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:

1. Division of Information Systems (http://zsi.tech.us.edu.pl/)
   head: Professor Mariusz Boryczka

2. Division of Computer Systems (http://zsk.tech.us.edu.pl/)
   head: Professor Piotr Porwik

3. Division of Algorithmics and Computational Intelligence (http://http://zaiio.ii.us.edu.pl/)
   head: Professor Urszula Boryczka

   head: Professor Wiesław Kotarski

5. 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 modeling and coding of 2D and 3D graphics together with their multiresolution representation. Fractal modeling is based on relation between IFS (Iterated Function Systems) coefficients and subdivision schemes together with new ideas (fractal homeomorisms, 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 analysed 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 modeled 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

Computer analysis of the mechanical properties of bone microstructure using model of spatial distribution of density

MNiSW grant No.: N N518 425036, 2009-2011, 398.100 PLN
Principal investigator: Marcin Binkowski, PhD
Co-principal investigator: Professor Zygmunt Wróbel, Professor Antoni John (Silesian University of Technology)

The main aim of the project is performing methodology which allows identification of biomechanical properties of the bone microstructure. It will be performed based on model of spatial distribution of bone density which is defined based on quantitative micro computed tomography.

The definition of high resolution numerical model which allows strength analysis is the powerful meaning of the project. The results of the project will allow perdition of mechanical properties of the modelled bone.

As a final effect of the project study of relationship between changes of the bone microstructure density (or nanostructure) and related decreasing of mechanical strength will allow for significant extending knowledge build as so far based on quantitative analysis of the microstructure geometry measured by histomorphometrical parameters. In such a high resolution measurement the changes in bone mineral density the quantitative identification of bone density distribution particularly for single trabecular and/or slim layer of the cortical bone.

Thanks to applying QmicroCT the analysis of the three dimensional parameters of microstructure/nanostructure will be possible. It will increase possibilities of delivering a new data to the medical diagnosis process and probably earlier diagnosis and successful treatment of osteoporosis and other diseases of the bone tissue. In addition there will be possible advantages changes in animal laboratory studies (rats, mice) related to both reduced number of individuals evolved in studies and providing more precise information related to bone density.

As a final conclusion, it is worth to underline the most important project advantage: the results will allow the beginning of discussion about bone tissue densitometry performed on the fundamental structural element, which not damage and three dimensional quantitative assessments is as so far unobtainable.

Applying the quantitative X-ray microcomputed tomography in establishing a standard for bone mineral measurement

Support grant for research in Poland after Post-doctoral fellowship.
Foundation for Polish Science 2009-2011, 40.000 PLN
Principal investigator: Marcin Binkowski, PhD

The main aim of the project is applying the Quantitative X-ray microcomputed tomography (QXMT) in estimation of bone mineral density in the animal bone samples. This method will be useful in establishing the new standard for the XMT measurement. Until today laboratories are doing research based on own protocols, as there is no common and accepted standard, which could be applied in each facility.

The research will be carry on based on rat bone samples. Tibias and femurs will be tested by several XMT scanners to deliver wide range of the results.

The method QXMT was laboured during previous project performed in 2007-2008 during postdoctoral research at the University College London. It enables quantitative measurement of the bone density therefore it can be successfully used as a tool to deliver correct measurement factors.
Those factors will be then processed to estimate appropriate standard of the bone density measurement.

Establishing and applying the XMT standard will accelerate bone research performed across-laboratories and across the scanners.

**Equipment for quantitative high-resolution computed tomography facility**

No contract: 393/FNITP/160/2010, 2010-2011, 1,675,000 PLN  
Principal investigator: Marcin Binkowski, PhD  
Co-principal investigator: Professor Zygmunt Wróbel

X-ray microcomputed tomography is a method which can be used to non-invasive scanning of the objects, which are subject of scientific research performed in Department of Biomedical Computer System (DBCS) in the Institute of Computer Science (CS). Based on tomography procedure objects can be imaged and measured in terms of three dimensional geometry, and distribution of relative density.

From 10 years this technique had been used in DBCS. Based on gained experience and funds if grant will be granted for our proposal a new laboratory will be constructed and equipped with high level X-ray volumetric scanner.

The laboratory will be the first laboratory in CS building, what provides new opportunity for DBCS giving an experimental support for existing and new projects.

Particularly, study of bone microstructure, measurement of the bone mineral density, and imaging other medical specimens will be continued based on own laboratory.

In addition X-ray facility will provide exceptional opportunity for wide interdisciplinary cooperation based on project related to tissue engineering, geology, palaeontology, electronics, material science, nutrition, chemical and many other fields.

Proposed facility will open a new opportunity for cooperation with other Department at the CS, faculties at the University of Silesia, as well as other University from Poland and abroad.

**Analysis and quality enhancing of digital fingerprint images**

MSHE grant No.: N N519 574038, 2010-2011, 39,820 PLN  
Principal investigator: Professor Piotr Porwik  
Co-principal investigator: Łukasz Więcław, PhD

In the supervisor’s research grant (no N N519 574038), the investigations are carried out collectively with the Central Forensic Laboratory of the Polish Police Fingerprint Department, Warsaw. In these research studies, attempts are undertaken to acquire of biometric data based on separated data of fingerprint records. The new image processing technique is designed and tested by a doctoral student of the Computer Systems Department, University of Silesia, Katowice. Investigation results will be published and the prepared software will be used in different Polish police departments, especially by the Fingerprint Department. Investigation results will be elements of the Ł. Więcław’s doctoral thesis, working under the prof. P. Porwik’s supervision.

**Equipping the Laboratory of Quantitative Analysis and Modelling Biomaterial Surfaces with a measuring confocal laser scanning microscope**

Contract No.: 599/FNITP/160/2010, 2010-2011, 695,000 PLN  
Principal Investigator: Sebastian Stach, PhD
The aim of this project is to develop a comprehensive system of analysing and modelling the surface and structure of engineering materials, with a particular emphasis on biomaterials. With this view in mind, systems have been developed and optimised, which constitute an optical metrology tool and are called measuring confocal Laser Scanning Microscopes (mcLSM). They have proved to be very effective in image processing, even in the case of the most complex surface topologies. Such systems use a laser with a wavelength of 405 nm, with extremely enhanced optics to provide very high resolution. Owing to the application of UV laser light in a combination with a confocal scanner, the optical capacity threshold as known for conventional equipment, has been exceeded.

The resolution has been increased through using a confocal scanning technique. In this method, the surface of a sample is scanned point by point. Control of movement in axis Z is extremely precise owing to the linear system with a 1 nm increment.

The measuring apparatus added to the profile of the laboratory being created will be the key support for the works conducted not only at the University of Silesia, but also for its partner centres, such as The Silesian University of Technology or the Medical University of Silesia.

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 organised 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 visualisation 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 under grant agreement no 619228.
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.

2011


2012


Elpiniki I. Papageorgiou, Froelich W., Multi-step prediction of pulmonary infection with the use of evolutionary fuzzy cognitive maps, Neurocomputing, 92, (2012), 28-35.


Nowak-Brzezińska A., Simiński R., Knowledge mining approach for optimization of inference processes in rule knowledge bases, P. Herrero et al. (Eds.): OTM 2012 Workshops, LNCS 7567, (2012), 534–537.


2013


Froelich W., Deja R., Deja G., Mining Therapeutic Patterns from Clinical Data for Juvenile Diabetes, Fundamenta Informaticae, 127, (1-4) (2013), DOI FI-2013-924, 513-528.

Waller T., Nowak R., Tkacz M., Zapart D., Mazurek U., Familial or Sporadic Idiopathic Scoliosis – classification based on artificial neural network and GAPDH and ACTB transcription profile, Biomedical Engineering Online (2013), DOI:10.1186/1475-925X-12-1.


Ţălu Ş., Stach S., Multifractal characterization of unworn hydrogel contact lens surfaces, Polymer Engineering and Science (2013), DOI: 10.1002/pen.23650.


Placzk B., Bernaś M., Uncertainty-based information extraction in wireless sensor networks for control applications. Ad Hoc Networks. ISSN: 1570-8705, http://dx.doi.org/10.1016/j.adhoc.2013.11.009


Błocho, M., Czech, Z.J., A parallel memetic algorithm for the vehicle routing problem with time windows, 8th International Conference on P2P, Parallel, Grid and Internet Computing, Compiegne, France (2013), DOI: 10.1109/3PGCIC.2013.28, 144-151.


3. Education

Education in computer science is organized into two stages: three-and-half-year engineer’s and two-year master’s studies. 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. Designer of intelligent applications (Specialized data bases and knowledge databases, 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. Computer management of innovative processes (Integrated information systems, Innovative activity, Legislative protection of innovation),
   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, Bions).

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).

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 20 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:

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:


Zbigniew J. Czech (e-mail: zbigniew.czech@us.edu.pl)

Ph.D.: Operating systems and languages for sequential control.
Habilitation: A region analysis algorithm for the data flow analysis problems.
Position: Professor.
Main fields of research interest:
Design and analysis of serial and parallel algorithms, parallel computing, discrete optimization problems.
Study visits:
Selected publications:

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:

3. Kotarski W., Gdawiec K., Machnik G.T., Basics of Modelling and Visualization, University of Silesia, Katowice, (2009), 1-110 + CD.

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

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:


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

Ph.D.: List instructions analysis in the concept of generic machine.
Position: Professor.
Main fields of research interest:
Expert systems, support systems for decision process, application of the rough sets theory.
Selected publications:
2. 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.

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

Ph.D.: Electrical properties of solid solution of Pb (Zr, Ti)O₃.

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:


4.2. Doctors and lecturers

Marcin Bernaś, PhD (marcin.bernas@us.edu.pl)
Marcin Binkowski, PhD (marcin.binkowski@us.edu.pl)
Romuald Błaszczyk, PhD (romuald.blaszczyk@us.edu.pl)
Miłosław Chodacki, PhD (miloslaw.chodacki@us.edu.pl)
Kornel Chromiński, MSc (kornel.chrominski@us.edu.pl)
Krystyna Czapla, MSc (krystyna.czapla@us.edu.pl)
Diana Domańska, PhD (diana.domanska@us.edu.pl)
Rafał Doroz, PhD (rafal.doroz@us.edu.pl)
Irena Fila, MSc (irena.fila@us.edu.pl)
Wojciech Froelich, PhD (wojciech.froelich@us.edu.pl)
Małgorzata Gajos, PhD (malgorzata.gajos@us.edu.pl)
Krzysztof Gdawieć, PhD (krzysztof.gdawiec@us.edu.pl)
Ireneusz Gościniak, PhD (ireneusz.gosciniak@us.edu.pl)
Tomasz Jach, PhD (tomasz.jach@us.edu.pl)
Małgorzata Janik, PhD (malgorzata.janik@us.edu.pl)
Paweł Janik, PhD (pawel.janik@us.edu.pl)
Przemysław Juszczuk, PhD (przemyslaw.juszczuk@us.edu.pl)
Robert Koprowski, PhD (robert.koprowski@us.edu.pl)
Jan Kozak, PhD (jan.kozak@us.edu.pl)
Przemysław Kudłacik, PhD (przemyslaw.kudlacik@us.edu.pl)
Aleksander Lamża, PhD (aleksander.lamza@us.edu.pl)
Agnieszka Lisowska, PhD (alisow@ux2.math.us.edu.pl)
Tomasz Łysek, MSc (tomasz.lysek@us.edu.pl)
Grzegorz Machnik, MSc (grzegorz.machnik@us.edu.pl)
Ewa Magiera, PhD (ewa.magiera@us.edu.pl)
Barbara Marszał-Paszek, PhD (barbara.marszal-paszek@us.edu.pl)
Mariusz Marzec, PhD (mariusz.marzec@us.edu.pl)
Agnieszka Nowak-Brzezińska, PhD (agnieszka.nowak@us.edu.pl)
Tomasz Orczyk, MSc (tomasz.orczyk@us.edu.pl)
Piotr Paszek, PhD (piotr.paszek@us.edu.pl)
Bartłomiej Płaczek, PhD (bartłomiej.placzek@us.edu.pl)
Iwona Polak, MSc (iwona.polak@us.edu.pl)
Paweł Popielski, MSc (pawel.popielski@us.edu.pl)
Małgorzata Przybyła-Kasperek, PhD (malgorzata.przybyla-kasperek@us.edu.pl)
Grzegorz Sapota, PhD (grzegorz.sapota@us.edu.pl)
Barbara Sieniewska, MSc (barbara.sieniewska@us.edu.pl)
Roman Simiński, PhD (roman.siminski@us.edu.pl)
Rafał Skinderowicz, PhD (rafal.skinderowicz@us.edu.pl)
Paweł Skadłubowicz, PhD (pawel.skadlubowicz@us.edu.pl)
Sebastian Stach, PhD (sebastian.stach@us.edu.pl)
Maria Styblinska, MSc (maria.styblinska@us.edu.pl)
Magdalena Tkacz, PhD (magdalena.tkacz@us.edu.pl)
Katarzyna Trynda, PhD (katarzyna.trynda@us.edu.pl)
Tomasz Wesołowski, MSc (tomasz.wesolowski@us.edu.pl)
Wojciech Wieczorek, PhD (wojciech.wieczorek@us.edu.pl)
Urszula Więckowska, MSc (urszula.wieckowska@us.edu.pl)
Łukasz Więcław, PhD (lukasz.wieclaw@us.edu.pl)
Krzysztof Wróbel, PhD (krzysztof.wrobel@us.edu.pl)
Beata Zielosko, PhD (beata.zielosko@us.edu.pl)
Jarosław Zyguła, PhD (jaroslaw.zygula@us.edu.pl)
Tomasz Xięski, PhD (tomasz.xiesski@us.edu.pl)

4.3. Support staff