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1. Introduction

The Institute of Computer Science was founded as the Institute of Scientific and Technical Information in 1974. Since then it has offered the master's program in the discipline of scientific and technical information. In 1993 the three-year program leading to the Licentiate's Title in Computer Science replaced that program. In 1994 the institute changed its name into the Institute of Applied Computer Science, and in 1997 into the Institute of Computer Science.

Education in computer science consist of two stages: three-and-a-half-year engineer's studies and two-year master's studies. Education in biomedical engineering is organized into one stage: three-year engineer's studies. In the academic year 2012/2013 there were enrolled 188 engineer's and 76 master's students in computer science, and 88 students in biomedical engineering. The institute is a part of the Faculty of Computer Science and Material Science (www.wiinom.us.edu.pl) of the University of Silesia (www.us.edu.pl). Since 2002 the Faculty of Computer Science and Material Science can award PhD degrees in computer science.

Professor Zygmunt Wróbel has been acting as headmaster of the Institute since 2012.

The institute consists of:

- Division of Information Systems (http://zsi.tech.us.edu.pl/)
  head: Professor Mariusz Boryczka
- Division of Computer Systems (http://zsk.tech.us.edu.pl/)
  head: Professor Piotr Porwik
- Division of Algorithmic and Computational Intelligence (http:// http://zaiio.ii.us.edu.pl/)
  head: Professor Urszula Boryczka
- Division of Modeling and Computer Graphics (http://zmigk.ii.us.edu.pl/)
  head: Professor Wiesław Kotarski
- Division of Biomedical Computer Systems (http://zksb.ii.us.edu.pl/)
  head: Professor Zygmunt Wróbel

2. Research

2.1. Areas of specialization

The Institute of Computer Science conducts research in the following areas:

Expert systems

The primary aim of studies is the development of the theoretical basis for designing and implementing expert systems. The validation and verification methods of knowledge databases are investigated. The design principles of support decision systems with knowledge databases verification are developed. Besides theoretical studies concerning the methods of knowledge base creation, the works on practical implementation of the support decision systems comprising knowledge verification module are also undertaken. The implementation of such systems requires an analysis of methods of knowledge representation and concluding.

The other direction of research is an application of the rough set theory for constructing support decision systems. With this regard the studies focus on the problem of multi-step diagnosing based on uncertain and incomplete information. Making up a decision requires some rough classification to be done where the steps of the classification are connected with a real diagnosing process carried out by experts. An example of such a complex diagnosing system is the support decision system for children neurology, which was realised in co-operation with the Children's Neurology Clinic of the Silesian Medical Academy. On this system the proposed solutions based on the rough sets theory are verified.

Recently, the very important directions of our research are composited knowledge bases (huge number of rules in a knowledge base with numerous premises in each rule, a large set of attributes, many of which are dependent) and inference processes on such bases. The studies also concern problems of complex medical data processing.

Biometric techniques

Various experiments with biometric systems that work as recognition units have been carried out recently. These investigations follow from contemporary needs of a security. Researches are conducted for three types of the biometric systems: fingerprints, signatures and voice recognition, where different image processing techniques are checked. Additionally, various similarity measures are also proposed and their effectiveness is tested in practical experiments.

The main goal of investigations is to find efficient methods which can help in behavioural description of the persons. There are some dedicated solutions proposed where statistical methods and individually selected similarity measures are applied in biometric recognition systems. These measures are selected on the basis of behavioural characteristics of the person.

In this researches both the static and dynamic features of the analysed objects are extracted and next used in the recognition process. Many experiments have been realized basing on own databases where signatures and finger imprints samples are stored. These databases have been created during recent years.

Spectral analysis of the Boolean functions

In these investigations some properties of the Boolean functions are recognised. In this approach the basis of the orthogonal Walsh and Haar functions are used and spectrum of the Boolean function in these bases is analysed. The distribution and values of the spectral coefficients

can indicate type of the function (linear, affine, bent, etc.). Various decomposition methods of Boolean function have been applied and are still tested. The researches are conducted for fully and weakly defined functions. Investigations are carried out for large functions where classical calculation of the spectrum is impossible. For this reason there are proposed methods where on the basis of the reduced spectrum, type of Boolean functions can also be recognised.

Multiresolution methods in Computer Graphics and Image Processing

The aim of investigations is to find efficient and fast algorithms that can be applied in computer graphics and image processing. Researchers are concentrated on two main scientific tasks.

The first one relates to fractal modelling and coding of 2D and 3D graphics together with their multiresolution representation. Fractal modelling is based on relation between IFS (Iterated Function Systems) coefficients and subdivision schemes together with new ideas (fractal homeomorfisms, stealing colours, V-fractals, superfractals) discovered recently by Barnsley. Fractal algorithms are interesting for practice because they need a small amount of information to generate resolution independent graphics and additionally in the progressive way. Progressiveness and resolution independency are very desirable features while transmitting graphical information through the net.

The second task relates to effective sparse multiresolution geometrical representation of images and their processing. The use of geometrical wavelets in image processing, especially adaptive methods, could lead to efficient algorithms among others in denoising, segmentation, edge detection or compression. Due to the fact that geometrical methods reflect Human Visual System in some sense such methods may be used in very advanced techniques of object detection or recognition. Another application may be found in content based compression. Additionally, building of fast algorithms could lead to real time applications in the all mentioned areas.

Analysis and processing of biomedical images

The project is devoted to the algorithms of analysis, processing and recognition of images applied in the identification of pathological states. By images we understand „classic" biomedical images. This group comprises X-ray, ultrasonic, thermovision images, as well as the microscopic images of tissues. In addition, two-dimensional images, so called biomedical signals, are analyzed and processed. Among them are EKG and EEG signals, cardiograph records of heart action, sounds of pathological speech etc.

Hospital computer systems

The aim of hospital computer systems is to improve acquisition, transmission and processing of data generated by measuring sensors and medical apparatuses. This in turn improves the quality of medical care, decreases its cost and has a positive impact on the administrative and financial activities of hospitals. In the project the distributed system of dynamic microbiological investigations in the networked computer system of a hospital is elaborated.

Computer techniques in biotechnology

The work of biological objects can be considered as a problem of controlling a multi-level object described by a set of parameters related with each other. The research group working on the application of computer techniques in biotechnology constructs new measurement converters and medical apparatuses in order to perform complex biomedical and biotechnological procedures. The recent project was devoted to programmable control of biotechnological systems.

Computerization of administrative processes

The subject of research is expert systems for the local administration needs. The research concentrates on general conditions of the computerization of administrative processes. In particular they comprise the legal foundations of computerization of management processes, such as the structure and tasks of the administrative bodies and the legal rules of using computer programs and automated databases. One of the research subjects concerns the systems of spatial information systems and personal data protection.

Computational swarm intelligence

Swarm intelligence is an artificial intelligence technique involving the study of collective behavior in decentralized systems. Such systems are made up by a population of simple agents interacting locally with one other and with their environment. Although there is typically no centralized control dictating the behavior of the agents, local interactions among the agents often cause a global pattern to emerge. Examples of systems like this can be found in nature, including ant colonies, bird flocking, animal herding, honey bees, bacteria, and many more. Swarm Intelligence techniques have mainly been applied to continuous nonlinear numerical optimization and in many real world optimization problems, especially in discrete optimization (TSP, JSP, TTP, MKP etc.). Its convergence rate also make them a preferred tool in dynamic environments: transportation networks and routing optimization (multi-objective optimization), constrained optimization, niching, game theory, data mining and data clustering.

Heuristic and evolutionary algorithms

The heuristic and evolutionary algorithms for solving combinatorial optimization problems are studied. These problems arise in many areas of applications. The algorithms use the concepts derived from artificial intelligence, biological, mathematical, and natural and physical sciences. The ant systems in the context of the travelling salesman, bus-scheduling and vehicle routing problems are investigated. Special attention is paid to the generative policies improving the performance of ant systems. The leader and elite strategies modelled upon the behaviour of real ants are examples of such policies. The vehicle routing problem with time windows which belong to the NP-hard problems is also solved by making use a variety of algorithms, including parallel simulated annealing. All these algorithms employ a local neighbourhood search and are probabilistic in nature. The way a neighbourhood structure is defined and randomness is introduced influence significantly the performance of algorithms. Yet another direction of research we carry out is genetic programming. In this regard the influence of grammars describing the generated programs on the efficiency of genetic programming is studied.

2.2. Research grants

Exploration of rule knowledge bases

MSHE grant No.: 2011/03/D/ST6/03027, 2012-2015, 451 400,00 PLN
Principal investigator: PhD Agnieszka Nowak – Brzezińska

The aim of the research is to develop theoretical foundations and methods of exploring patterns and relationships which can be found in large rule-based knowledge systems and to introduce new methods of inference. It is a recently arised issue of high importance, both in terms of theoretical and practical aspects. It requires the research of a fundamental nature, but also a methodological study and vast implementational considerations. In the scope of essential research the results will include: (1) developing the concept of a knowledge base meta-model and a study of its formal description and all of the properties, (2) development of methods for the extraction of the proposed model from rule bases of big volume, including the scalability and effectiveness of the proposed approach and (3) development of novel inference methods for the created model.

A modular, hierarchically organized rule based system using the cluster analysis method and decision units is planned to be built. These methods have been successfully used in the optimisation of the inference task due to the analysis of the internal properties discovered in the rule sets. Further part in this section introduces an extension of the clustered rules and the decision units oriented for extraction of the additional knowledge from rule-based knowledge bases.

The practical result will be achieved by the development of a computer software utilising the created model and methods of its analysis, with an interactive visualization and knowledge base meta-model analysis subsystem including the presentation and interpretation layer of the discovered relationships. The software will be a tool which implements domain decision-making system, acting as both a tool for the knowledge engineer and a runtime environment for the target domain system.

ISS-EWATUS Integrated Support System for Efficient WATer USage and resources management

Project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration.

Grant No.: 619228, 2014-2017 451 400 PLN
Coordinator: dr Ewa Magiera
Science and Quality Manager: dr eng. Wojciech Froelich
Dissemination Officer: dr Małgorzata Gajos-Gržetič

The ISS-EWATUS project is an interdisciplinary effort of specialists from water management and ICT research to develop an intelligent "Integrated Support System for Efficient WATer USage and resources management". The project consortium consists of 10 organizations: Poland: University of Silesia - Institute of Computer Science (coordinator), Institute for Ecology of Industrial Areas (IETU), RPWiK S.A. Sosnowiec (municipal water operators), GB: Loughborough University, Brunel University, Greece: Center for Research and Technology Hellas (CERTH), DOTSOFT S.A., DEYASK Skiathos (municipal water operators), Netherlands: STICHTING VU-VUMC (university Amsterdam)

ISS-EWATUS is intended to focus on the potential for saving water in household and urban environments. At the household level, ISS-EWATUS proposes a low cost, mobile device-oriented set of tools to support households with water conservation. ISS-EWATUS will make users aware of their water consumption by providing near real-time access to their household water meters. On the basis

of data gathered individually for every household, ISS-EWATUS will assess the existing potential for saving water and develop a decision support system that can provide advice regarding behaviors that would save water in households.

The other work package of ISS-EWATUS will investigate social issues related to water conservation. The planned social-media platform will enable water stakeholders to share experiences. The social-media platform will be used for interaction among different categories of water stakeholders in order to transmit feedback from those who were successful in reducing water consumption. In this way, the users will increase their awareness of their water consumption, and they will help each other to manage their water consumption better.

At the urban level, the main goal of ISS-EWATUS is to reduce water leaks within the water delivery system by maintaining the water pressure within appropriate bounds. Data collected from water distribution systems will be used to analyze consumption patterns to provide evidence of leaks and trigger alerts; the data will also be used to predict future water consumption based on historical consumption and other pertinent parameters. The urban DSS will help water companies identify leaks and suggest emergency actions, assess demands in the medium and the long term, and manage the demands through an optimal balance between supply and demand measures.

The other work package of ISS-EWATUS will be devoted to the development of adaptive pricing policy. A simulation model will be developed to assess the pricing mechanisms.

The main goal of ISS-EWATUS is to develop a universal decision support system for every house and water delivery company in Europe; therefore it has been necessary to differentiate validation places appropriately. The first validation place is Skiathos, Greece and the second validation place of ISS-EWATUS is located in Sosnowiec, Poland.

2.3. Recent publications

The lists of publications by the members of the institute given below contain only the publications written in English.

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3. Education

Education in computer science is organized into two stages: three-and-half-year engineer's, two-year or one-and-half-year master's study. The similar system applies to vocational study schemes.

Education in biomedical engineering is organized into one stage: three-year engineer's studies.

Additionally, best graduates have a possibility to prepare their PhD thesis at the third level studies.

Undergraduate studies

At the undergraduate studies in computer science, besides computer and information systems, students receive a vast amount of knowledge on management, business, marketing, and about legal problems referring to widely understood economic activities. The program of studies provides students with sound bases of elementary discipline as well as practical skills indispensable to their future work.

Instruction is conducted in various forms with a particular regard to laboratory classes. Facilities in the laboratories give a possibility to acquire skills in using methods and tools of computer science. The program of studies contains the following blocks of courses:

- General education courses (mathematics, physics, electronics, foreign languages – West-European, informatics law),
- Courses in the field of information science basics (introduction to computer science, algorithms and data structures, fundamentals and programming languages),
- Courses in the field of information systems (databases, systems of information retrieval, expert systems, graphic interaction systems, computer systems design),
- Facultative courses for acquiring a particular vocational skill.

After the third semester year of studies students choose a specialization. The list of specializations to choose from is as follows (in parentheses some main courses within a faculty are given):

A. Engineer's studies in computer science:

a. Data processing technology (Information systems security, Parallel programming, Advanced programming techniques),

b. Software engineering (Modern object-oriented languages, User-oriented design, Internet application design),

c. Engineering graphics (Interactive graphics, GUI design, Data visualization),

d. Information systems engineering (Integrated information systems, Innovative activity, Cloud computing),

e. Computer networks and mobile devices (Web environments and applications, Mobile device programming, Network infrastructure devices),

f. Designer of web applications (Graphical web interfaces, Designing with Flash technology, Network Ajax applets).

Computer games programmer is a new speciality on Computer Science faculty (Introduction to game programming, Animation programming, Introduction to artificial intelligence and expert systems, Swarm intelligence systems, Physical processes simulation, Game theory, 3D modeling, Programming with DirectX, Introduction to HDR technology).

B. Engineer`s studies in biomedical engineering (Informatics in Medicine):

a. Medical imaging (Medical Imaging Devices, Medical Images Analysing and Processing, Digitizing and 3D Analysis, Reconstruction in Medicine),

b. Telemedicine and Hospital Information Systems (The Basis of Telecomunication, Medical Data Acquisition, Biomedical Data Bases),

c. Biomedical mechatronics (Introduction to Mechatronics, Mechatronics in Rehabilitation, Medical Manipulators and Robots),

d. Bioinformatics (The Basis of Biostatistics, Algorithms Complexity Analysis, Data Mining).

Postgraduate studies

At the two-year master's studies students acquire knowledge on such problems as computer systems modeling and analysis, programming in integrated environments, image processing, operation systems design and application of computer systems to the automation of industrial processes as well as to data measurements. After the first semester of studies students choose a specialization.

The list of specializations to choose is the following (in parentheses some main courses within a faculty are given):

a. Computer networks and software designer (Computer networks design, Networks data bases, Networks interfaces design),

b. Information systems and intelligent systems (Information networks systems, Specialized expert systems, Data and knowledge protection),

c. Software engineering (RIA Technology, Mobile systems and applications, Optimization techniques, Graphics and multimedia processing methods),

d. Computer visualization systems (Multi-resolution image analysis, Geometrical modeling, Artificial intelligent methods),

e. Modern programming technics (Parallel programming, Modern object-oriented languages, Advanced methods of intelligent calculation),

f. Medical Informatics (Information systems in medicine, Bionics).

2-year Master's studies also give students the opportunity to choose from three specialties. The list of specialties is as follows:

a. Bioinformatics (Fundamentals of natural sciences, Introduction to bioinformatics, Artificial intelligent systems),

b. Data analyst (Statistical methods of data analysis, Learning systems, Methods and techniques of classification of objects).

c. BIEN - Modeling and Visualization in Bioinformatics - a new, innovative speciality of lectures in English (Introduction to Bioinformatics, Methods of data analysis, Graphical methods to model bioinformatics problems, Artificial intelligence, Knowledge discovery, Mathematical statistics, Database design, Programming, Optimization theory, Simulation and visualization methods).

In the final study year students prepare their master's theses and on passing master's examination they are granted the master's degree in computer science.

Applicants for admission to these studies must hold a licentiate's title in computer science (or its equivalent).

Information Technology faculty offers 3 semester 2nd level studies, which aim is to educate the graduate exhibiting special proficiency in IT knowledge use both in theoretical and practical aspects. The graduate, who is prepared to undertake a profession in the field of IT in various industries both in the country or abroad.

2nd level graduate from Information Technology faculty:

1. Possesses grounded knowledge and skills in advanced IT fields;
2. Possesses skills of analytic and synthetic thinking allowing non-standard approaches to various practical problems solving requiring analysis, developing or adapting advanced IT technologies;
3. Possesses the skill of developing IT solutions on the basis of mathematical models and is able to evaluate these solutions, test them and ensure their security;
4. Is aware of importance and results of IT engineer professional activities and understands the meaning of intellectual honesty;
5. Can present advanced IT content in verbal and written forms and rationally discuss them;
6. Possesses the skill of individual knowledge widening and deepening within the frames of current IT trends.
7. Possesses high qualifications and skills in the field of IT, which cause him to be competitive on labor market.

PhD studies

Institute of Computer Science since 2007 offers four-year studies of the third level (PhD), which ends up granting the degree of PhD of technical sciences in the field of Computer Science. Students prepare a doctoral thesis under the guidance of an academic supervisor coordinating their research.

During these studies, students gain knowledge and skills in mathematics (e.g. discrete mathematics, probability calculus and mathematical statistics), computer science (e.g. parallel algorithms, artificial intelligence, computer networks, image processing, security systems) and additional courses (methodology research, intellectual property protection). Students have also the opportunity to choose optional courses from 7 proposals. For each year of study they may apply for different types of scholarships, both from the university (for the best student, doctoral, quality-supplement) as well as from other sources (e.g. EU projects).

4. Staff

4.1. Professors

Mariusz Boryczka (e-mail: mariusz.boryczka@us.edu.pl)

Ph.D.: Application of the rough sets theory to the optimization of decision tables and to the analysis of multicriteria decision problems.
Habilitation: Ant colony programming in the process of the automatic approximation of functions.
Position: Associate professor.
Main fields of research interest:
Artificial intelligence, evolutionary computation, optimization, automatic programming.
Selected publications:

1. Bura W., Boryczka M., Ant colony system in ambulance navigation, Journal of Medical Informatics & Technologies, vol. 15, (2010), 115-124.
2. Bura W., Boryczka M., The Parallel Ant Vehicle Navigation System with CUDA Technology, Computational Collective Intelligence. Technologies and Applications, LNCS, vol. 6923, (2011), 505-514.
3. Bura W., Boryczka M., Ant Colony Optimization for the Pareto Front Aproximation in Vehicle Navigation, in: N. Nguyen, K. Hoang and P. Jędrzejowicz (eds): Computational Collective Intelligence, Technologies and Applications, LNCS, vol. 7654, (2012), 493-502.
4. Polak I, Boryczka M., Breaking LFSR Using Genetic Algorithm, C. Badica, N.T. Nguyen and M. Berezovan (eds.), Computational Collective Intelligence. Technologies and Applications, LNAI 8083, (2013), DOI: 10.1007/978-3-642-40495-5_73, ISBN: 978-3-642-40494-8, 731-738.
5. Łysek T., Boryczka M., Genetic Programming with Dynamically Regulated Parameters for Generating Program Code, Dosam Hwang, Jason J. Jung, Ngoc Thanh Nguyen, editors, Computational Collective Intelligence, Technologies and Applications, Volume 8733 of Lecture Notes in Computer Science, ISBN 978-3-319-11288-6, Springer, (2014), 363-372.

Urszula Boryczka (e-mail: urszula.boryczka@us.edu.pl)

Ph.D.: Automatic recognition of linguistic categories of words for scientific-technical information retrieval.
Habilitation: Algorithms of the ant colony optimization.
Position: Associate professor.
Main fields of research interest:
Artificial intelligence, swarm intelligence, data mining, optimization techniques.
Selected publications:

1. Boryczka U., Juszczuk P., Approximate Nash Equilibria in Bimatrix Games, LNCS, vol. 6923, (2011), 485-494.
2. Boryczka U., Kozak J., An Adaptive Discretization in the ACDT Algorithm for Continuous Attributes, LNCS, vol. 6923, (2011), 475-484.
3. Boryczka U., Kozak J. Ant Colony Decision Forest Meta-ensemble, Nguyen, N.T., Hoang, K., Jędrzejowicz P., (eds.), Computational Collective Intelligence. Technologies and Applications - 4th International Conference, ICCCI 2012, Ho Chi Minh City, Vietnam, November 28-30, Proceedings, Part II, Springer, Berlin, (2012), 473-482.
4. Boryczka U., Strąk Ł.: Efficient DPSO Neighbourhood for Dynamic Travelling Salesman Problem. Nguyen N.T., Badica C., Jędrzejowicz P. (eds.), Computational Collective Intelligence. Technologies and Applications - 5th International Conference, ICCCI 2013, Craiova, Romania, September 11 - 13, (2013), Proceedings, Part II, Springer, Berlin.
5. Boryczka U., Dworak J., Genetic Transformation Techniques in Cryptanalysis, ACIIDS (2), Lecture Notes in Computer Science, Springer, Berlin, 2014, vol. 8398, (2014), 147-156.

Wiesław Kotarski (e-mail: kotarski@ux2.math.us.edu.pl)

Ph.D.: Application of conical approximations to optimal control problems for parabolic systems.
Habilitation: Some problems of optimal and Pareto optimal control for distributed parameter systems.
Position: Professor.
Main fields of research interest:
Optimal control theory, multicriterial optimization, applications of computer algebra systems (MAPLE V) to simulation, fractal modeling and image theory.
Study visits:
Stefan Banach International Mathematical Center, Warsaw, Poland (1980), International Centre for Theoretical Physics, Trieste, Italy (1985), The African University, Aswan, Egypt (1990), The Fields Institute, Waterloo, Canada (1992).
Selected publications:

1. Kotarski W., Fraktalne modelowanie kształtu, Wydawnictwo EXIT, Warszawa, (2008), 1-206.
2. Kotarski W., Gdawiec K., Machnik G.T., Basics of Modelling and Visualization, University of Silesia, Katowice, (2009), 1-110 + CD.
3. Gdawiec K., Kotarski W., Lisowska A., Automatic Generation of Aesthetic Patterns with the Use of Dynamical Systems, LNCS, vol. 6939, (2011), 691-700.
4. Kotarski W., Gdawiec K., Lisowska A., Polynomiography via Ishikawa and Mann Iterations, LNCS, vol. 7431, (2012), 305-313.
5. Gdawiec K., Kotarski W., Lisowska A., Polynomiography with Non-Standard Iterations, WSCG Poster Proceedings, Union Agency, (2014), 21-26.

Piotr Porwik (e-mail: piotr.porwik@us.edu.pl)

Ph.D.: Utilization of the Walsh functions in diagnostics of digital devices.
Habilitation: Orthogonal transforms for binary data features extraction.
Position: Associate professor.
Main fields of research interest:
Spectral and discrete representations of multiple-valued and binary functions, digital logic design, digital signal and image processing, biometrics and biomedical imaging.
Selected publications:

1. Porwik P., Conditions of the affine extension of an incompletely defined Boolean function. Computing and Informatics vol.29, (2010), 1073-1088.
2. Porwik P., Sosnowski M., Wesołowski T., Wróbel K. A Computational Assessment of a Blood Vessel's Compliance: A Procedure Based on Computed Tomography Coronary Angiography, HAIS 2011. Lecture Notes in Artificial Intelligence. Part I. Springer-Verlag, (2011), 428-435.
3. Doroz R., Porwik P., Handwritten signature recognition with adaptive selection of behavioral features, 10^{th} Int. Conf. on Computer Information Systems & Industrial Management Applications CISIM Calcutta, India, Springer-Verlag, (2011), 128-136.
4. Porwik P., Orczyk T., DTW and voting-based lip print recognition system. 11th Int. Conf. on Information Systems and Industrial Management Venice, Italy, September 26-28, (2012), 191-202 (The best paper award).
5. Kudłacik P., Porwik P., A new approach to signature recognition using the fuzzy method, Pattern Analysis and Applications, Vol. 17, Issue 3, (2014), 451-463.

Alicja Wakulicz-Deja (e-mail: alicja.wakulicz-deja@us.edu.pl)

Ph.D.: List instructions analysis in the concept of generic machine.
Habilitation: Foundations of information retrieval systems. Analysis of methods.
Position: Professor.
Main fields of research interest:
Expert systems, support systems for decision process, application of the rough sets theory.
Selected publications:

1. Wakulicz-Deja A., Przybyła-Kasperek M., Application of the method of editing and condensing in the process of global decision-making, Fundamenta Informaticae 106 (1), 2989 Fundamenta Informaticae, (2011), 93-117.
2. Przybyła-Kasperek M., Wakulicz – Deja A., Application of reduction of the set of conditional attributes in the process of global decision making, Fundamenta Informaticae 122(4), 2013, DOI: 10.3233/FI-2013-793, 327-355.
3. Wakulicz-Deja A., Nowak-Brzezińska A., Przybyła-Kasperek M., Complex decision systems and conflicts analysis problem, Fundamenta Informaticae 127 (1-4), (2013), DOI: 10.3233/FI-2013-924, 513-528.
4. Przybyła-Kasperek M., Wakulicz-Deja A., Global decision-making system with dynamically generated clusters, Information Sciences Volume 270, (2014), 172–191, DOI: 10.1016/j.ins.2014.02.076.
5. Przybyła-Kasperek M., Wakulicz-Deja., A dispersed decision-making system - The use of negotiations during the dynamic generation of a system's structure, Information Sciences, Volume 288, (2014), DOI: 10.1016/j.ins.2014.07.032, 194–219.

Zygmunt Wróbel (e-mail: zygmunt.wrobel@us.edu.pl)

Ph.D.: Electrical properties of solid solution of Pb $(Zr_x\ Ti_{1-x})O_3$.
Habilitation: Synthesis of passive canonical structure in analogue electronic circuits.
Position: Professor.
Main fields of research interest:
Computer analysis and biomedical signal and image processing, biomedical engineering computer systems.
Selected publications:

1. Janik P., Janik M. A., Wróbel Z., Micro-condensation sensor for monitoring respiratory rate and breath strength, Sensors and Actuators A, Physical 185 (2012), 160-167.
2. Koprowski R., Wróbel Z., Wilczyński S., Nowińska A., Wylęgała E., Methods of measuring the iridocorneal angle in tomographic images of the anterior segment of the eye, BioMedical Engineering OnLine (2013), 12:40 doi:10.1186/1475-925X-12-40.
3. Mickiewicz P., Binkowski M., Bursig H., Wróbel Z., Preservation and sterilization methods of the meniscal allografts: literature review, Cell and Tissue Banking, (2013), DOI 10.1007/s10561-013-9396-7.
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5. Koprowski R., Kasprzak H., Wróbel Z., New automatic method for analysis and correction of image data from the Corvis tonometer, Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization, (2014), DOI:10.1080/21681163.2014.959137.

4.2. Doctors and lecturers

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