



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 | PUBLICATIONS |
LABORATORIES

October 2023

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and Management in Rzeszów,

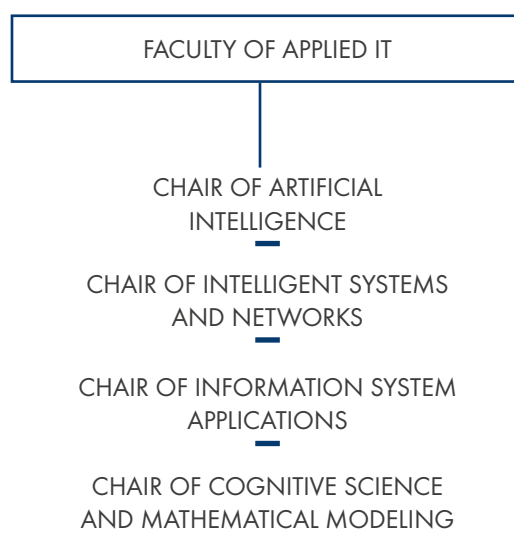
EVALUATION OF SCIENTIFIC ACTIVITIES FOR 2017-2021

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

The Faculty of APPLIED IT has received the Certificate of Educational Excellence in the category "Always for the student—Excellence in supporting student development". UITM is the first and only non-public higher education institution to be honored by the PKA Presidium with such a distinction.

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

The rapid development of new technologies and modern devices requiring specialized software poses new challenges and a need for IT specialists, which has created very good work and development prospects for graduates in this field. At UITM, IT courses include full-time and part-time, and first- and second-cycle studies. Classes are conducted along both Polish and English language paths. The concept of IT education is directly related to the mission of the university, which aims to educate comprehensive and creative specialists to meet the needs of external stakeholders, and to conduct research in IT and telecommunications to contribute to the development of science and the economy.

Activities associated with education in IT relate in particular to the implementation of the university's strategic objectives. The extensive use of active teaching methods in the course plans and curricula makes the learning process more practical, and facilitates the development of students' competence and creativity.

The education program in IT focuses on implementing content related to algorithmic and computational thinking, and studies in this field enable students to gain a practical knowledge of the methods and technologies used by computer specialists. These studies help learners acquire theoretical and practical knowledge of 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, and a large proportion of the classes are conducted by practitioners. Research and teaching staff are engaged in cooperation with business entities through work on projects and diploma theses, which improves the qualifications of the staff and stimulates their innovative activities.

The first-cycle study program in IT 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 through education modules covering key issues in modern IT, in terms of both hardware and software, such as software modeling, object-oriented programming, internet programming, etc. The issues of security and data protection in computer systems and IT project management are also discussed. In addition to theory, laboratory and project classes enable students to develop practical skills in object and internet programming, software modeling, and network infrastructure management. Great emphasis is placed on teamwork skills and familiarizing students with various teamwork management methodologies. Practical classes are conducted in cooperation with IT companies. During their studies, students may choose a course from the electives offered, in addition choosing a specialty, meaning that they can shape their development path according to their interests.

The aim of second-cycle studies is to expand the knowledge acquired in the first-cycle studies and prepare students to solve research and scientific problems. IT studies at UITM are characterized by a wide range of practical classes, and include 960 hours of vocational training.

The following specialties are offered in IT:

First-cycle engineering studies conducted in the Polish language include:

COMPUTER GAMES ENGINEERING

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

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

INTERNET AND MOBILE TECHNOLOGIES

The aim of this course is to prepare specialists in the areas of computer languages, techniques, tools and methodology to create internet applications and systems, starting with the creation of web pages, portals, websites, and then to design and implement internet database systems, hypermedia systems and advanced network applications. Students gain practical knowledge and skills in the development of applications for mobile devices and e-business, and learn about the legal aspects of the Internet and issues related to network security and data protection, design, and the implementation and operation of internet applications and systems. Specialty classes are conducted as part of programs 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, in companies operating in e-commerce and e-services, in departments dealing with the promotion and marketing of companies on the Internet, as well as in 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 this area and the high earnings and development opportunities that are available make data science a very future-oriented specialty that is really worth the interest. The aim of this specialty is to educate specialists who are well-prepared in terms of the effective use of advanced IT dedicated to data science. It is offered as a response to the growing demand for specialists in the field. As part of the data science specialty, practical classes are conducted that provide technical skills in programming in the R and Python languages, the installation and configuration of big data environments, and the management of large datasets, including data mining and the use of machine learning algorithms with data preparation and processing.

Soft skills are developed that allow learners to meet the requirements of 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;

DESCRIPTIONS OF FIELDS OF STUDY

- Cloud Technologies and Cloud Computing;
- Data security / Cybersecurity.

Specialty classes follow programs consulted with partners of the field of study, and are conducted by practitioners (engineers) employed in IT companies in our region.

The classes aim to provide a practical knowledge of methods, techniques and tools for data presentation and reporting; methods, techniques and tools for machine learning; skills in the design, implementation and evaluation of machine learning models and their applications in solving practical problems occurring in contemporary organizations; the ability to use visualization forms that are appropriately selected for the context, the recipients and the purpose of the message; the ability to use interactive forms of visualization and data reporting in the form of dashboards appropriately selected for the context, the recipients and the purpose of the message; the ability to prepare data presentations (analysis results) using storytelling principles; and skills within the areas of data exploratory analysis, design, implementation and evaluation of machine learning models and their applications in solving the practical problems that occur in contemporary organizations.

Graduates of this 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 as data engineers. Today, data engineering specialists are mainly sought by banks, telecoms and large e-commerce companies.

PROGRAMMING

The aim of this specialty is to prepare IT specialists in programming, ranging from basic issues such as compilation theory and the syntax and semantics of programming languages, through programming at the operating system level, to the creation of extensive business applications in a network environment. Particularly strong emphasis is placed on the ability to solve problems through group projects. Courses include technical training in modern programming languages and environments, based on the training programs of companies such as Adobe, Apple, Cisco, Microsoft, VMware, and Oracle. Students can obtain international certificates, use modern laboratories and computer equipment, and participate in commercial projects conducted by the university and its partners. The study program includes object-oriented programming, data storage and processing, technical training (in selected programming languages), and advanced programming technologies, among other topics. Specialty classes are conducted according to programs consulted with partners of the faculty and by practitioners (engineers) employed in IT companies in our region.

Graduates of this specialty will be prepared to take up work in IT companies that involves 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, starting from the first semester of their studies.

SOFTWARE ENGINEERING IN SECURE NETWORKS

The purpose of education in this area is to prepare IT specialists in the field programming, beginning from subject scratch like compilation theory, the syntax and semantics of programming languages, through programming at the operating system level, to creating advanced, secure, and basic applications in a network environment. A graduate of this course is an engineer with knowledge and skills in the field of creating control applications from standard standards, including syntax and semantics of programming languages, through programming at the operating system level, to creating extended business applications in a network environment, as well as security systems and computer network policy. Support for Cisco training programs is provided, which guarantees the high quality of these classes and ensures they are technologically up to date. Students will acquire knowledge and skills in programming technologies and tools, security systems, data engineering techniques, programming of security applications, and organization of the IT security management process.

The graduate has the ability to solve problems as part of group projects. He has knowledge of programming, which is used in classes on modern computer languages and the programming environment, based on the development of training programs from companies such as Cisco, Microsoft, Adobe, Apple, and Oracle. Graduates of this

course are suited for work in companies on the creation and development of secure operating systems, and verification of the quality of system products in terms of security.

IOT (INTERNET OF THINGS) TECHNOLOGIES

The aim of education in the specialty is to produce specialists in the design and implementation of systems based on Internet of Things technology. This specialty is offered as a response to the technological trends in IT and related disciplines, and to the growing demand for specialists in the field. The specialty program covers, among other things, the design and management of computer networks (which form the foundation of the Internet, IoT networks and system security, sensor networks, and smart city solutions), elements of analytics, and big data. Graduates of this specialty are prepared to design and build IoT systems. In addition, they will gain skills related to management and operation of modern networks, including network infrastructure, the programming of intelligent systems, IoT data analytics, and processing. Graduates of this specialty will find employment in companies designing and implementing intelligent IT systems, maintaining computer networks, or running their own businesses.

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

APPLIED IT

This program is designed to educate specialists who are able to create and maintain IT systems and solutions. In addition to key courses developing IT knowledge and skills, the program offers a wider and more flexible choice of courses in computer game design and programming, and IoT technology. Students have at their disposal specialized laboratories for the design and configuration of IT systems and the exploration of new technologies in IT. The specialty curriculum uses training programs from IT giants such as Microsoft, Oracle, Google, Apple and Cisco.

PROGRAMMING

The aim of this specialty is to produce IT specialists in programming, ranging from basic issues such as compilation theory, the 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 as part of group projects. Courses include technical training in modern programming languages and environments, based on training programs from companies such as Adobe, Apple, Cisco, Microsoft, VMware, and Oracle. Students can obtain international certificates, use modern laboratories and computer equipment, and participate in commercial projects conducted by the university and its partners. The study program includes programming languages, requirements engineering, CASE tool methodology, and software development techniques. Specialty classes are conducted according to a program 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 involving the creation and development of existing IT systems, the creation of software and documentation, monitoring the quality of IT products, or creation and maintenance of source code standards and documentation.

GAME DESIGN AND PRODUCTION

This is a new specialty that replaces the Computer Graphics course that was previously offered. The aim of this specialty is to educate professional engineers and experts in the process of computer game production, with specialized knowledge and skills in creating computer graphics for games, designing computer games, managing game production, and the application of programming technologies to game production. The specialty covers a wide range of issues affecting the production cycle of computer games as well as issues concerning the organization and management of the production process. During classes, professional software packages such

DESCRIPTIONS OF FIELDS OF STUDY

as Adobe Photoshop, Illustrator, 3ds Max, Unreal Engine, and CRYENGINE are used. Classes are conducted by qualified university employees and specialists from well-known companies from the gaming industry. Graduates are prepared to work primarily within the dynamically developing computer games market as game designers, graphic designers, animators, and programmers. They can also find work in many similar industries connected with the creation of 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 this specialty is to familiarize students with the essence of business analytics, its possible applications, and the main techniques and tools that can be used to solve the problems that arise in modern companies and that can be applied to make decisions based on large datasets.

Through this specialty, learners will gain skills in planning, implementing and applying the most popular program environments in key areas of business analytics, including descriptive, prescriptive, and predictive analytics. Modeling, analysis and re-engineering of business processes are very important areas included in the specialty program.

According to the latest research conducted by Computerworld, 78% of leaders in Poland and 70% of major business entities in industry use the methods, techniques and tools of business analytics. Graduates of the IT Analytics in Business specialty may find employment in these companies. Companies in 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 scope of this specialty program will prepare students for the effective and efficient use of business intelligence tools, as support for the typical activities carried out by management staff at any organizational level (operational, tactical or strategic), from two perspectives: firstly in relation to creating information and knowledge based on data, planning and implementing IT infrastructure for business analytics; and secondly with regard to optimally organizing tasks within business processes and planning corrective actions using the latest solutions in information and communication technologies.

The university has extensive experience with the IT systems employed for business analytics in management and related fields, and has practitioners who conduct classes in this field. We have a rich infrastructure which allows us to offer complex practical exercises. Students can develop their interests in laboratories through research clubs, and can take additional courses to prepare for certification. Pearson VUE and Prometric examination centers are located at our university, which allows learners to gain their chosen international certificates on the premises. Through cooperation with the international BorgWarner group, our program of studies provides the skills required by candidates to work in companies. There is also the opportunity to take up internships and gain experience in the profession. Students who graduate from this specialty can find employment in many companies.

SECURITY AND COMPUTER NETWORKS – CISCO

This specialty allows learners to acquire practical skills in the 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 highly sought after in the labor market.

This specialty is based on Cisco training programs, which guarantees that it is both high quality and technologically up to date. After completing the specialty, graduates are prepared to solve problems involving complex computer networks and applied information security systems. This is achieved thanks to courses based on Cisco Academy's proven teaching programs, such as CCNA, CCNA Security and CCNP, as well as the presence of experienced teaching staff.

The study program covers issues related to the security of electronic operations, scalable computer networks, monitoring the flow of electronic information, and data centers. In this specialty, students develop knowledge and skills by participating in classes taught in specialized laboratories, as part of a study program enriched with training programs from 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 trained 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. This specialty is aimed at learners who are interested in professional development in this sector of industry. Within the framework of the courses offered during the study program, technological issues are discussed to a large extent. The goal is to introduce students to the details of the process of creating a game world and designing a game with tools that are commonly used in productions appearing on the market. There are also more general courses, which are

related to the creation of a game concept, analytics, and the various aspects of running a business in the modern gaming market. These 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 in this industry are attractive, but require highly specialized knowledge and the ability to use tools that constitute technological standards. Through this study program, students acquire the knowledge and skills necessary to work in a role such as a gameplay programmer, online programmer, artificial intelligence (AI) programmer, level designer, quest designer, or QA tester.

SOFTWARE PRODUCTION ENGINEERING

This specialty prepares qualified specialists for work in programming companies, which are one of the most important and absorbent labor markets for IT graduates. Studies at our university provide an opportunity to learn both the theoretical foundations of a given subject and to gain the practical skills that are highly valued by employers, which are acquired through a number of projects. In this specialty, practical classes include software engineering workshops, design patterns and software architecture, and the methodology of programming project management.

Classes are taught 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 students to work with modern equipment and provide access to the latest software. Access to authorized training materials is also offered, which helps students to prepare for certification exams.

Graduates of the specialty are prepared to work in programming teams creating software with a wide range of applications. Learners are also able to use the latest solutions currently available on the market in the areas of software development, the design process, and product creation management.

CYBERSECURITY

This is a separate educational path that is implemented since the first semester of full-time and part-time second-cycle IT studies. This specialty was developed in response to the security challenges in cyberspace, in which almost every business entity operates. Companies, state institutions, local government units, the army, health care and other organizations need increasingly advanced protection in cyberspace.

This path educates specialists who can manage security, design and implement security techniques, and monitor and analyze IT systems with a view to security. The demand for specialists in this field is growing, due not only to the increase in current threats, but also to the tightening of national and European legal regulations and the requirements imposed on economic entities.

As part of this specialty, a group of courses is conducted that allow students to gain knowledge and skills related to information security management, its sociological and legal aspects, and technical security measures. Students learn about issues such as authentication, authorization and digital signatures, the sociological and legal aspects of security, programming and technical security measures, resource virtualization and distributed computing, and the security auditing and monitoring of information systems. Students learn about security policies, their design and implementation.



Second-cycle – Master's studies conducted in the English language:

CYBERSECURITY

The cybersecurity program was created in response to the challenges related to security in cyberspace, in which almost every business entity operates. Companies, state institutions, local government units, the army, health care and other organizations need increasingly advanced protection in cyberspace. This path educates specialists who can manage security, design and implement security techniques, and monitor and analyze IT systems with a view to security. The demand for specialists in this field is growing, not only due to the increase in current threats, but also to the tightening of national and European legal regulations and the requirements imposed on economic entities.

As part of this specialty, a group of courses is conducted that allow students to gain knowledge and skills related to information security management, its sociological and legal aspects, and technical security measures. Students learn about issues such as authentication, authorization and digital signatures, the sociological and legal aspects of security, programming and technical security measures, resource virtualization and distributed computing, and the security auditing and monitoring of information systems. Students learn about security policies, their design and implementation.

DATA SCIENCE

This specialty program covers the key competences for our rapidly growing data science department. Students gain the knowledge and skills necessary to process big datasets through the use of the most important tools and programming languages for these applications, such as R and Python. They learn about data mining techniques, machine learning, and environments for data analytics and visualization. Students gain a knowledge of the entire process, from formulating the right questions, to handling data in the context of the problem being solved, data preparation, analysis (model building, verification, validation), and the visualization and presentation of results.

SCIENTIFIC RESEARCH

RESEARCH AND IMPLEMENTATION PROJECTS

Multi-sensory platform for imaging and detecting threats in areas with highly dynamic changes in environmental conditions:

Project lider: Military University of Technology

Partners: University of Information Technology and Management in Rzeszow and DRI Solutions Ltd.

The aim of this project is to develop a demonstration model of a multi-sensory platform integrated with an autonomous aviation research platform in the form of an unmanned aerial vehicle and helicopter, equipped with a secure, encrypted telecommunications link and a machine learning system to create a priority threat map. The system will be equipped with a daylight camera (VIS), a cooled night camera with a bolometric matrix (MWIR), a laser designator (LD) for laser-guided weapons, a laser rangefinder (LRF), and a target tracking module (VT). The demonstration model is designed to work in an environment with high humidity and salt fog, characterized by significant gusts of wind, i.e., an environment with highly dynamic environmental changes corresponding to sea conditions..

Period of implementation: 03.01.2023–02.01.2026

Financing: National Center for Research and Development (NCBiR)

Use of digital learning twins technology to increase employee performance:

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

The main objective of this project is to test the feasibility of using digital replicas of employees at selected workstations. This requires the acquisition of real-time data representing the characteristics of the tasks performed and the job role, competencies, knowledge, and experience of the employee. In addition, the project involves the analysis of data acquired from wearable devices, which represent the psychophysical parameters of the employees and the characteristics of the physical environment in which they work. The purpose of this analysis is to investigate the factors that have a significant impact on increasing employee productivity while enhancing employee satisfaction and experience. The project also validates the concept of using digital communication between twins performing tasks with similar characteristics. Additional factors that can optimize the performance of a specific task are defined.

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: **Prof. J.W. Grzymała-Busse, Ph.D., Eng.**
on the German side: **Prof. Jens Hauelsen**

The aims of this project are to develop image processing methods and algorithms to support the diagnosis of malignant melanoma by dermatologists and general practitioners, and to provide 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 for environmental and public safety monitoring:

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

This involves a cross-sector partnership between Boguchwała Smart City and UITM employees. Scientific activity was used to design and implement a monitoring system for various types of pollutants in the Boguchwała commune. The models and tools developed in this way formed the basis of a project involving a security monitoring system, and UITM was invited by local government units to form a cross-sector partnership in order to apply for financing for the project. The application was recognized by the Ministry of Development in 2019, and funds were obtained for this project, which aims to improve the state of environmental and public safety in the commune.

The goals of this research are:

1. the regionalization of methods and means of synthesis and analysis of environmental monitoring based on the use of the IoT;
2. the development of methodological foundations for the construction of monitoring systems as pervasive computing solutions and cyber-physical systems; and
3. to lower 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 this project is to develop new effective perception mechanisms using the generalized idea of motivated learning and new associative learning and reasoning mechanisms. The results achieved from the project will allow modern cognitive systems to be built based on specific needs, which are conditionally and intelligently capable of defining associations and forming the knowledge needed to achieve set goals.

Period of implementation: **15.03.2017–14.09.2020**

Financing: **National Science Center OPUS program**

Massively parallel games and modeling of information warfare by means of web mining and big data:

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

The aim is to construct a game-theoretic model for the automatic monitoring of online web sources for blocking or performing information warfare attacks. New big data mining methods have been proposed for information operations to protect the national interest when making political decisions in Poland. These methods are expected to provide information superiority in terms of collecting, processing, and disseminating information in mass media, think-tank reports, etc. This superiority is necessary for protection against possible information warfare actions taken to deny, exploit, corrupt or destroy the information relating to Polish national interests. Information transmission in the mass media resembles waves, and to protect ourselves, we need to know the initial points of these 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 may be implied by the waves).

Period of implementation: **3.12.2019-31.05.2020**

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

Improvements to an automatic intelligent customer service system with artificial intelligence:

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

The aim of this project, conducted by UITM employees, is the application of AI in speech recognition algorithms for call center speakers in the Polish language. Research in this area has shown that deep neural network techniques give better quality speech recognition than the hidden Markov models (HMM-GMM) that are frequently used in applications with regard to the Polish language. Call centers are characterized by numerous repetitive operations. As a result of natural phenomena (e.g. hurricane winds), energy networks may fail, meaning that problems are reported on a mass scale. This will generate a sudden increase in calls that are too numerous for traditional human-operated call centers to handle. To solve this problem, a telephone speech recognition system has been developed for Polish speakers. It can be used to support emergency call centers 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 the effective training of complex intelligent systems:

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

Successful completion of this project has solved many scientific and practical problems by replacing the traditional design approach with a new learning approach. This alternative method has a broader significance, as it allows us 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

Exploration of incomplete data in biomedical imaging:

Project manager: **Teresa Mroczek, Ph.D**

This research has two separate goals: (i) the creation of new methods for analyzing incomplete datasets, moving away from the commonly used approach to incomplete data mining in which missing attribute values are imputed before the mining process, for the development of incompleteness interpretation methods and set indicators, and (ii) the development of new methods for the quantitative assessment of biomedical images, including the development of a method for the automatic classification of digital images of melanocytic skin nevi using deep learning networks.

Period of implementation: **2023-2025**

Hybrid models using fuzzy and approximate set theories and their application in medicine:

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

This involves the development of rough-fuzzy models for image processing and analysis for the problem of optimization of physiotherapy offices and the development of an optimal hybrid rule system based on expert knowledge and machine learning.

Period of implementation: **2023-2024**

Models of fuzzy and rough sets theory used for posture detection:

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

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

Implementation period: **2021-2023**

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**

Adoption of mobile solutions in the context of university education:

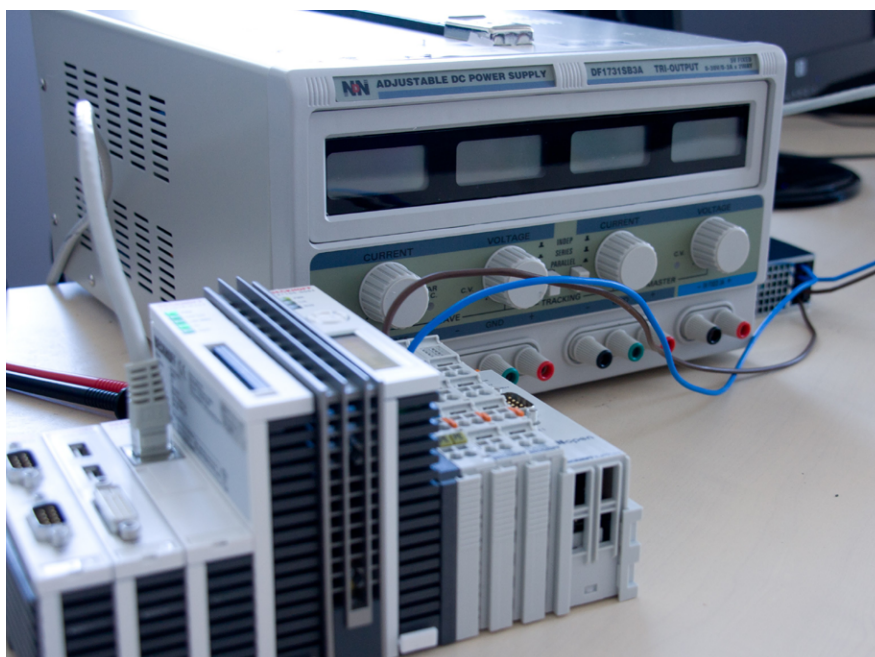
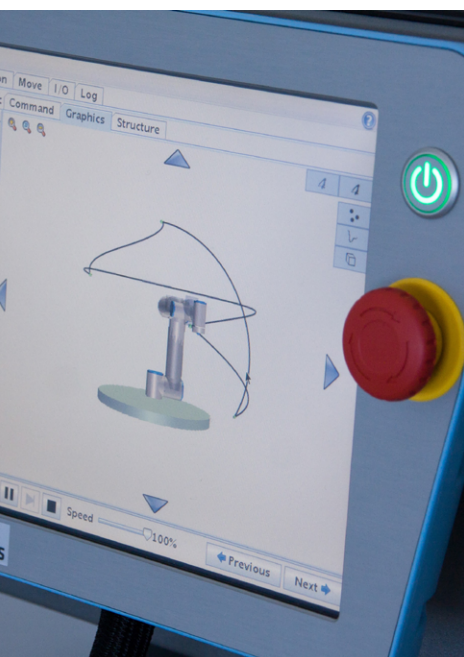
Project Manager: **Małgorzata Rataj, Ph.D.**

The aims of this research are 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 other universities depending on the characteristics of the university, the profile of its educational offering, and the characteristics of its students.

Implementation period: **2018-2020**

IT SERVICES CENTER

The IT Services Center was established in response to market demand for a unit whose purpose would be to put into production technologies developed as part of research conducted at the Faculty of Applied IT and to conduct related service activities.



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

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RESEARCH COMMISSIONS FOR ENTITIES OUTSIDE OF HIGHER EDUCATION

Year: 2022

Inspiration Vibes Sp. z o.o.

Research and development service related to the development of an innovative service for placing and handling orders by customers in restaurants using a mobile application on the phone.

Naftoremont-Naftobudowa Sp. z o. o.

Research service to develop a database for the welding process for the company's project "Development of innovative technology for prefabrication of steel structures, pipelines and pressure equipment components based on the results of numerical analysis".

My Way Security Sp. z o. o.

Research and development service related to the development of an innovative vehicle monitoring system in the logistics and trucking and passenger-trucking sectors.

Year: 2021

MIX FILTERS Sp. z o.o.

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

Helix Solutions 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

PROXIMO AERO Spółka z o. O.

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

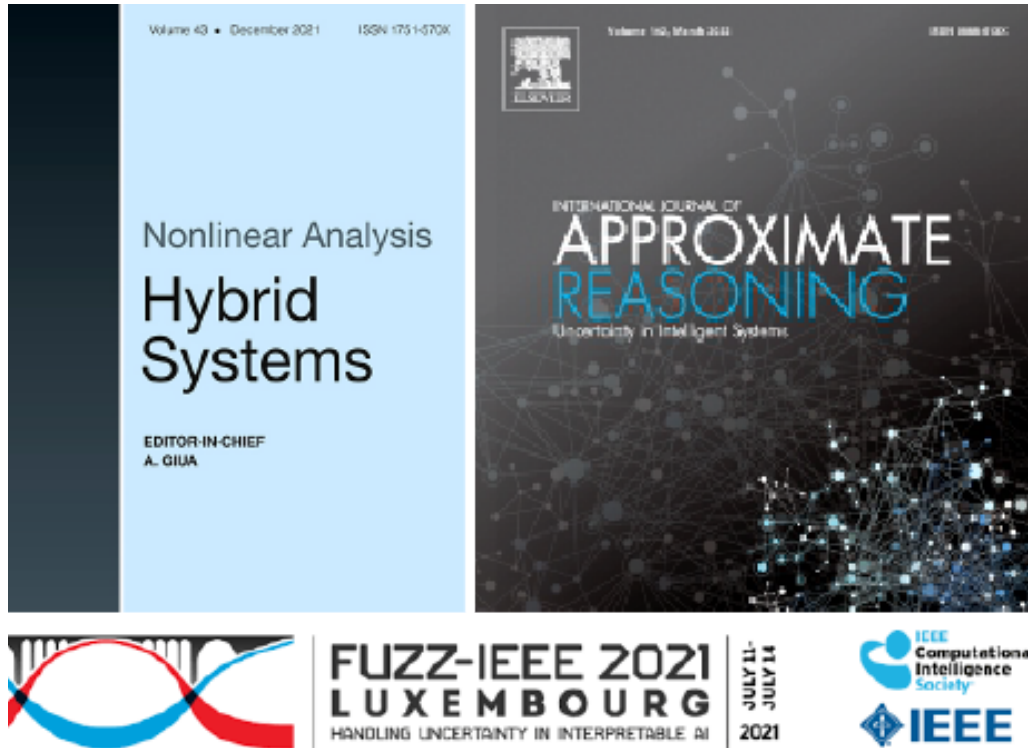
Brend Group Sp. z o. o.

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

STAL-RES 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

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:

Hajder, M., Hajder, L., Hajder, P., Kolbusz, J. (2023). Cloud Native Approach to the Implementation of an Environmental Monitoring System for Smart City Based on IoT Devices. In: Mikyška, J., de Mulatier, C., Paszynski, M., Krzhizhanovskaya, V.V., Dongarra, J.J., Sloat, P.M. (eds) Computational Science – ICCS 2023. ICCS 2023. Lecture Notes in Computer Science, vol 10477. Springer, Cham

Publication

Hajder, Mirosław; Hajder, Piotr; Hajder, Lucyna; Liput, Mateusz; Kolbusz, Janusz. Supporting winter road maintenance procedures with the use of distributed measurements based on IoT, thermodynamic models and machine learning . 2023 IEEE International Conference on Pervasive Computing and Communications Workshops and other Affiliated Events (PerCom Workshops), The 21st International Conference on Pervasive Computing and Communications, 13-17 mar 2023 Atlanta, Georgia, stany Zjednoczone; 515 – 520. ISBN: 978-1-6654-5381-3

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Horzyk, A., Bulanda, D., Starzyk, J.A. (2023). Construction and Training of Multi-Associative Graph Networks. In: Koutra, D., Plant, C., Gomez Rodriguez, M., Baralis, E., Bonchi, F. (eds) Machine Learning and Knowledge Discovery in Databases: Research Track. ECML PKDD 2023. Lecture Notes in Computer Science(), vol 14171; 277–292. Springer, Cham

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Matusiewicz, Zofia. Fuzzy eigenvectors with matrix product of type max – increasing operation. Fuzzy Sets and Systems 2023, Volume 465, 108536. ISSN 0165-0114

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Pękala, Barbara; Garwol, Katarzyna; Czuma, Janusz; Kosior, Dawid; Zarba, Lech; Chyła, Marcin. Early detection of the risk of depressive episodes using a proprietary diagnostic test by new epistemic similarity measures. Applied Soft Computing, 2023, Volume 148, 110910, ISSN 1568-4946

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Starzyk, J. A.; Kowalik, M.; and Horzyk, A. Motivated Agent with Semantic Memory. W: ECAI 2023, the 26th European Conference on Artificial Intelligence, and of PAIS 2023, the 12th Conference on Prestigious Applications of Intelligent Systems, held from 30 September to 4 October 2023 and on 3 October 2023 respectively in Kraków, Poland, Frontiers in Artificial Intelligence and Applications; s. 2202 – 2209. ISBN 978-1-64368-436-9

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Yelizarov, M., Yelizarov, O., Berezovska, I., Rataj M. Influence of the natural radon radiation on the spread of the COVID 19 pandemic. Scientific Reports volume 13, 12752 (2023). ISSN 2045-2322

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Wrzesien, Mariusz; Wrzesien, Milosz; Homenda, Wladyslaw. Time Series Classification Using Images: The Case Of SAX-Like Transformation. 31st International Conference on Information Systems Development (ISD2023 Lisbon) Instituto Superior Técnico, in Lisbon, Portugal, on August 30–September 1, 2023

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Dmytro Zaitsev. Strong Slepcev nets are Turing complete. Information Sciences 2023, 621; 172-182. ISSN 0020-0255

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Patrick G Clark, Jerzy W Grzymala-Busse, Zdzisław S Hippe, Teresa Mroczek, Rafał Niemiec. Global and saturated probabilistic approximations based on generalized maximal consistent blocks. Logic Journal of the IGPL 2023, 31, 2; 223–239. ISSN 1367-0751

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Jerzy Król, Krzysztof Bielas & Torsten Asselmeyer-Maluga. Random World and Quantum Mechanics. Foundations of Science 2023, 28, 2; 575–625. ISSN 1233-1821

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Hao Wang, Jinwei Wang, Xiangyang Luo, Yuhui Zheng, Bin Ma, Jinsheng Sun, Sunil Kumar Jha. Detecting Aligned Double JPEG Compressed Color Image With Same Quantization Matrix Based on the Stability of Image. *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY* 2022, 32, 6; 4065-4080. ISSN 1051-8215

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Jacek Rodzinka, Tomasz Skica, Teresa Mroczek, Elżbieta Ociepa-Kicińska. How Government Size Optimization affect on European Economies? *WSEAS Transactions on Business and Economics* 2022, 19; 647-659. ISSN 1109-9526

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Małgorzata Rataj, Joanna Wójcik. The Impact of Covid-19 on Online Final Exam Scores Among Computer Science Students. Proceedings of the 23rd European Conference on Knowledge Management ECKM 2022, Vol. 23 No. 2 (2022): Hosted By University of Naples Parthenope and University of Naples Federico II, Italy 1-2 September 2022, s. 955-964.

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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

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

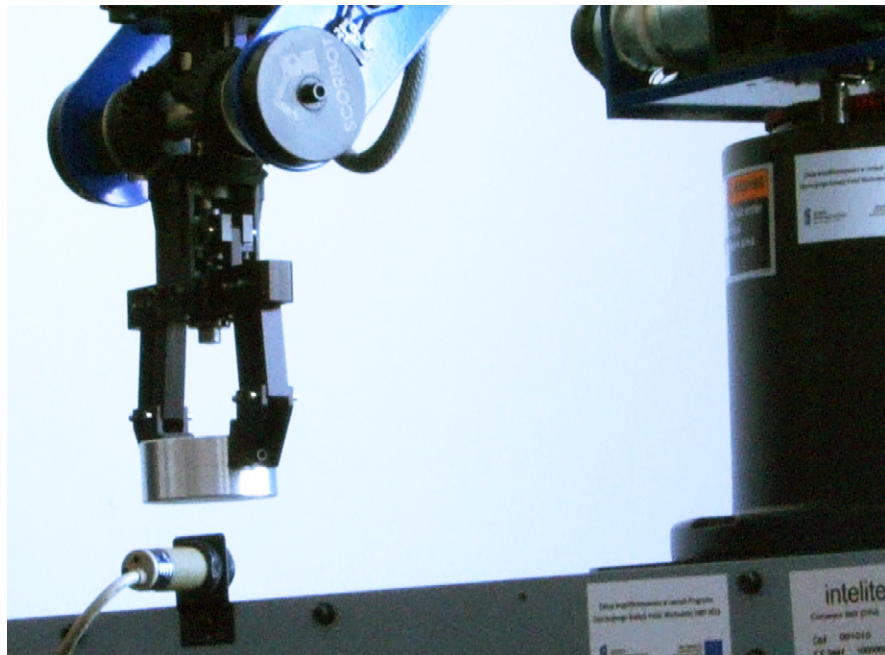
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Publication

LABORATORIES

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



ARTIFICIAL INTELLIGENCE LABORATORY

This 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. A lack of complete information about real-world objects is a common situation, and an object may have an 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 very often happens that an object is associated with more than one concept, in which case another type of uncertainty arises as to what the object actually is. An example of this may be a situation in which two doctors provide different diagnoses based on identical symptoms. This laboratory enables the building of expert systems for such uncertain environments. The tools for their induction are developed and the essence of uncertainty is explored.

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.

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



LABORATORY OF ADVANCED NETWORK TECHNOLOGIES AND WIRELESS TECHNOLOGIES

This laboratory is used to teach both the basics of building modern computer networks and advanced techniques for securing traffic between networks and ensuring transmission quality.

. It was created for specialists in the design, implementation and configuration of LAN and WAN computer networks. The main goal is to allow students to gain knowledge and skills related to the configuration, maintenance and protection of computer networks. The laboratory is set up to conduct training as part of the Cisco Network Academy, in particular training at the level of CCNA (Cisco Certified Network Associate) and 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 acts as a technical base for thesis work towards a Master's degree in the field of computer networks. The technical equipment in this laboratory enables the creation of new courses and types of training, and in the case of existing 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 +.

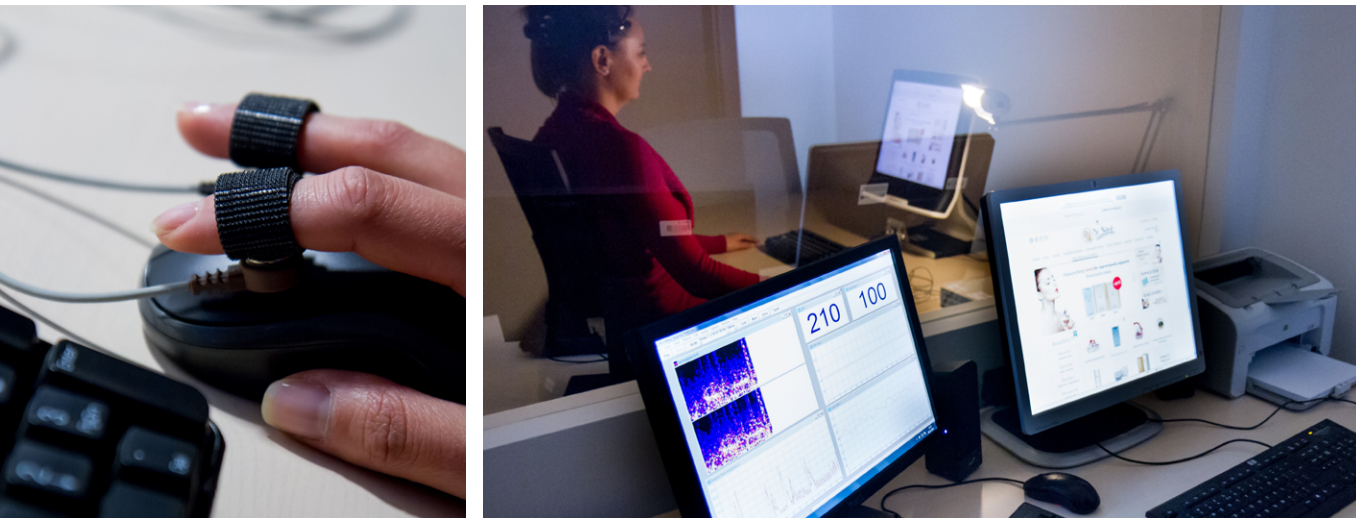
For more information [visit our website](#).



LABORATORY OF NEUROCOGNITIVE ERGONOMICS

The main tasks carried out in this laboratory include:

- research within the broad field of neurocognitive ergonomics;
- the introduction of students to issues related to possible applications of the achievements of psychology, cognitive science and neurosciences during the design process, with particular emphasis on research within computer application usability;
- and the implementation of projects aimed at adapting (optimizing) the environment to the cognitive abilities of humans.



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 offers scientists a wide range of opportunities. Research conducted in the Laboratory of Neurocognitive Ergonomics covers interdisciplinary fields related to ergonomics, medical IT (the acquisition and exploration of bio-signals), psychology, cognitive science and neuroscience. Research carried out in the laboratory includes the following issues:

- the perception of works of art, including 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.);
- the perception of text and graphic elements, including diagnosing disorders in the reading process, the optimization of hypertext structures, and the optimization of the content of school textbooks;
- the acquisition and exploration of bio-signals, including exploring the use of data obtained through eye-tracking, researching methods of searching for patterns in data obtained by electroencephalography and neuroimaging;
- the effectiveness of analytical methods related to the complexity of navigation structures and screen computer applications;
- neuromarketing.

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

DATABASE LABORATORY

The equipment in this laboratory allows to research to be performed to meet 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.

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

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