



**UNIVERSITY of INFORMATION
TECHNOLOGY and MANAGEMENT**
in Rzeszów, POLAND

FACULTY OF APPLIED IT

of the University of
Information Technology
and Management in Rzeszów

ORGANISATIONAL STRUCTURE |
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RESEARCH AND DIDACTIC LABORATORIES

FACULTY OF APPLIED IT

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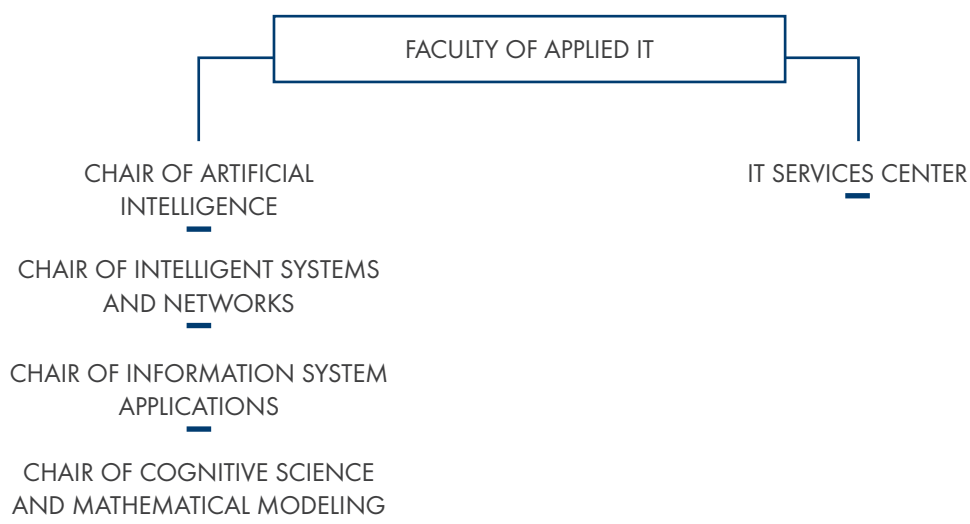
EVALUATION OF SCIENTIFIC ACTIVITIES FOR 2017-2021

Information and Communications Technology - scientific **category B**

In 2021, the Presidium of the Polish Accreditation Committee gave a positive evaluation for the IT studies for the third time and stated that the education process implemented at the University of Information Technology and Management in Rzeszow enabled students to achieve the assumed learning outcomes for first- and second-cycle practical studies. The next program evaluation has been scheduled for the academic year of 2026/27.

ORGANIZATIONAL STRUCTURE OF THE FACULTY OF IT

The structure of the Faculty of Applied IT includes research and didactic units (chairs) and a service centre.



FIELDS OF STUDY CONDUCTED WITHIN THE FACULTY OF APPLIED IT

FIRST-CYCLE STUDIES

Information Technology – full-time and part-time studies

Engineering studies – in Polish

Bachelor's studies – in English

SECOND-CYCLE STUDIES

Information Technology – full-time and part-time studies (in Polish and English)



DESCRIPTIONS OF FIELDS OF STUDY

INFORMATION TECHNOLOGY

Information Technology is a very modern and dynamically developing field of knowledge. Students who study Information Technology will, in the future, participate in the creation of new technologies and IT tools.

The rapid development of new technologies and modern devices requiring specialised software pose new challenges to IT specialists, which creates very good work and development perspectives for graduates in this field. UITM Information Technology includes full-time and part-time, first- and second-cycle studies. Classes are conducted in Polish and English-language paths. The concept of Information Technology education is directly related to the mission of the University, aiming at educating comprehensive and creative specialists for the needs of external stakeholders, and conducting research in information technology and telecommunications contributing to the development of science and economy.

Activities related to education in Information Technology relate in particular to the implementation of the University's strategic objectives. Extensive use of active teaching methods in the plan of studies and the curriculum makes the learning process more practical and facilitates the development of students' competence and creativity.

The education programme in Information Technology focuses on implementing content related to algorithmic and computational thinking. Studies in this field familiarise students with practical knowledge of methods and technologies used by computer specialists. The studies help acquire theoretical and practical knowledge concerning the latest IT solutions used in various areas of life.

Classes are conducted by renowned scientists as well as specialists with many years of professional experience. A large part of classes are conducted by practitioners. Research and teaching staff are engaged in cooperation with business entities within implementation of projects and diploma theses, which raises the qualifications of the staff and stimulates their innovative activities.

First-cycle studies programme for Information Technology provides students with general engineering competence in the areas of: mathematical analysis and algebra, numerical methods, set theory and discrete mathematics, basic physics, entrepreneurship and management, as well as intellectual property protection. Field-related competences are obtained within education modules covering key issues for modern IT, both in terms of hardware and software, including software modelling, object-oriented programming, internet programming, etc. Also discussed are the issues of security and data protection in computer systems and IT project management. In addition to theory, during laboratory and project classes students develop practical skills in object and internet programming, software modelling, and network infrastructure management. In addition, much emphasis is placed on teamwork skills and familiarising students with various team work management methodologies. Practical classes during studies are conducted in cooperation with IT companies. During their studies students may, beside choosing a specialty, choose course from the offer of electives, thus shaping their development path according to their interests.

Second-cycle studies are aimed at expanding the knowledge acquired at first-cycle studies and preparing students to solve research and scientific problems. Information Technology studies at UITM are characterized by a wide range of practical classes, including 960 hours of vocational training.

The following specialties are offered in Information Technology:

At first-cycle engineering studies *conducted in the Polish language:*

COMPUTER GAMES ENGINEERING

The aim of this specialty is to educate professional engineers, experts in the process of computer game production, with specialised knowledge and skills in computer graphics creation in games, computer games design, game production management and applied programming technologies in game production. The specialty covers a wide range of issues constituting the production cycle of computer games as well as issues concerning organization and management of the production process. During classes, professional software such as Adobe Photoshop, Illustrator, 3ds Max, Unreal Engine, CRYENGINE is used. Classes are conducted by qualified university employees and by specialists from well-known companies from the gaming industry.

Graduates are prepared to work primarily on the dynamically developing market of computer games as: game designers, graphic designers, animators, programmers. They can also find work in many similar industries connected with creating virtual spaces and simulations for prototype and educational purposes.

INTERNET AND MOBILE TECHNOLOGIES

The aim of education in this specialty is to prepare specialists within languages, techniques, tools and methodology for creating internet applications and systems, starting from creating web pages, portals, websites, through designing and implementing internet database systems, hypermedia systems and advanced network applications. Students gain practical knowledge and skills in application development for mobile devices and e-business applications, as well as learn about the legal aspects of the Internet and issues related to network security and data protection, design, implementation and operation of internet applications and systems.

Specialty classes are conducted according to programmes consulted with partners of the faculty and by practitioners – engineers employed in IT companies in our region. Graduates of the specialty are prepared to work in IT companies designing and implementing internet applications and systems, companies operating in e-commerce and e-services, departments dealing with the promotion and marketing of companies on the Internet as well as institutions and offices implementing online customer service systems.

DATA SCIENCE

Data Science is one of the fastest growing fields of IT. The high demand for specialists in the area, high earnings and development opportunities make data science a very future-oriented specialty which is really worth the interest. The aim of the specialty is to educate specialists well-prepared for effective use of advanced information technologies dedicated to Data Science. The specialty is a response to the growing demand for specialists in the field. As part of the Data Science specialty, practical classes are conducted which provide technical skills in programming in R and Python languages, installation and configuration of Big Data environments, management of large data sets, including data mining and machine learning algorithms within data preparation and processing.

Soft skills are developed, allowing to collect requirements from business stakeholders and domain experts. The curriculum covers issues such as:

- Descriptive and Mathematical Statistics Profiled for Data Science
- Time Series Analysis;
- Simulation Modelling;
- Databases and Data Warehouses for Big Data;
- Programming in R and Python;
- Data Mining;
- Machine Learning;
- Data Visualisation;
- Cloud Technologies and Cloud Computing;
- Data security / Cybersecurity.

Specialty classes follow programmes consulted with partners of the field of study and are conducted by practitioners – engineers employed in IT companies in our region.

The classes are aimed at: providing practical knowledge of the methods, techniques and tools of data presentation and reporting; methods, techniques and tools in machine learning; shaping skills in the design, implementation and evaluation of machine learning models and their applications in solving practical problems occurring in contemporary organisations; shaping the ability to use visualisation forms appropriately selected for the context, recipients and the purpose of the message; shaping the ability to use interactive forms of visualisation and data reporting in the form of dashboards appropriately selected for the context, recipients and purpose of the message; shaping the ability to prepare data presentations (analysis results) using Storytelling principles; shaping the skills within data exploratory analysis, design, implementation and evaluation of machine learning models and their applications in solving practical problems occurring in contemporary organisations.

Graduates of the specialty can find employment in companies and state institutions, working in interdisciplinary teams, grouping representatives of the recipients of analyses and data processing systems, as designers and developers of computer software, or data engineers. Today, data engineering specialists are mainly sought by banks, telecoms and large e-commerce companies.

PROGRAMMING

The aim of education in this specialty is to prepare IT specialists in programming, ranging from basic issues such as compilation theory, syntax and semantics of programming languages, through programming at the operating system level, to creation of extensive business applications in a network environment. Particularly strong emphasis is placed on the ability to solve problems within group projects. Courses include technical trainings in modern programming languages and environments, based on training programmes of such companies as: Adobe, Apple, Cisco, Microsoft, VMware, Oracle. Students can get international certificates; use modern laboratories and computer equipment; participate in commercial projects conducted by the University and its partners. The study programme includes, among others: Object-Oriented Programming, Data Storage and Processing, Technical Training (in selected programming languages), Advanced Programming Technologies. Specialty classes are conducted according to programmes consulted with partners of the faculty and by practitioners – engineers employed in IT companies in our region.

Graduates of this specialty are prepared to take up work in IT companies within: creating and developing existing IT systems, creating software and documentation, monitoring the quality of IT products, or creating and maintaining source code standards and documentation. Students also acquire knowledge and skills in programming as part of a separate education path implemented since the first semester of studies.

IOT (INTERNET OF THINGS) TECHNOLOGIES

The aim of education in the specialty is to produce specialists in design and implementation of systems in the Internet of Things technology. The specialty is a response to the technological trends in IT and related disciplines, and to the growing demand for specialists in the field.

The specialty programme covers, among others, the design and management of computer networks, which are the foundation of the Internet, IoT network and system security, sensor networks, Smart City solution as well as elements of analytics and Big Data.

Graduates of the specialty are prepared to design and build Internet of Things systems. In addition, their skills are related to management and operation of modern networks including network infrastructure; they can develop in programming of intelligent systems, IoT data analytics and processing. After this specialty, graduates find employment in companies designing and implementing intelligent IT systems, maintaining computer networks, or run their own businesses.

At first-cycle – Bachelor studies conducted in the English language:

APPLIED IT

The programme is designed to educate specialists prepared to create and maintain IT systems and solutions. In addition to key courses developing IT knowledge and skills, the programme offers a wider and more flexible choice of courses in computer game design and programming, and the Internet of Things technology. Students have at their disposal specialised laboratories for the design and configuration of IT systems and the exploration of new technologies in IT. The specialty curriculum uses training programmes of IT giants such as Microsoft, Oracle, Google, Apple and Cisco.

PROGRAMMING

The aim of education in the specialty is to produce IT specialists in programming, ranging from basic issues such as compilation theory, syntax and semantics of programming languages, through programming at the operating system level, to the creation of complex business applications in a network environment. Particularly strong emphasis is placed on the ability to solve problems in group projects. Courses include technical trainings in modern programming languages and environments, based on training programmes of such companies as: Adobe, Apple, Cisco, Microsoft, VMware, Oracle. Students can get international certificates; use modern laboratories and computer equipment; participate in commercial projects conducted by the University and its partners.

The study programme includes, among others: Programming Languages, Requirements Engineering, CASE Tool Methodology, or Software Development Techniques. Specialty classes are conducted according to programmes consulted with partners of the faculty and by practitioners – engineers employed in IT companies in our region.

Graduates of this specialty are prepared to take up work in IT companies within: creating and developing existing IT systems, creating software and documentation, monitoring the quality of IT products, or creating and maintaining source code standards and documentation.

GAME DESIGN AND PRODUCTION

This is a new specialty that replaces the previously available one (Computer Graphics). The aim of the specialty is to educate professional engineers, experts in the process of computer game production, possessing specialised knowledge and skills in creating computer graphics in games, designing computer games, managing game production and applied programming technologies in game production. The specialty covers a wide range of issues constituting the production cycle of computer games as well as issues concerning organisation and management of the production process. During classes, professional software such as Adobe Photoshop, Illustrator, 3ds Max, Unreal Engine, CRYENGINE is used. Classes are conducted by qualified university employees and by specialists from well-known companies from the gaming industry. Graduates are prepared to work primarily on the dynamically developing computer games market as: game designers, graphic designers, animators, programmers. They can also find work in many similar industries connected with creating virtual spaces and simulations for prototype and educational purposes.



At second-cycle – *Master's studies conducted in the Polish language:*

IT ANALYTICS IN BUSINESS

The aim of the specialty is to familiarise students with the essence of business analytics, its possible applications and the main techniques and tools which can be used to solve problems occurring in modern companies and to make decisions based on large data sets.

As part of the specialty, skills are acquired in planning, implementing and applying the most popular programme environments in key areas of business analytics – descriptive, prescriptive and predictive analytics. Modelling, analysis and re-engineering of business processes constitute a very important area included in the specialty programme.

According to the latest research conducted by Computerworld, in Poland, 78% of leaders and 70% of major business entities in the industry use the methods, techniques and tools of business analytics. Graduates of IT Analytics in Business may find employment in those companies. Companies from our region are looking for specialists in IT analytics in business.

Thematic scope for the specialty includes e.g. the following issues:

- Preparation of data and conducting analyses based on methods and techniques of descriptive statistics;
- Tools enabling analysis of data recorded at various levels of detail and data visualisation techniques using various forms of presentation (charts, managerial desks, infographics, mind maps);
- Methods of forecasting and carrying out what-if analyses?
- Techniques, methods and tools to optimise key process indicators;
- The process of creating analytical models for linear and nonlinear problems, activities related to the optimisation of created models and analysis of sensitivity with interpretation of the results obtained;
- Techniques for modelling decision-making situations and solving business problems using computer simulation;
- Analysis of large data sets using data mining techniques and methods;
- Modelling, analysis and optimisation of company business processes.

The selected thematic scope of the specialty programme allows to prepare students for effective and efficient use of business intelligence tools as support for typical activities carried out by the management staff at any organisational level – operational, tactical and strategic – both from the perspective of creating information and knowledge based on data, planning and implementing IT infrastructure for business analytics, as well as optimally organising tasks within business processes and planning of corrective actions using the latest solutions in information and communication technologies.

The University has extensive experience within IT systems employed in management and related fields as used in business analytics, and has practitioners who conduct classes in the field. We have a rich infrastructure which allows to carry out complex exercises in practice. Students can develop their interests in laboratories within research clubs and additional courses preparing for certificates. Pearson VUE and Prometric examination centres are located at our University, which allows to obtain a chosen international certificate right here.

Thanks to cooperation with the international BorgWarner group, the programme of our studies reflects the skills required from candidates to work in companies. There is an opportunity to take internships and gain experience in the profession. People who graduate from the specialty can be employed in many companies.

SECURITY AND COMPUTER NETWORKS – CISCO

The specialty allows to acquire practical skills in the area of design and implementation of the latest network technologies, as well as the implementation of security policies for computer systems and networks. Knowledge and skills in computer networks and their security are sought after in the labour market. The specialty, based on Cisco training programmes, guarantees their high quality and technological up-to-dateness.

After completing the specialty, graduates are prepared to solve problems in complex computer networks with applied information security systems. This goal is achieved thanks to courses based on Cisco Academy's proven teaching programmes such as CCNA, CCNA Security and CCNP, as well as thanks to experienced teaching staff.

The study programme covers issues related to e.g. security of electronic operations; scalable computer networks; monitoring the flow of electronic information; data centres.

As part of the specialty, students develop their knowledge and skills by participating in classes in specialised laboratories, implementing a study programme enriched with training programmes within the Cisco Networking Academy:

- Computer and ICT networks design laboratory;
- Physics, optoelectronics and telecommunications surveying laboratory;
- CISCO network technology laboratory;
- MICROSOFT, NOVELL, ORACLE, VMWARE, CITRIX computer laboratory;
- CISCO SYSTEMS (CCNA) computer laboratory;
- CISCO SYSTEMS (CCNP) computer laboratory;
- CISCO SYSTEMS computer laboratory, allowing education at Cybersecurity, Wireless, VoIP levels.

Graduates of the specialty are prepared to work in companies and institutions in which network and services infrastructure is maintained. They are prepared to solve problems related to the operation and management of network systems as well as network and information security.

VIDEO GAME PRODUCTION

Video game production is a fascinating field, but it requires a wide range of technical expertise. The specialty is aimed at people interested in professional development in that industry sector. Within the framework of the courses realised during the studies, technological issues are discussed to a large extent. Their goal is to introduce students to the details of the process of creating a game world and designing a game with the use of tools used in productions appearing on the market. There are also more general courses related to the creation of a game concept, analytics and aspects of running a business in the modern gaming market. The courses are taught both by university staff and by employees of companies cooperating with the university. Graduates are prepared to work in the gaming industry. The jobs offered by that industry are attractive but require highly specialised knowledge and

the ability to use tools that constitute technological standards. During the studies, students acquire the knowledge and skills necessary to work in positions such as: Gameplay Programmer, Online Programmer, AI Programmer, Level Designer, Quest Designer, QA Tester..

SOFTWARE PRODUCTION ENGINEERING

The specialty prepares qualified specialists for work in programming companies, which are one of the most important and absorbent labour markets for IT graduates. Studies at our University provide an opportunity to learn both theoretical foundations related to a given subject, as well as to gain practical skills, highly valued by employers, which are acquired during a number of projects.

Within the specialty, practical classes are conducted within: Software Engineering Workshop; Design Patterns and Software Architecture; Programming Project Management Methodology, held by qualified scientific and teaching staff as well as practitioners with extensive experience working in renowned programming companies.

The educational process uses computer laboratories which enable work with modern equipment and access to the latest software. Access to authorised training materials is offered, which helps students can prepare for taking certification exams.

Graduates of the specialty are prepared to work in programming teams creating software with a wide range of applications. At the same time, they are able to use the latest solutions currently available on the market, related to both the software development itself as well as the design process and product creation management.

CYBERSECURITY

- a separate educational path implemented since the first semester of full-time and part-time second-cycle Information Technology studies

Cybersecurity, a separate education path, is a response to security challenges in cyberspace, in which almost every business entity operates. Companies, state institutions, local government units, the army, health care and other areas need more and more advanced protection in cyberspace.

The path educates specialists who can manage security, design and implement security techniques, as well as monitor and analyse IT systems with a view to security. The demand for specialists in that field is growing due to the increase in threats, but also due to the tightening national and European legal regulations and requirements imposed on economic entities.

As part of the specialty, a group of courses is conducted which allow students to explore knowledge and gain skills related to information security management, sociological and legal aspects thereof, and technical security measures. Students learn about such issues as: authentication, authorisation and digital signature; sociological and legal aspects of security; programme and technical security measures; resource virtualisation and distributed computing; security audit and monitoring of information systems. Students learn about security policies, their design and implementation.



At second-cycle – *Master's studies conducted in the Polish language:*

CYBERSECURITY

– a separate educational path implemented since the first semester of full-time and part-time second-cycle Information Technology studies

Cybersecurity, a separate education path, is a response to security challenges in cyberspace, in which almost every business entity operates. Companies, state institutions, local government units, the army, health care and other areas need more and more advanced protection in cyberspace.

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DATA SCIENCE

The specialty programme covers key competences for a rapidly growing data science department. Students gain the knowledge and skills necessary to process Big Data sets with the use of tools and programming languages dominating in those applications, such as R and Python. They learn about data mining techniques, machine learning, and environments for data analytics and visualisation. Students go through the entire process, from formulating the right questions to data in the context of the problem being solved, through data preparation, analysis (model building, verification, validation), result visualisation to presentation of the results.

SCIENTIFIC RESEARCH

RESEARCH AND IMPLEMENTATION PROJECTS

The technology of digital learning twins in the process of increasing employee performance

Project manager: **Arkadiusz Lewicki, Ph.D.**

The main objective of the project is to test the feasibility of applying the concept of digital replicas of employees on selected workstations. That requires the acquisition of real-time data representing the characteristics of the tasks performed, job position, competencies, knowledge and experience of the employee. Additionally, the project plans to analyse data acquired from wearable devices. The data will represent the psychophysical parameters of employees and the characteristics of the physical environment in which they perform their work. The purpose of the analysis is to investigate the factors which have a significant impact on increasing employee productivity while enhancing employee satisfaction and experience. In addition, the project will validate the concept of using digital communication between twins performing tasks with similar characteristics. The research aims to define any additional factors that can optimise the performance of a specific task.

Period of implementation: **06.2021–02.2022**

Financing: **Podkarpackie Centrum Innowacji (PCI)**

Digital solutions for automatic skin cancer diagnosis

Project manager on the Polish team: **Łukasz Piątek, Ph.D., Eng.**

on the German side: **Prof. Jens Hauelsen**

The aim of the project is to develop image processing methods and algorithms which will support the diagnosis of malignant melanoma performed by dermatologists and general practitioners, providing objective and reliable results.

It will be implemented in cooperation with Technische Universität Ilmenau and the JensLab company.

Period of implementation: **05.2019–04.2022**

Financing: : **National Center for Research and Development (NCBiR)**

Contact: lpiatek@wsiz.edu.pl

Dynamically reconfigured system of environmental and public safety monitoring (cross-sector partnership: Boguchwała Smart City)

Project manager: **Mirosław Hajder, Ph.D., Eng.** mhajder@wsiz.edu.pl

UITM employees' scientific activity was used to design and implement a monitoring system of various types of pollutants in the Boguchwała commune. The developed models and tools formed the basis of the project of a security monitoring system; UITM was invited by local government units to a cross-sector partnership in order to apply for financing of the project. The application was recognized by the Ministry of Development in 2019, thanks to which funds were obtained for the implementation of the project aimed at improving the state of environmental and public safety in the commune.

The research was aimed at:

1. Regionalization of methods and means of synthesis and analysis of environmental monitoring based on the use of the Internet of Things;
2. Development of methodological foundations for monitoring systems construction as pervasive computing solutions and cyber-physical systems;
3. Lowering the costs of designing, constructing and operating regional environmental monitoring systems.

Period of implementation: **2019–2022**

Financing: **from European Union means within the Operational Program Technical Assistance 2014-2020**

"Boguchwała Smart City – Dynamically reconfigured system of environmental and public safety monitoring with detection of sources, issuers and separation of safety areas"

Developing effective mechanisms for robot perception using motivated learning and self-organizing associative memory

Project manager: **Prof. Janusz Starzyk, Ph.D.** jstarzyk@wsiz.edu.pl

The main aim of the research proposed in the project is to develop new effective perception mechanisms using the generalized idea of Motivated Learning (ML) and new associative learning and reasoning mechanisms. The research results achieved within the project will allow to build modern cognitive systems which, based on specific needs, are conditionally and intelligently capable of defining associations and forming the knowledge needed to achieve the set goals.

Period of implementation: **15.03.2017–14.09.2020**

Financing: **National Science Center OPUS program**

Massive-Parallel Games and Modeling of Information Warfare by Means of Web Mining and Big Data Analysis

Project manager: **A. Schumann, Ph.D., Assoc. Prof.** aschumann@wsiz.edu.pl

The aim was to construct a game-theoretic model for the automatic monitoring of online Web sources for blocking or performing information attacks in information warfare. In the project, new big data mining methods were proposed for information operations protecting national interests in making political decisions in Poland. Those methods should help information superiority in collecting, processing, and disseminating information in mass media, think-tank reports, etc. The point is that we need such superiority to protect ourselves against possible information warfare actions to deny, exploit, corrupt or destroy the information of Polish national interests. Information transmission in mass media resembles waves and, to protect ourselves, we should know the initial points of those waves (hidden players who stimulate public interest in selected news or reports), the direction of the waves (what a fitting public opinion is formed for), and how long the waves can hold (what results can be implied by those waves).

Period of implementation: **3.12.2019–31.05.2020**

Financing: **Podkarpackie Regional Operational Program (Podkarpackie Innovation Center, F3_40)**

Automatic intelligent customer service system improvement with Artificial Intelligence application

Manager: **Leszek Gajecki, Ph.D., Eng.** lgajecki@wsiz.edu.pl

The aim of the research conducted by UITM employees is artificial intelligence application in speech recognition algorithms of the Polish language of call centre speakers. The research has shown that deep neural network techniques allow for better quality of speech recognition than the Hidden Markov Models (HMM-GMM) frequently used in applications with regard to the Polish language.

Call centres are characterized by numerous repetitive operations. As a result of natural phenomena (e.g. hurricane winds), energy network failures occur and hence problems are reported on a mass scale. That generates a sudden increase of calls which is too much for traditional human-operated call centres to handle.

To solve that problem, a telephone speech recognition system has been developed for Polish. It can be used to support emergency call centres through their automatization, i.e. replacing human operators with specialized software.

Financing: Own funds and the National Centre for Research and Development (NCBiR) in the project "IVA service platform of virtual voice agents for emergency call hotlines automation" 2017–2018

A new approach to effective training of complex intelligent systems

Project manager: **Prof. Bogdan Wilamowski, Ph.D., Eng.**

Successful completion of the project has solved many scientific and practical problems by replacing the traditional design approach with a new learning approach. That alternative method can have a broader significance allowing to find solutions to many problems that until now were impossible to solve with traditional methods.

Period of implementation: **20.01.2016–25.06.2019**

Financing: **National Science Center OPUS program**

Contact: jkolbusz@wsiz.edu.pl

SCIENTIFIC RESEARCH FINANCED WITH GRANTS OF THE MINISTRY OF SCIENCE AND HIGHER EDUCATION

Models of fuzzy and rough sets theory used for posture detection

Project leader: **Barbara Pękala, Ph.D., Assoc. Prof.**

The aim of the research is to develop new methods of computational intelligence constructed for uncertain data requiring non-classical methods of representation and modelling. In particular, sets of fuzzy and approximate inference algorithms for detecting body posture will be identified, which demonstrate effectiveness at a given level of accuracy and quality of individual classification methods.

Implementation period: **2021-2022**

Analysis of the problem of collecting, processing and constructing a model from real data

Project Manager: **Zofia Matusiewicz, Ph.D.** zmatusiewicz@wsiz.edu.pl

The goal of the project is to obtain results related to:

- the impact of data availability and quality on selected research methods,
- the impact of data incompleteness on research activities,
- analysis of data preprocessing procedures and their influence on comparability of final results,
- development and analysis of real-world models.

Implementation period: **2021-2023**

Application of advanced methods of Artificial Intelligence

Project Manager: **Leszek Gajecki, Ph.D.** lgajecki@wsiz.edu.pl

Team: Marek Jaszuk, Ph.D.; **Teresa Mroczek, Ph.D., Eng.; Leszek Puzio, Ph.D., Eng.;**

Grażyna Szostek, M.Eng.; Rafał Niemiec, M.Eng.

The main aims of the conducted research are:

1. Development of new association mechanisms of learning and inference.
2. Semantic analysis application for improvement of speech recognition system performance, application in e.g. call centre support
3. Application of advanced methods of Artificial Intelligence for Big Data real sets analysis

Implementation period: **2019-2022**

Adoption of mobile solutions in the context of university education

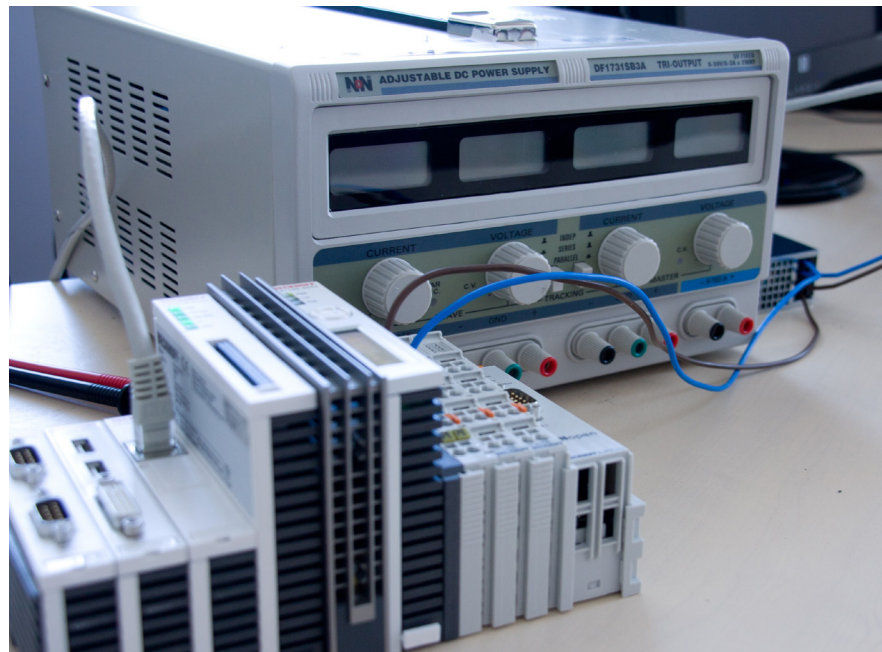
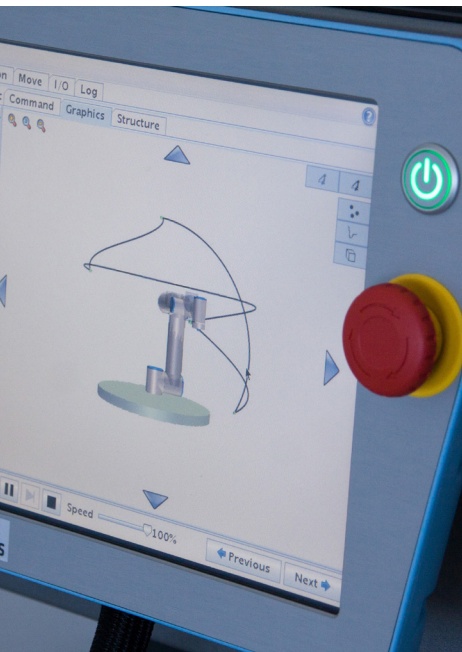
Project Manager: **Małgorzata Rataj, Ph.D.**

The aim of the research was to create a coherent model of the strategy of m-learning implementation at the university and to identify the key factors conditioning successful implementation of mobile learning at universities depending on the characteristics of the university, the profile of its educational offer and the profile of its students.

Implementation period: **2018-2020**

IT SERVICES CENTER

The IT Services Centre was established in response to market demand for a unit whose purpose would be to implement technologies obtained within research conducted at the Faculty of Applied IT into production and to conduct related service activities.



The IT Services Centre has a comprehensive offer in the field of broadly understood computerization. Based on many years of experience and knowledge of solutions from world leaders in the IT industry, it carries out works in the field of design, implementation and maintenance of computer networks as well as research work aimed at creating innovative products. In the years 2008–2020, several hundred various implementation and research IT projects were implemented as part of CUI, including projects on behalf of the Employment Offices, Aeronaval de Construcciones e Instalaciones S.A. and Haxon Telecom sp. z o.o. The IT Services Centre is certified by Microsoft – MCSA (Microsoft Certified Systems Administrator), MCSE (Microsoft Certified Systems Engineer), MCDBA (Microsoft Certified Database Administrator), MCSA (Microsoft Certified Solution Developer) and Cisco – CCNA (Cisco Certified Network Associate), CCNP (Cisco Certified Network Professional), HPE and Novell.

Contact: Artur Skoczylas askoczylas@wsiz.edu.pl

RESEARCH COMMISSIONS FOR ENTITIES OUTSIDE OF HIGHER EDUCATION

Year: 2021

Research service consisting in the development, based on the results of R&D, of a new product in the form of an innovative hardware and software solution for a remotely managed intelligent machine - a filter machine that eliminates the problems of the machine industry

MIX FILTERS Sp. z o.o.

Research service consisting in the development of an innovative product in the form of a diagnostic support device for aircraft engine rotors

Helix Solutions Sp. z o. o.

Research service consisting in developing a design project and designing an innovative respiratory support device with an automated mechanical ventilation module

PROXIMO AERO Spółka z o. O.

Research service consisting in the development of a new product in the form of an innovative device for disinfecting rooms in a network system

Brend Group Sp. z o. o.

Research service consisting in the development of a new product in the form of an innovative solution for a safety anchor with a monitoring system

STAL-RES Sp. z o.o.

Year: 2020

Research service consisting in the development of a new product in the form of an innovative hardware and software solution for a remotely managed intelligent machine – an entrance gate that eliminates the problems of residents of guarded / closed estates

Landeo Sp. z o.o.

Design and implementation of an IT system – a computer application for customer service

Iwoniczanka Sp. z o.o.

Research service consisting in developing of a design project and designing a new innovative construction of an automated machine for cutting in many planes.

Motum Marcin Leszczyński

Research service consisting in the development of innovative technology for the production of a mixer spiral.

INA Sp. z o.o.

Research service consisting in the development of a new product – a hybrid wind turbine monitoring the degree of aeration in a water body.

MJM Janusz Majda

Research on selected issues within radio and radiolocation technologies aimed at the Ordering Party developing an innovative system for acquiring and analysing data in real time from sports fields

JW Partners Sp. z o.o.

Research service consisting in the development of a prototype based on evolutionary algorithms of a driver work plan generator in public transport management systems.

ITS Technology Solveo Sp z o.o. Sp. k.

PUBLICATIONS



Employees of the Faculty of Applied IT publish their research results in journals indexed in international databases: Computers and Electronics in Agriculture, Logic Journal of the IGPL, Nonlinear Analysis-Hybrid Systems, Scientific Reports, Sustainable Cities and Society, International Journal of Intelligent Systems, International Journal of Applied Mathematics and Computer Science, Journal of Complex Networks, Sensors, International Journal of Approximate Reasoning.

LIST OF SELECTED PUBLICATIONS OF EMPLOYEES SINCE 2020:

Sunil Kumar Jha, Zia Chishti, Zulfiqar Ahmad, Khaliq-ur-Rehman Arshad. Enterobacter sp. SWLC2 for biodegradation of chlorpyrifos in the aqueous medium: Modeling of the process using artificial neural network approaches. Computers and Electronics in Agriculture, 2022, 193; 106680. ISSN 0168-1699

Publication

Andrew Schumann. Swarm Intelligence. From Social Bacteria to Humans. From Social Bacteria to Humans Publisher; CRC Press, Taylor & Francis Group, 2021, stron 190. ISBN 9780367137939

Publication

Dawid Kosior, Krzysztof Dyczkowski, Jarosław Szkoła, Barbara Pękala. Application of entropy measures with uncertainty in classification methods with missing data problem. [W:] 2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), 2021, Luxembourg, 11 lip 2021 - 14 lip 2021; 854-861. ISBN 978-1-6654-4407-1

Publication

Janusz A. Starzyk, Marek Jaszuk, Łukasz Maciura, Adrian Horzyk. Concurrent Associative Memories With Synaptic Delays. W: IEEE Transactions on Neural Networks and Learning Systems, 2021, 32. 8. s. 3736-3747. ISSN 2162-237X

Publication

Krzysztof Dyczkowski, Jarosław Szkoła, Dawid Kosior, Barbara Pękala. Classification of uncertain data with a selection of relevant features based on similarities measures of Interval-Valued Fuzzy Sets. [W:] 2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), 2021, Luxembourg, 11 lip 2021 - 14 lip 2021; 564-571. ISBN 978-1-6654-4407-1

Publication

Patrick G. Clark, Cheng Gao, Jerzy W. Grzymala-Busse, Teresa Mroczek, Rafał Niemiec. Complexity of rule sets in mining incomplete data using characteristic sets and generalized maximal consistent blocks. Logic Journal of the IGPL, 2021, 29,2:124-137. ISSN 1367-0751

Publication

Paweł Drygas, Maksymilian Knap, Dorota Gil, Bogdan Kwiatkowski, Barbara Pękala. Preference and weak interval-valued operator in decision making problem. [W:] 2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), 2021, Luxembourg, 11 lip 2021 - 14 lip 2021. ISBN 978-1-6654-4407-1

Publication

Paweł Klimasara, Michael C. Mackey, Andrzej Tomski, Marta Tyran-Kamińska. Randomly switching evolution equations. Nonlinear Analysis-Hybrid Systems, 2021, 39, 100948. ISSN 1751-570X

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Piotr Hajder, Janusz Kolbusz, Mirosław Hajder, Mateusz Liput. Scalable computing system with two-level reconfiguration of multi-channel inter-node communication. [W:] Computational Science – ICCS 2021 21st International Conference, Krakow, Poland, June 16–18, 2021, Proceedings, Part IV, 540-553. ISBN 978-3-030-77969-6

Publication

Philipp Prinke, Jens Hauelsen, Sascha Klee, Muhammad Qurhanul Rizqie, Eko Supriyanto, Karsten König, Hans Georg Breunig, Łukasz Piątek. Automatic segmentation of skin cells in multiphoton data using multi-stage merging. Scientific Reports, 2021, 11, 1, 14534. ISSN 2045-2322

Publication

Qing Li, Lianying Zhang, Limao Zhang, Sunil Jha. Exploring multi-level motivations towards green design practices: A system dynamics approach. Sustainable Cities and Society, 2021, 102490. ISSN 2210-6707

Publication

Urszula Bentkowska, Dawid Kosior, Zdenko Takáč, Aitor Castillo, Mikel Sesma-Sara, Javier Fernandez, Julio Lafuente, Humberto Bustince, Barbara Pękala. Interval-valued equivalence measures respecting uncertainty in image processing. International Journal of Intelligent Systems, 2021, 36, 6; 2767-2796. ISSN 0884-8173

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Wiesław Paja, Krzysztof Pancerz, Jaromir Sarzyński, Barbara Pękala. Application of the Fuzzy Logic to Evaluation and Selection of Attribute Ranges in Machine Learning. [W:] 2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), 2021, Luxembourg, 11 lip 2021 - 14 lip 2021. ISBN 978-1-6654-4407-1

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Adrian Horzyk, Daniel Bulanda, Janusz Starzyk. ASA-graphs for efficient data representation and processing. International Journal of Applied Mathematics and Computer Science, 2020, 30, 4; 717–731. ISSN 1641-876X

Publication

Arkadiusz Lewicki, Krzysztof Pancerz. Ant-based clustering for flow graph mining. International Journal of Applied Mathematics and Computer Science (AMCS) 2020, 30, 3; 561-572. ISSN: 1641-876X

Publication

Janusz A. Starzyk, Łukasz Maciura, Adrian Horzyk. Associative Memories With Synaptic Delays. IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS 2020, 31,1;331 – 344. ISSN 2162-237X. DOI: 10.1109/TNNLS.2019.2921143

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Marek Jaszuk, Michał Furgał, Janusz Starzyk, Wojciech Pałka, Dawid Darlak. Spatial scene representation and navigation in a mobile robot using RGB-D camera. W: Proceedings 52th International Symposium on Robotics. Ed:Walter Zulauf, Hiroshi Fujiwara, Junji Tsuda, Alexander Verl, 2020; 221-228. ISBN 978-3-8007-5429-8

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Mikhail Goubko, Alexander Kuznetsov. Lower bound for the cost of connecting tree with given vertex degree sequence. Journal of Complex Networks, 2020, 8, 2. ISSN: 2051-1329

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W.W. Koczkodaj, F. Liu, V.W. Marek, J. Mazurek, M. Mazurek, L. Mikhailov, C. Özel, W. Pedrycz, A. Przelaskowski, A. Schumann, R. Smarzewski, D. Strzalka, J. Szybowski, Y. Yayli. On the use of group theory to generalize elements of pairwise comparisons matrix: A cautionary note. International Journal of Approximate Reasoning, 2020, 124; 59-65. ISSN 0888-613X

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Zbigniew Gomółka, Damian Kordos, Ewa Żeślawska. The Application of Flexible Areas of Interest to Pilot Mobile Eye Tracking. Sensors, 2020, 20, 4; 986. ISSN 1424-8220

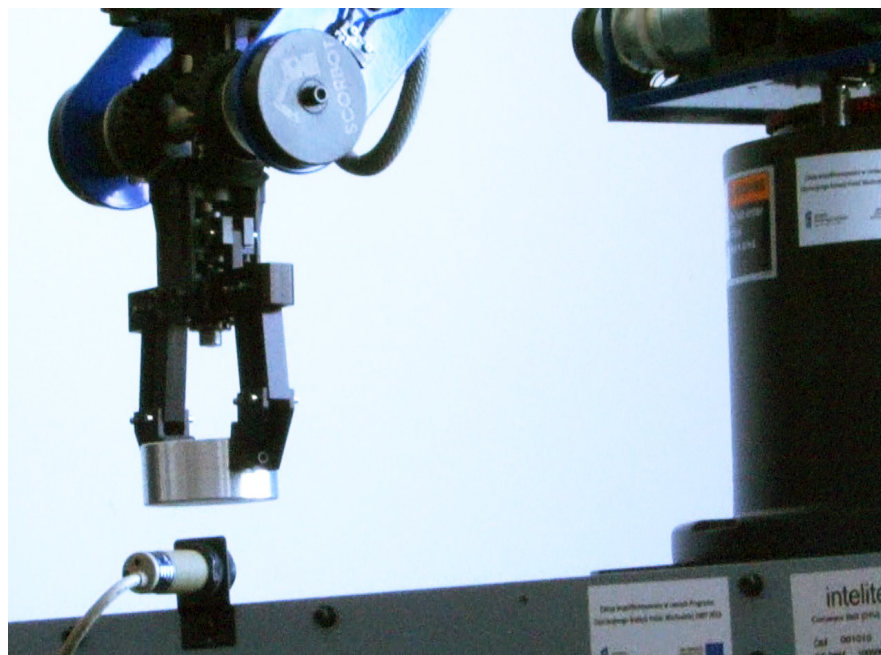
Publication

Zbigniew Gomółka, Paweł Krutys, Bogusław Twaróg, Ewa Żeślawska. A new approach to spatiotemporal estimation of the river state. JOURNAL OF PROCESS CONTROL 2020, 94; 125-143. ISSN 0959-1524

Publication

LABORATORIES

USED IN THE EDUCATIONAL PROCESS, IN RESEARCH AND COMMERCIAL ACTIVITIES OF THE FACULTY OF APPLIED IT



ARTIFICIAL INTELLIGENCE LABORATORY

The laboratory conducts research on AI algorithms in the field of knowledge engineering and services in the field of data mining.

In particular, research is being carried out on sets whose elements are described by means of incomplete descriptors. Lack of complete information about real world objects is a typical situation. An object may have incomplete description for a variety of reasons. For example, some features of the object may have been registered at the time of observation, but were later erased or are missing. They may also not have been registered due to their general immateriality or the immateriality of the concept to which the object belongs. Moreover, it happens very often that an object belongs to more than one concept. Hence another type of uncertainty arises – of what the object actually is. An example of that may be a situation in which two doctors provide different diagnoses based on identical symptoms. The laboratory allows to build expert systems working in such uncertain environments. The tools for their induction are developed and the essence of uncertainty is explored.

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Building of the International Education Center

For more information [visit our website](#).

LABORATORY OF ADVANCED ROBOTISATION AND AUTOMATISATION TECHNOLOGY

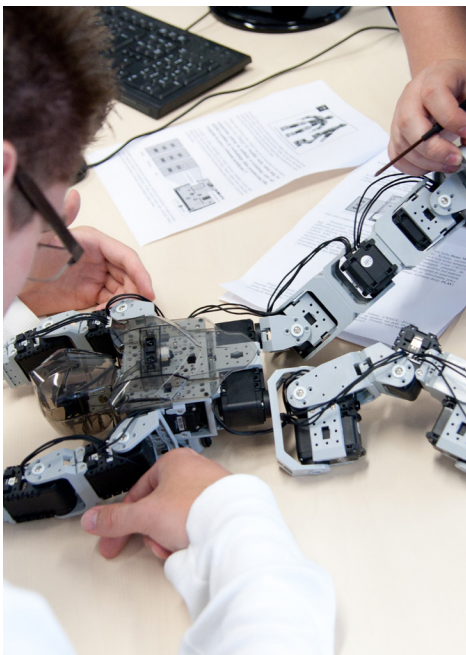
Thanks to its equipment, the laboratory allows to conduct research for the needs of industry. The possible research fields include:

- Industrial automation and links between automatics and IT;
- Industry fields related to Smart Home;
- Analysis of the effects of combining solutions based on industrial automation with construction automation;
- Possibility to design critical infrastructure systems and critical security systems in production plants;
- Environment protection aspect – broadly understood security and environment monitoring systems;
- Information systems and measurements in intelligent networks.

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For more information visit our website.



AUTOMATION AND ROBOTICS LABORATORY

The didactic Laboratory of Automation and Robotics was established as a response to market demand for specialists in robot programming and automation of technological processes. In that laboratory, classes on e.g. Programmable Digital Circuits are held. An IT student acquires competences within tools and methods of digital circuit design, implementation of digital systems in programmable logical structures, and the ability to use computer-aided design tools when creating digital systems. In Application of IT in Automation and Robotics classes, the student becomes familiar with the principles of operation of selected automation devices, as well as selected robot structures and dependencies connecting the control layer (IT) with the equipment (technical aspects). In this course, IT students acquire the necessary skills in robot programming and programmable logic controllers.

For more information [visit our website](#).



LABORATORY OF ADVANCED NETWORK TECHNOLOGIES AND WIRELESS TECHNOLOGIES

The Laboratory of Advanced Network Technologies and Wireless Technologies is used to teach both the basics of building modern computer networks and advanced techniques for securing traffic between the networks and ensuring transmission quality.



It was created for specialists in design, implementation and configuration of LAN and WAN computer networks. The main goal of the laboratory is to give students the knowledge and skills within configuration, maintenance and protection of computer networks. The laboratory is prepared to conduct training as part of the Cisco Network Academy, in particular: training at the level of CCNA (Cisco Certified Network Associate), CCNP (Cisco Certified Network Professional), as well as in the field of network security (preparation for CCSP certification), IP telephony (preparation for CCVP certification) and wireless technologies (preparation for CWNE certification), based on NETLab technology. This laboratory is a technical base for the preparation of Master's degree theses in the field of computer networks. Appropriate technical equipment of the laboratory enables the creation of new courses and types of training, and in the case of already conducted classes and diploma theses, it ensures they are conducted at the highest level. It allows to carry out research in:

- computer network design;
- network traffic analysis and modelling;
- research on the self-similarity of movement;
- optimization of network protocols;
- research on the security of wired and wireless networks.

Through classes in the laboratory and access to professional equipment, students can prepare for professional certifications:

- Cisco Certified Networking Associate (CCNA);

- Cisco Certified Network Professional (CCNP);
- Cisco Firewall Specialist;
- Cisco Wireless LAN Support Specialist;
- CompTIA Linux +;
- CompTIA A +;
- CompTIA Network +;
- CompTIA Security +;
- CompTIA Server +.

For more information [visit our website](#).

LABORATORY OF NEUROCOGNITIVE ERGONOMICS

The main tasks carried out in the Laboratory include:

- conducting research within broadly understood neurocognitive ergonomics;
- introducing students to issues related to possible application of the achievements of psychology, cognitive science and neurosciences during the design process, with particular emphasis on research within computer application usability;
- implementation of projects aimed at adapting (optimizing) the human environment to their cognitive abilities.



Classes at the Laboratory of Neurocognitive Ergonomics allow students to familiarize themselves with issues related to the practical application of the achievements of psychology, cognitive science and neurosciences in the design of interactive computer systems and internet applications as well as visual / graphic stimuli of various nature.

The Laboratory gives scientists various opportunities. Research conducted in the Laboratory of Neurocognitive Ergonomics covers an interdisciplinary area linking the interests of ergonomics, medical IT (bio-signal acquisition

and exploration), psychology, cognitive science and neuroscience. Research carried out in the laboratory includes the following issues:

- perception of works of art: research in the field of neuroaesthetics, research on the possibility of using art (painting) as a visual stimulus in the diagnosis and therapy of neuropsychological disorders (including emotional disorders, phobias, etc.);
- perception of text and graphic elements: diagnosing disorders in the reading process, optimization of hypertext structures, optimization of the content of school textbooks;
- acquisition and exploration of bio-signals: studying the possibilities of exploring data obtained through eye-tracking, researching the methods of searching for patterns in data obtained by electroencephalography and neuroimaging;
- the effectiveness of analytical methods used in the process of analysing the complexity of navigation structures and screen computer applications;
- neuromarketing.

For more information, please [visit our website](#).

DATABASE LABORATORY?

Thanks to its equipment, the laboratory allows to perform research for industrial needs. Possible research areas include:

- - security – threat simulation,
- - improvement of database management methods and data analysis,
- - scalability of databases,
- - processing queries,
- - data cleaning, transformation and visualization,
- - metadata management.

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