Preface

Special Issue on "Computer Science and Information Technologies" (CSIT)

Background

The 19th International Workshop on Computer Science and Information Technologies (CSIT 2017) was held in Germany, Baden-Baden, October 8-10, 2017. The Workshop was a forum for presentation of new results in research, development and applications in computer science and information technologies.

The previous Workshops on Computer Science and Information Technologies (CSIT) were conducted in Moscow (1999), Ufa (2000, 2001, 2003, 2005, and 2007), Patras, Greece (2002), Budapest, Hungary (2004), Karlsruhe, Germany (2006), Antalya, Turkey (2008), Crete, Greece (2009), Moscow-Saint-Petersburg, Russia (2010), Garmisch-Partenkirchen, Germany (2011), Ufa - Hamburg - Norwegian Fjords (2012), Vienna-Budapest-Bratislava (2013), Sheffield, England (2014), Rome, Italy (2015), Prague- Kunovice, Czech Republic (2016).

There were two more CSIT meetings since 2017 in Bulgaria (Varna, 2018) and in Austria (Vienna, 2019), their papers and results may be used for further special issues in Acta Polytechnica Hungarica or in other journals, depending on the demand and on the success of the recent work

As the title of the meetings (Workshop according to its name; conference, according to its value and size) is quite general, there are several topics, which may be discussed and were discussed, from the theoretical side and from the application side as well to give forum to several people. Just to give a short list of paradigms involved:

> *Artificial Intelligence, Decision Support Systems, Modeling, Simulation, Networking, Integration, Date- and Knowledge-Base Management, Data Mining, Big Data, Robotics, Industrial Automation, Green Production, etc.*

> *Applications in industry, management, finances and agriculture, etc,*

The workshops aim at bringing together researchers from different areas, including Distributed Systems, Management of Data and Knowledge, Computer Control. These areas are heavily related nowadays. Agent technology, Peer-to-Peer Information management and ubiquitous computing are just examples of the strong interrelationship between these disciplines. The Workshop organizers in the last years regularly provided a platform for cross disciplinary discussions in the framework of the announced topics.

Goals and Approach

During the past 20 years history of the workshops, taking into consideration the scientific level of the papers presented and published in the proceedings, having an increasing international participation we believe that the meeting became adult and strong enough to attract a broader international interest. The managers of CSIT and of the Acta Polytechnica Hungarica (the international journal of the Óbuda University) decided to jointly prepare and publish a special issue devoted to CSIT. Prof. Nafisa Yusupova (Ufa) and Prof. George Kovács (Budapest) were invited as guest editors.

Most of the papers were selected from the contributions of the 2017 Baden Baden meeting, however some earlier papers were added to increase the scientific level.

The initiator and main organizer of all CSIT workshops is the Ufa State Aviation Technical University (USATU) of the city Ufa.

USATU (UGATU in Russian) has a rather special role in the Russian University system, as fundamental university with old traditions. Founded in 1932, Ufa State Aviation Technical University is one of the largest universities of higher education in the Russian Federation. Serving 1500 faculty members and 20 000 students from 27 countries around the world. The university is situated on a 500-acre campus in Ufa, Republic of Bashkortostan.

The Faculty of Informatics and Robotics (Dean – Prof. Nafisa Yusupova) offers more than 40 academic options in several subject areas. The Faculty is proud of strong position of leadership in computing in the region, representing numerous industrial links and projects. A central part of our Informatics and Robotics Faculty's goals is to perform modern research in Informatics and Robotics by focusing our efforts in various specialization areas represented but not limited by: Algorithms and Artificial Intelligence, Programming Languages and Software Engineering, Computer Engineering and Systems.

Ufa is the capital of Bashkortostan, Russia. The city is situated in the Ural mountains closed to the Europe-Asia border, inhabited mostly by Russians, Tatars and Bashkirs. The city is cut to two parts by the Bjelaja river similarly to the river Danube, which cuts Vienna, Bratislava, Budapest and Belgrade to two-two parts.

According to most researchers recent Finland and Hungary both were populated by those people leaving Bashkir territories moving to the west in the early medieval years.

Organizing/Editing the Special Issue on CSIT

The papers of this special issue were selected from the 2017 workshop material. All authors were kindly requested to rewrite their contributions to match with journal requirements, and then the improved papers went through the regular journal review procedures. Finally 18 papers were selected for publication in this special issue.

The basic difference between a normal and a special issue is, that something keeps the papers of the special issue together, there is something common.

A special issue is generally published based on a given topic (open call or invitations) or selected from a meeting of 80-120 presentations. It generally consists of 15 to 30 papers collected into groups of 3-6 contributions, which are similar in some points of view, and there is a reasonable sequence of papers within each group. All are defined by the logic or structure of the papers. In our recent case the basis was one meeting (CSIT 2017) having about 60 contributions representing a huge selection of topics.

The editors wanted to organize the papers according to some guidelines, as for example the place of research activity on the "From Theory to Application" Line (TAL). The steps of technical innovation from basic research to industrial applications through different levels of applied research are always different and changing from time to time. Innovation is a very broad area, the selected papers may cover only some little segments of it.

> *We warn the reader from believing that the long forgotten slogan: "Science Goes To Work" is warmed up, just most aspects of innovation involve science working directly for us, for innovation, for our common future*

THEORY	BASIC RESEARCH		APPLIED RESEARCH		PRACTICE	
TTTT	G1	G2	G3	G4	G5	G6	RRRR

Groups Sequences, Theory, Dreams, Reality, etc.

Based on the above given approach we planned to **start with pure theory** (basic research, TTTT), then the so called applied results is coming up, and finally applications, industrial realizations (RRRR) are to be discussed.

> *From a more scientific point of view one should mention PLM (Product Life-cycle Management), what details the complete life-span of every product (all innovation results and more) from birth of an idea through several design and implementation steps, not forgetting about tests, service, maintenance and reuse and recycling at the end.*

The normally simple question: which contributions belong together, which ones should be in the same group ?turned out to be too complex to answer, as all papers deal with 2 to 6 topics, and use 1-10 tools and/or methodologies; "the most relevant" ones of them is hard to choose. Finally the clusters of papers were formed by means of taking into account of several keywords of type topics ad of type tools & means, which were not necessarily the same, which were given by the authors.

We assigned simple keywords (as identifiers) to every paper, to decide their best places using several aspects, to help in using the "theory to industry" line (TAL).

All papers will be outlined soon, now it is just to see which papers fit into which basic categories (selected more or less arbitrarily), as, for example below

Information management	(Im)	2 papers
Application oriented information management (Ima)		x papers
Application oriented information management (Ima)		11-x papers
CAD-CAM-industry oriented	(ind)	2 papers
Maps, geography, government	(gov)	2 papers
Control, industry (cont)		7 papers

Naturally several items could be defined differently, some issues may belong to more groups at the same time. All papers have their (proper) place in the theory to industrial application line (TAL), and the number of members in the groups is the most important.

In the 6 lines above the numbers identify the papers along the TA line. It is clear that their distribution is rather uneven, as the group Ima (No. 2. applications of information management) is overloaded, almost all papers belong to it. Pure theory (TTTT) and pure industry (RRRR) are very small subgroups, which cannot yet be seen.

Two remarks:

a) It will be seen that most papers have 3 or more authors, what suggests that these topics are complex enough to request that groups should work on them.

b) Another important information is that one or more universities and research organizations are involved in the special issue from the following cities: Ufa, Ekaterinburg, Dresden, Sankt-Petersburg, Moscow, Orenburg, Irkutsk, Izhevsk, Chelyabinsk, Baden-Baden, Budapest.

Groups/Clusters and Sequences

A commonly used clustering could be just to put the papers in a sequence according to the place of the first authors in the alphabet.

G1 - G6 six groups (or six clusters) for 12 papers, introducing all papers

The goal of the guest editors is to assist the reader in choosing papers to read or to study them, or to find relationships between old and newer contributions, or just to find given authors or topics, etc. The o IDs in the contents and in the coming lists have the form G.n.m, (G is constant, n is the group number (1-6) and m (1-18) is the sequence number of the paper in our list. The groups and sequences are based on the TAL (if possible and reasonable) in general and used for given tasks.

- Group No. 1 and No. 2. and partially No. 3 are dealing with basic software solutions, TTTT (plus risk based approach and data mining)

- Group No. 4 gives papers solving some 3D mapping, picture and territory management, which are not for the general public, but for any local authorities.

- Group No. 5 contains intelligent, multilevel control solutions, approaching to the RRRR level of the TAL.

- The last group (G6) presents industrially useful, practical applications (RRRR).

G1. Software design and development/first part *(general applications in different application fields, including applications of ontologies)*

G1.1 In their paper *"Analytical Toolset for Model-based Stochastic Error Propagation Analysis: Extension and Optimization Towards Industrial Requirements"* the authors (T. Fabarisov, N. Yusupova, K. Ding, A. Morozov and K. Janschek) discuss and solve some problems to help industry the application of MBSI by means of extending and optimizing the available analytical toolset to give industry a useful tool.

The paper with the hard, complex problems, which are properly defined and solved, could be called the flagship of CSIT, and it demonstrates the research strength and devotion of all participants of the workshops, and it reminds us that only the very best papers were selected for this issue.

G1.2 In the paper "*JSON Documents-Processing Using Situation-oriented Databases"* by V. Mironov, A. Gusarenko, N. Yusupova, Y. Smetanin the description of two sound approaches to an important problem of processing heterogeneous information are given. The authors use several tools to minimize home-made, unique software. For example, see the paper for details: JSON, XML, Document Object Model, web service, associative array, Query, Socrata Quary Language, Data extraction, Hypertext pre-processor, Situation Oriented DB. And these are working together to produce the two solutions. Heterogeneous data are managed in the previous paper as well.

G2. Software design and development/second part *(general to specific applications)*

G2.3 G. Kulikov, V. Antonov, A. Fakhrullina and L. Rodionova *in "Formal representation of the model for implementing system engineering functions because of the necessary diversity of structural relationships with the polycubic data organization"* define a formal representation of subject domain based on system model in the form of category of processes. The possibility of constructing a number of identical formal algorithms for controlling the integrity of the structure of initial processes is shown, and the necessary "external" control in case of violation is defined.

G3 **Intelligent solutions – using data mining in medicine/toxicology** *(data mining and risk based approach)*

G3.4 The paper of A. Massel ad D. Gaskova.3.09 is entitled "*Application of a Risk-based Approach to Identify Critical Ties*" describes the identification of critical facilities (infrastructure, equipment), which appear in the energy sector. The authors formulated a risk-based approach to decision-making in identification of critical facilities (infrastructure, equipment) in terms of cyber threats.

G3.5 In the paper *"Complex Analysis of Medical Data with Data Mining Usage"* the authors (N. Yusupova, G. Shakhmametova and R. Zulkarneev) present a new approach to the medical, in particular, the toxicological data-analysis, data-processing and a multilevel system realization. The three-stage technique for data analysis with data mining usage is offered. The results of the research, as relationship of gender and age with poisoning with drugs and/or narcotics are discussed in details.

G4 **Working for government – tasks of territories &. map generation, university education**

G4.6 In their paper "*The new combined method of the generation of a three-dimensional dense map of environment based on history of camera positions and the robot's movements*" the authors (A. Vokhmintcev and M. Timchenko) solve some problems of the development of adaptive methods to generate a three-dimensional combined dense map of the accessible environment. The map provides a required accuracy of reconstruction and it determines a pos4tion of a robot in a relative coordinate system. A new dynamic matching algorithm combining visual features and depth information are able to build global consistent maps is proposed. The performance of the proposed system in real environment is presented and discussed. Moving robots and cameras assist in realization.

G4.7 In the paper "*Analysis of the Territorial Systems State Based on a Complex of Indicators*" V. E. Gvozdev, O. I. Khristodulo and D. V. Blinova discuss and solve some reliability problems of the basic topological structures of GRID systems containing a minimal enough set of constructive elements. The construction of structural reliability models based on series- parallel reliability schemes are described. The application of these approaches create the basis for a multidimensional analysis of the GRID-systems' reliability characteristics in the design and development stages. This, in turn, creates the prerequisites for assessing the functional safety of such systems.

G4.8 In the paper entitled *"Energy-efficient technologies in the educational program of the architectural higher school"* the authors (Zakharova, Krivonogov, Kruglikov and Petunin) discuss the world trends in the modern construction in relation to ecological rational design according to "green" standards and applications of the building information modeling – BIM. There are ideas and

solutions how to implement "green" building in Russia. The key issue is chaging eduational systems in higher level schools. Intreresting examples prove the success of the efforts of the teachers ad students of the University of Architecture and Art and of the Ural Federal University meeting requirements of "green" standards.

The next two clusters contain 2-2 papers with useful, RRRR solutions. G5 details complex control problems, while G6 is devoted to CAD/CAM, CNC and scheduling.

G5 Complex, multilevel intelligent control – for industry

G5.9 In their paper "*Design of Multi-Level Intelligent Control Systems of Complex Technical Objects on The Basis of Theoretical-Information Approach*" the authors (B. Ilyasov, V. Vasilyev and S. Valeev) discuss an approach of designing advanced multi-level intelligent control systems for complex technical objects on the basis of theoretical-information. Their system allows to make project decisions during the design of control algorithms. The project demonstrates the usability of their ideas is the design of intelligent control systems for aviation gas-turbine engines.

G5.10 Another paper devoted to aircraft problems is "*Architecture of the security access system for information on the state of automatic control systems*" by I. Frid, A. M. Vulfin, V. V. Berkholts, D. Ju. Zakharov and K. V. Mironov. Security of the aircraft control and control system is a natural, basic demand in aircrafts. This paper discusses a problem of secure access provision via Web-service to a data base. This data base contains critical information about the parameters of the architecture of the security access system life cycle of complex technical devices (CTD). This article presents a logic model of access to a data base as well.

G6 Scheduling and production solutions - working in industry

The last group of papers in this issue deal with the solution of scheduling industrial problems, namely CNC control data-diode development and cloud scheduling.

G6.11 The paper "*Routing in CNC Cutting Machines: Engineering Constraints*" by A. Petunin and P Chentsov is devoted to some problems of sheet cutting optimization with engineering specifics. There are two hard restrictions often forgotten by CNC designers ad users: thermal expansion and sheet rigidity restrictions. The solution uses the dependence of the cost functions on the route, where the machine works (the cutting tool moves) and on the direction of tool motion on the contour.

G6.12 In the paper *"Effective Scheduling Method of The Cloud System of Collective Access to Virtual Working Environments"* the authors I. Bolodurina, L. Legashev describe a cloud system of collective access (CSCA) to virtual working environments as a means of providing an economically profitable remote access to paid and free software for educational institutions of secondary education. The problem of efficient CSCA scheduling to optimize the usage of cloud virtual machines and software licenses has been studied in details. The mathematical model of CSCA is presented. The UML class diagram of CSCA simulator is described. The statistical analysis of fitness function value distribution is performed.

Conclusion of the introduction

The guest editors made their best to make this special issue as user friendly as possible with commenting and introducing the serious scientific contributions – often using easy to understand expressions.

The reader can see and experience the broad spectrum and high scientific level of the CSIT meetings, the diversity of contributions from theory to practice in several different domains with different aspects of information management.

The guest editors are grateful to the editors of Acta Polytechnica Hungarica for the hard work they assisted to manage and publish this special issue and they are thankful to all authors, who contributed and last, but not least to all reviewers and their assistance powers who worked a lot to make the papers acceptable by increasing the quality, explaining the authors what and how should they improve.

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Guest Editors

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