionalization. Such exceptional properties can be used in design of fast, affordable, and simple devices for bioanalysis since appropriate biosensors are required for early stage diagnosis of the disease as well as disease progression monitoring.

Depending from the working principle, graphene-based biosensors can utilize their electrical or electrochemical properties to selectively detect proteins, DNA, glucose or cholesterol. Nanomaterial in such biosensor is used to construct a receptor capable to interact with a target analyte. Next, the biological sensing element (bacteria, DNA) connects to a transducer, which does the conversion from biological data to electrical data. The transducer in turn connects to a measuring device translating the electrical signal to a measurable quantity. The most common measurement techniques include electrochemical impedance spectroscopy, field-effect transistors, cyclic voltammetry (CV), and differential pulse voltammetry. Typically in bioelectrochemistry, the reaction under investigation would either generate a measurable current (*amperometric*), a measurable potential or charge accumulation (*potentiometric*) or measurably alter the conductive properties of a medium (*conductometric*) between electrodes. Electrochemical sensing usually requires a *reference* electrode, a *counter* or auxiliary electrode and a *working* electrode, with the graphene or graphene-polymer nanocomposites as the most emerging materials for future bioelectronics devices. Such electrodes can be printed via ultrasonic, non-contact printing for biological sensing (DNA or enzyme).

Graphene-based ink should enable the selectelvely detect the target biomolecules, for example, attached DNA oligonucleotide probes for Group B *streptococcus* (GBS) to the printed, graphene-platinum ink. The most important issue is to conjugate biorecognition molecules to the ink in a way that they would remain functional, i.e. will provide electrochemical signal.

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Innovation and Big Data

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Abstract. In the World, we see that now and then well-known companies are in trouble since they do not innovate in time. They keep their well-established way of operating and adhere to their old fashioned business models. As a keynote speaker, I would like to advice the scientific community to pay more attention in their research to the possibilities of Big Data in relation to innovation.

This relation is rather delicate as can be seen from the following examples.

- The autonomously self driving car. The national and international car associations have to adapt their whole services can marketing system.
- TCCrowdsourced online dispute resolution. Lawyers and Judges have to reconsider their system of comparing verdicts and law enforcement.
- Airbnb is changing the hotel-bed and breakfast commercial activities.
- Uber Taxi is changing the business model of Taxi companies.
- Blockchains with as application Bitcoin are changing the position of the banking institutions.

The prevailing question is: What does Big Data add to this Development?

In the lecture we will emphasize the seven phases of data development, viz. Collecting Data, Cleaning Data, Interpreting Data, Analysing Data, Visualising Data, Narrative Science, Emergence of new Paradigms.

Moreover, emphasis will be placed on Obstacles: Public safety, Narrative Science, Commercial competition, and Privacy and ethics.

Finally, attention will be pointed to Sensitive data such as Racial or Ethnic Origin.

The general rule for companies is that the processing of sensitive data is prohibited without explicit consent (Directive 95/46/EC, article 8).

Usability Evaluation Method Using Biological Data

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Abstract. Usability has been important factor on the design for the interface of product and system. The current evaluation methods used to assess the usability factors are interview and questionnaires. These are based on the subjective approach, therefore certain limitations are encountered. It is difficult to get the data on usability for a long duration, the quality of evaluation depends on the skill of the evaluator and these evaluation approaches are costly and time-consuming. Then, our research team has been studying the objective usability evaluation methods using biological data, some of which are eye movement and fingertip movement during the operations of the target interface. Based on the analysis of the captured data, the interface design can be sufficiently improved. In the keynote, basic idea and specific experiment of the proposed method will be presented.

Complex Adaptive Systems and Interactive Granular Computing

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Abstract. Agent-based decision support in solving problems related to Complex Adaptive Systems (CAS) requires relevant computation models as well as methods for incorporating reasoning over computations performed by agents. To model, crucial for CAS, interactive computations performed by agents, we extend the existing Granular Computing (GrC) approach to Interactive Granular Computing (IGrC) by introducing complex granules (c-granules or granules, for short). Agents performing computations learn due to interaction with the environment how to perform actions and through interactions with the environment they discover relevant rules of behavior, not provided a priori. Many advanced CAS tasks may be classified as control tasks performed by agents aiming at achieving the high quality computational trajectories relative to the considered quality measures over the trajectories. Here, new challenges are to develop strategies to control and predict the behavior of the system. We propose to investigate these challenges using the IGrC framework. The reasoning, which aims at controlling computations, in order to achieve the required targets, is called an adaptive judgment. Adaptive judgment is more than a mixture of reasoning based on deduction, induction and abduction. IGrC is based on perception of situations in the physical world. Hence, the theory of judgment has a place not only in logic but also in psychology and phenomenology. This reasoning deals with granules and computations over them. Due to the uncertainty the agents generally cannot predict exactly the results of actions (or plans). Moreover, the approximations of the complex vague concepts, e.g., initiating actions (or plans) are drifting with time. Hence, adaptive strategies for evolving approximations of concepts are needed. In particular, the adaptive judgment is very much needed in the efficiency management of granular computations, carried out by agents, for risk assessment, risk treatment, and cost/benefit analysis. The discussed approach is developed in cooperation with many co-workers, in particular with Dr Andrzej Jankowski and is based on the work on different real-life projects.

Competitive Intelligence Analytics in the Big Data Context

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Abstract. Competitive intelligence is the action of defining, gathering, analyzing, and distributing intelligence about products, customers, competitors, and any aspect of the environment needed to support executives and managers making strategic decisions for an organization. Traditionally, competitive intelligence is detected and analyzed mainly by experts/managers based on the intra-organizational data/information. However, external big data (e.g. query log, social interaction, blog/twitter, online review, helpfulness votes, open media, etc.) becomes a more and more important source for conducting online competitive intelligence analysis, e.g., dynamic competitor identification and competitiveness degrees measuring with Google search query log, customer insights detection from online reviews, incremental competitive intelligence digests extraction with Internet news. Moreover, due to the 4V characteristics of the big data source, some intelligent and automatic methods should be developed to overcome the shortcomings of traditional methods conducted by human experts. In this talk, I will briefly introduce several related novel methods.

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