3rd Cycle

Doctoral Study Programmes

University *of Ljubljana*
Faculty *of Computer and Information Science*

Earning a Doctorate
is One of the Highest Honours

Computer and information science is one of the leading areas shaping the economy, education, culture, administration and other disciplines. The rise of computer technology dictates the need for highly qualified professionals which are capable of developing new computer and information technologies and implementing them in innovative environments.

At the Faculty of Computer and Information Science we offer the doctoral study programme in Computer and Information Science. The programme appeals to young people, especially those who plan on pursuing research and scientific work in computer science and informatics.

The main focus is on reseach, interdisciplinarity and cooperation with domestic and foreign experts. Special emphasis is devoted to combining scientific and professional areas wih elective courses and an academic advisor programme.

- ☑ **STATE OF THE ART COURSES**
- ☑ **RESEARCH-FOCUSED PROGRAMMES**
- ☑ **LECTURES ARE HELD IN ENGLISH**
- ☑ **MODERN FACILITIES**

Doctoral Study Programme in Computer and Information Science

The Computer and Information Science doctoral programme is designed to further the student's knowledge of computer science and information technology, while also providing training in the soft skills required for research and development. The course is recommended for students who intend to pursue a career in academia and for students who intend to carry out demanding and innovative research and development in the industry.

Dr. MATIC CANKAR,
Researcher at XLAB

To become an expert in your field you need to be up to speed with the latest research and technology. Enrolling in doctoral studies important step on the road towards gaining skills and staying on track with ongoing research, which is crucial in order to develop new ideas and contribute to international research projects. This knowledge enables me to tackle and solve the academic and industrial issues that arise if you are working for an IT company with a strong research group like XLAB.

Scheme of the Study Programme

The Computer and Information Science doctoral study programme comprises organised forms of study, research and the doctoral dissertation. It is a four-year programme performed entirely in English.

Mandatory Courses

The two mandatory courses are Scientific Skills 1 and Scientific Skills 2, which include topics such as paper writing, preparing good oral and poster presentations, copyright and patent laws, ethics in science, writing project proposals and the like.

Elective Courses

The candidate chooses four elective courses, two of which are selected from these elective courses: Predictive Analytics for Structured Data • Information System Integration Methods • Advanced Algorithms for Search and Planning • Machine Learning for Natural Language Processing • Deep Learning for Computer Vision • Mathematics for Machine Learning • Incremental Learning from Data Streams • Contemporary Approaches to Algorithm Design • Selected topics on Cryptography and Computer Security • Advanced Topics in Network Science

The other two elective courses may be chosen from the above list or from other doctoral study programmes at the University of Ljubljana or other universities with a combined workload of at least 10 ECTS credits.

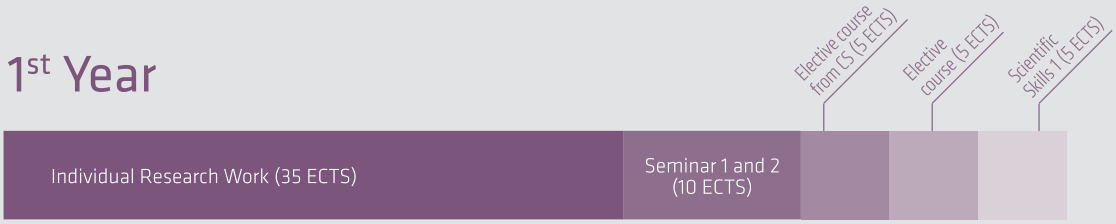
Seminars

Seminars are a compulsory part of the study programme and serve to ensure regular doctoral student meetings and discussions about their research. There are five seminars in total: one in each of the first four semesters and one in the last semester of the study programme. The seminars are closely related to the students' research work; at these seminars the students present their work (e.g. papers, theses) to each other and to their mentors.

Research and the Doctoral Dissertation

The students' time is mostly devoted to carrying out their own scientific research with guidance from their mentors. The final result, the doctoral dissertation, should be an original contribution to science and must be written in accordance with the university's policy on doctoral dissertations.

1st Year



The first study year comprises two elective courses, the Scientific Skills 1 course and Seminars 1 and 2. Candidates establish the focus of their research with the guidance of their mentors and start conducting the research.

2nd Year

In the second year, the candidates take part in two elective courses and Seminars 3 and 4, but primarily focus on research that is guided by their mentors and on which they work closely with their chosen laboratory. In order to progress to the third year, candidates must have an approved thesis topic which includes a written description and a defence.

3rd Year

The third year is reserved for research.

4th Year

The fourth year is reserved for research and preparation of the doctoral thesis, which the candidate presents in Seminar 5. The candidate also learns how to write a project proposal in the Scientific Skills 2 course.

Dr. ŽIVA RAMŠAK,
Research Assistant at the National Institute of Biology

The interdisciplinary doctoral study programme has provided enough flexibility and independence, to be able to shape a career path of my own choosing. In addition it trained me in the skills required to navigate between diverse knowledge areas, particularly on the cusp between life and computer sciences. Alongside that, it broadened my overview of ongoing research internationally and expanded the network of collaborators, resulting in a well-rounded investigator equipped with means to adapt to future new experiences, thus allowing for personal growth as well.

Interdisciplinary Doctoral Study Programme in Biosciences

In addition to our core Doctoral Programme Computer and Information Science we also offer the Interdisciplinary Doctoral Study Programme in Biosciences. The programme is provided together with the Biotechnical Faculty, the Faculty of Electrical Engineering, the Faculty of Health Sciences and the Faculty of Mechanical Engineering. The study programme consists of organised learning (lectures, practicals, presentations of themes of doctoral dissertations, etc.) amounting to 60 ECTS credits, while the remaining 180 ECTS credits are devoted to individual research work for doctoral dissertation. More information on: **http://bioznanosti.si/en**

Research Work

The research work carried out in our 19 laboratories is diverse. The research is particularly intense in field of artificial intelligence and related disciplines, such as machine learning, data mining and computer vision, and applied to different domains from bioinformatics and cognitive modelling to intelligent robotics. Another important research area is data acquisition and management as well as integration of information systems. We are addressing various other research questions from different fields of computer and information science which can be seen through the keywords on the next pages and the list of ongoing research projects. Doctoral students are actively involved in carrying out their research in collaboration with other researchers.

RATKO PILIPOVIĆ,
doctoral student

The curiosity, the enthusiasm, the desire for knowledge, that is what it takes to turn a good engineer into a brilliant researcher. Challenges you will face in doctoral study aren't for light-hearted, but if you overcome them, great rewards are waiting for you. Every day in the doctoral study you will experience ups and downs through which you will become stronger and more independent researcher. Evolving each day, bit by bit, you grow up and become a better and more fulfilling person as your research progresses. I am glad that I have experienced all of it at the Faculty of Computer and Information Science. With a help of a friendly faculty staff and considerate professors, each day I am one more step closer to achieving my life goal: Doctorate in Computer Science.

Dr. MARINKA ŽITNIK

Researcher at Stanford University

My research focuses on statistical modelling and analysis of multimodal data. I enjoy developing methods and emerging tools, and solving computational challenges in large-scale data systems. It has become increasingly common to observe and measure technological, biological, and information systems at different levels of granularity and from different perspectives. During my doctoral study, I have developed new machine learning and data fusion methods to learn useful patterns from heterogeneous data systems.

My work has a wide range of application of which I focus on those from biomedicine, health care, genomics, and system biology. I use data analytic tools to automatically generate testable hypotheses from massive biological and clinical data. In several cases, predictions made by my computational methods have directly contributed to the new discoveries in the wet laboratory experiments. In one case, my methods predicted new bacterial resistance genes, which were afterwards validated by biologists at Baylor College of Medicine, USA. In another case, I used my data fusion methods to guide the experiments about a cancer-related enzyme family at Karolinska Institutet, Sweden.

I am now a postdoctoral scholar in the Computer Science Department at Stanford University. At Stanford, I work on new mathematical models to better understand the organizational, structure and dynamics of multimodal networks. Together with collaborators in the U.S. and Europe, we test the models for exciting applications in the biomedical world.

Dr. LUKA ČEHOVIN ZAJC

Assistant Professor at the Faculty of Computer and Information Sicence

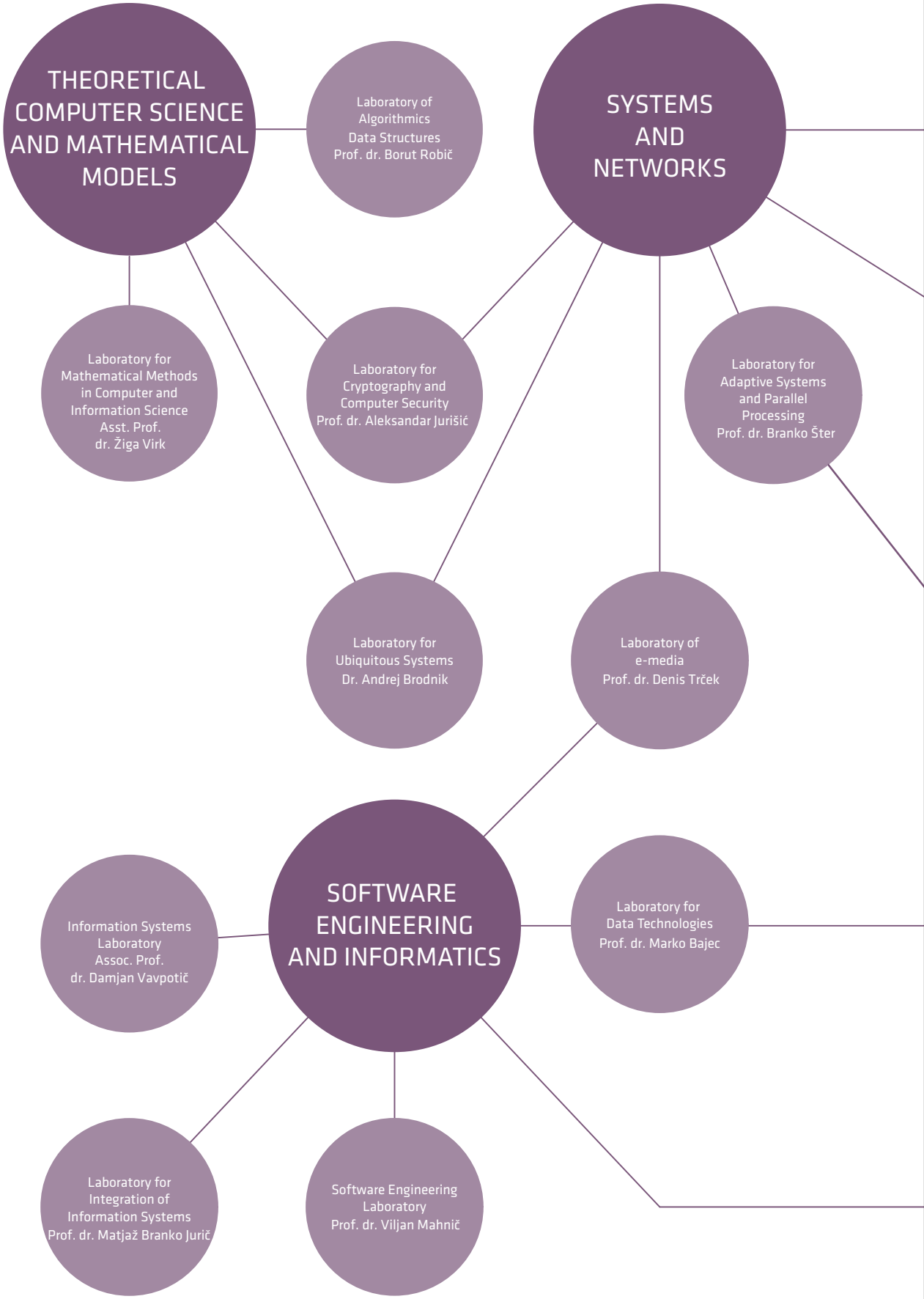
The focus of my research work during my doctoral studies was visual tracking. I have developed algorithms that are capable of predicting the position of deformable, non-rigid objects in real time videao streams. Having to evaluate these algorithms, I have also worked on improving visual tracking evaluation methodology. My work has been published in several major computer vision conferences and journals and has been the basis for the methodology used in the VOT Challenge, an initiative that organizes competitions and workshops with the goal of advancing the field of visual tracking. Since my doctorate I have been working on various projects related to computer vision, robotics, and human-computer interaction.

Dr. DOMEN KOŠIR

Senior Software Developer at Celtra Ltd.

I have worked as a developer in the online advertising industry and found myself wondering how the large volume of data could be used to make advertising mode efficient. I enrolled in the doctoral study at the Faculty of Computer and Information Science as a researcher from the industry. In the following years I focused mainly on web-related data mining problems, like profiling web users, building recommendation systems, and analysing advertising-related data.

I have developed several new algorithms and published them in scientific journals. My continued work in the adverttising industry enables me to use newly acquired knowledge in everyday work. Knowledge brings new opportunities!


THEORETICAL COMPUTER SCIENCE AND MATHEMATICAL MODELS
Laboratory of Algorithmics Data Structures Prof. dr. Borut Robič
SYSTEMS AND NETWORKS
Laboratory for Mathematical Methods in Computer and Information Science Asst. Prof. dr. Žiga Virk
Laboratory for Cryptography and Computer Security Prof. dr. Aleksandar Jurišić
Laboratory for Adaptive Systems and Parallel Processing Prof. dr. Branko Šter
Laboratory for Ubiquitous Systems Dr. Andrej Brodnik
Laboratory of e-media Prof. dr. Denis Trček
SOFTWARE ENGINEERING AND INFORMATICS
Information Systems Laboratory Assoc. Prof. dr. Damjan Vavpotič
Laboratory for Data Technologies Prof. dr. Marko Bajec
Laboratory for Integration of Information Systems Prof. dr. Matjaž Branko Jurič
Software Engineering Laboratory Prof. dr. Viljan Mahnič


COMPUTATIONAL BIOLOGY
Computer Structures and Systems Laboratory Prof. dr. Nikolaj Zimic
Computer Communications Laboratory Assoc. Prof. dr. Mojca Ciglarič
Bioinformatics Laboratory Prof. dr. Blaž Zupan
Laboratory for Biomedical Computer Systems and Imaging Prof. dr. Franc Jager
Artificial Intelligence Laboratory Assist. Prof. dr. Aleksander Sadikov
Laboratory for Cognitive Modelling Prof. dr. Igor Kononenko
MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE
Visual Cognitive Systems Laboratory Assoc. Prof. dr. Danijel Skočaj
MACHINE PERCEPTION AND MULTIMEDIA
Laboratory for Computer Graphics and Multimedia Assoc. Prof. dr. Matija Marolt
Computer Vision Laboratory Prof. dr. Franc Solina

Research projects

Research work at the Faculty is carried out by 120 researchers in 19 different laboratories. It is made through more than 100 various research projects each year funded by the European Commission, the Slovenian Research Agency, industrial partners and other funding agencies. We cover a wide range of research topics with a focus on certain specialised areas of computer and information science. Doctoral students participate in these projects, gaining international experience as a result.

Machine Learning and Data Mining

Orange Data Mining – open source machine learning and data visualization tool
Predicting Cognitive Diseases – machine learning tools for diagnostic practice

Biomedical research

BioPharm.si – next generation of biological medical products
SilicoFCM – platform for in silico clinical trials of familial cardiomyopathies
scOrange – single cell gene expression analysis
Smart Blood Analytics – flexible and scalable approach for medical diagnosis

Biometry

Ear Biometrics – ear detection and person recognition
Biometric Recognition Based on Eye Information – deep learning methods
Deindentification of Faces – using generative neural networks for privacy protection

Language Resources and Technologies

Thesaurus of Modern Slovene – responsive dictionary

Internet of Things

Ekosmart – a smartcity ecosystem
Vitabits – health platform for remote patient monitoring

Join our existing reseach groups!

Doctoral students and doctoral study candidates are welcome to join existing research groups. Follow open calls for research positions on Career at the Faculty webpage **fri.uni-lj.si/en/career-faculty**.

Computer and Machine Vision

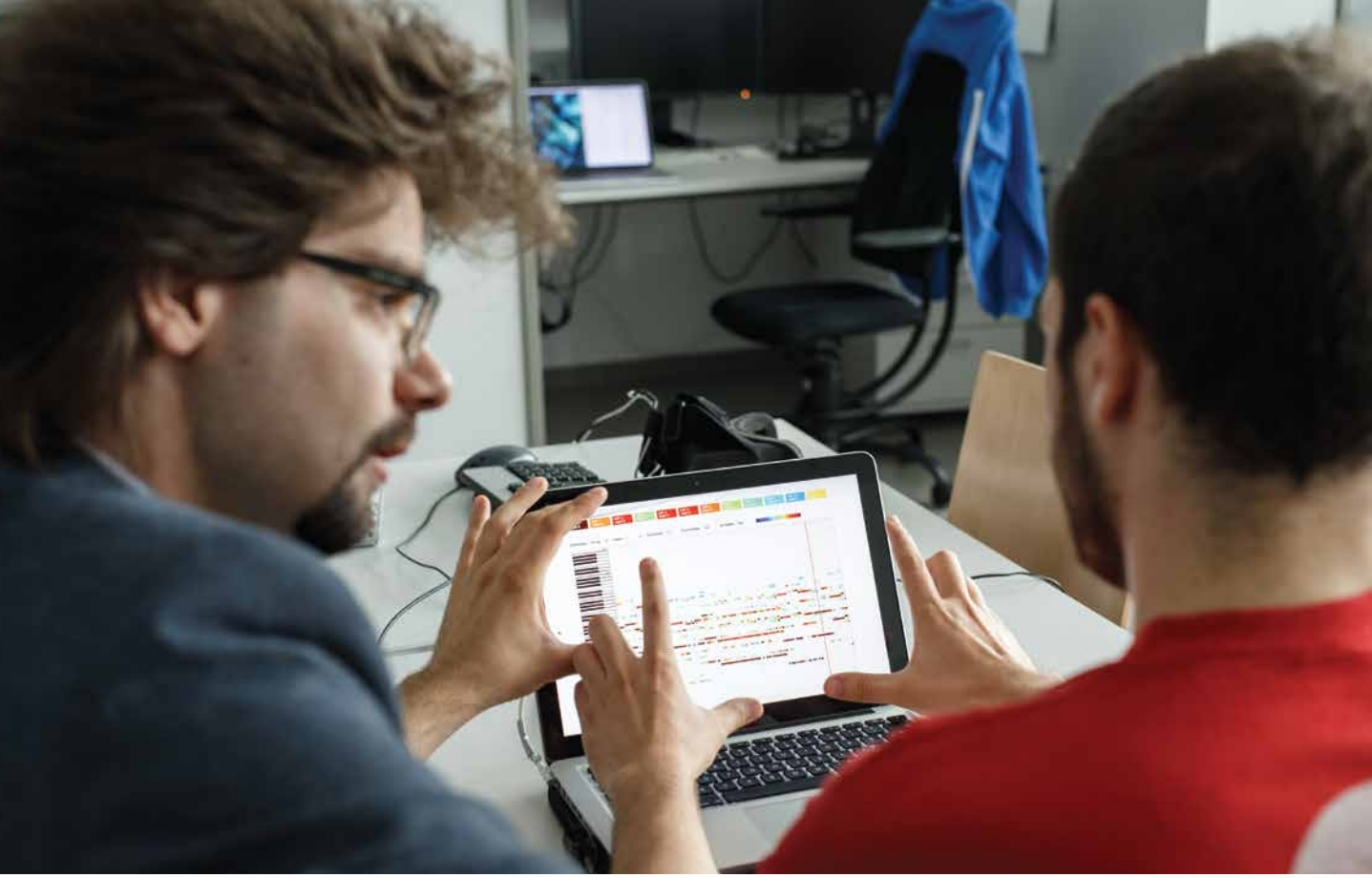
Visual Object Tracking (VOT) Challenge – leading an international initiative for evaluation of visual trackers
GOSTOP – robotics for the factories of the future
Obstacle Detection for Unmanned Suface Vehicles – detectors for robotic boats

High Performance Computing

cHiPSet – high performace modelling and simulation for big data applications
Joint Chinese-Slovenian HPC laboratory – analysis of biomedical data and image analytics

Society

Tourism 4.0 – enriched tourist experience, managing tourist flows
Micreate – ICT tools and digital storytelling for integaration of migrant children
GETM3 – improvement of employability and global management of young talents



Advisors

The selection of advisor for doctoral studies is vitally important. Make your selection in relation to your field of interest. Before your final selection, talk to the advisor, familiarise yourself with their laboratory, read through some of the advisor's most recent articles and consider whether the field they are involved in is appropriate and of interest to you.

The role of the advisor is to help you choose your field of research, to formulate the topic, select courses, to monitor your work and provide helpful advice. You will be in continuous contact with your advisor, you will collaborate with members of their laboratory and use the equipment it offers. The advisor will help you formulate your doctoral thesis so that your original contributions to computer and information science will be evident in it.

Find your advisor

A list of potential advisors is posted on website fraca.si/advisors.

Scholarships and Research Positions

The Faculty offers positions for:
- Teaching assistants
- Junior researcher positions
- Researcher positions

There are several scholarships available for doctoral students. The Public Scholarship, Development, Disability and Maintenance Fund of RS and other agencies offer several scholarships to foreing citizens for doctorate studies in Slovenia. Please carefully read the requirements published on website www.sklad-kadri.si/en/. If you have any questions, do not hesitate to contact our student affairs team at international.office@fri.uni-lj.si.

There are scholarships offered by private Slovenian company Gorenje for doctoral students, for more information please contact international.office@fri.uni-lj.si.

In 2019/2020 there several scholarship programmes available for students from The Hashemite Kingdom of Jordan, Georgia, Ghana, Egypt, Tunisia and Ukraine.

Tuition Fees

In the academic year of 2019/2020 the tuition fee for the Doctoral Study Programme Computer and Information Science is 4000€ for the first two years, 2600€ for the third year, and 3000€ for the last year. Whereas for the Doctoral Study Programme in Biosciences the tuition fee is 3800€ the first two years and the 2200€ for the last two years.

How to Apply?

Enrolment Procedure

Students apply for studies via eVŠ web portal at http://portal.evs.gov.si/prijava. The application deadline is 3 June 2019.

Application process includes recognition of foreign education. Detailed information regarding application process is available in the call for enrolment.

Admission Requirements

Candidates that have completed the following can enrol in the third-cycle study programme:

(a) A second cycle master's programme;
(b) A vocational study programme regulated by EU directives or any other uniform master's study programme evaluated at 300 ECTS;
(c) A university study programme adopted before 11 June 2004;
(d) A professional study programme adopted before 11 June 2004 and study programmes leading to specialization. Prior to enrolment, candidates must complete study requirements in the scope of up to 60 ECTS from the second-cycle Computer and Information Science study programme. Their study requirements (a list of courses) will be determined by the Faculty's committee, in view of the candidate's prior education (completed programme).
(e) A study programme leading to a MSc degree. Candidates will be accorded credits up to 60 ECTS.

Given that they have completed an equivalent level of education abroad, foreigners applying for doctoral programmes are subject to the same conditions as Slovenian citizens. The equivalence of education with the purpose of continuation is determined in accordance with the University of Ljubljana statuses. The procedure is led by the authorized person at the University of Ljubljana, with the content managed by the Senate of the member faculty of the University of Ljubljana Senate.

Application Enclosures

- CV
- Motivation letter
- Two recommendation letters
- Original or the duplicate of the final certificate, representing general requirement for access to higher education in the country of issue, legalized on the basis of: the 1961 Hague Convention (at the court with territorial jurisdiction where the certificate or diploma has been issued); with properly filled in apostille form affixed of the Authentication of Documents in International Traffic Act. Countries for which no legalization is required: Austria, Bulgaria, Bosnia and Hercegovina, Cyprus (for documents issued by public higher education institutions and universities), Czech Republic, France, Greece, Croatia, Hungary, Republic of Macedonia, Romania.
- Certified Slovene or English translation of the certificate or diploma
- Photocopy of the original certificate or diploma
- Certified copies of the evidence on the contents and duration of education and the requirements fulfilled during the educational programme (Diploma supplement, annual report cards, transcripts or others);
- A short chronological description of the entire education prepared by the applicant.

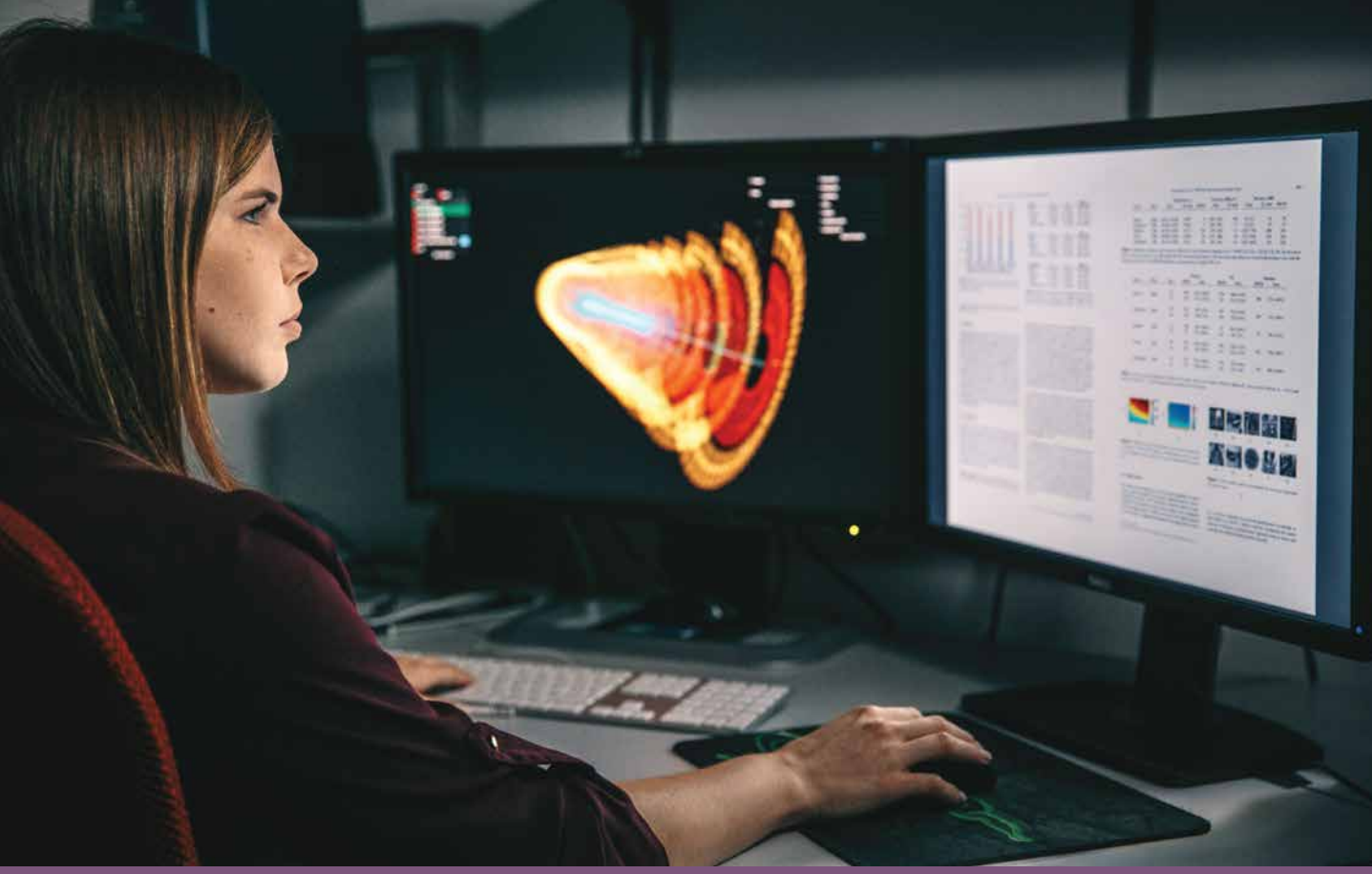
Application process includes recognition of foreign education, documents needed are described above. Detailed information regarding application process is available in the call for enrolment.

Employment Opportunities

Employment opportunities for Computer and Information Science doctoral graduates are very broad. Primarily, the programme trains doctors of science who become high-level professionals working in enterprises and social institutions that develop computer or IT solutions. These institutions also use solutions for innovation purposes to gain competitive advantages or to improve the quality of business and work. Typical roles are leadership and R&D. Due to a great need for such professionals at home and around the world, we estimate that the employability of doctoral students who complete the programme is high. The fact that there is a high demand for such qualified personnel is an additional motivation for future students to enrol in this study programme. This is reinforced by the experiences of students who have completed their doctorates, given the fact that they found jobs without any difficulty.

TOMI ILIJAŠ,
CEO and founder of Arctur

We are working in a knowledge-intense sector of HPC and HPDA, where the need for highly educated professionals is more than obvious. The alumnae of the Faculty of Computer and Information Science are our first choice when we are hiring such a staff. With an excellent doctoral programme, the Faculty of Computer and Information Science offers a good option for those who want to dig deeper and fly higher. Many years ago, I had a privilege to sharpen my research potential during my doctoral study at the Faculty of Computer and Information Science, but unfortunately had to give priority to family and business just before finishing it. Nevertheless, the gathered knowledge helped me to establish a R&D oriented company that competes with big players on a global market.



Dr. ŠTEFAN FURLAN,
CEO at Dodona Analytics

The doctoral programme has deepend my analytical and critical thinking. The ability to think analytically is vital when it comes to solving everything from small everyday problems to the most complex strategic bussines solutions. On the doctoral programme I was given the opportunity to work in very interesting areas of scientific reearch and, for me, this was also a real test of my perseverance. I also broadened my connections in Slovenia and abroad, meeting several interesting and highly competent people with whom I am currently working and will continue to do so in the future.

International Collaborations

We have expanded our network of international partners to more than 200 universities, research institutions and companies. This enables us to share knowledge and join resources to tackle bigger challenges.

- Joint Research Centre of European Commission (Italy) – doctoral partnership on cybersecurity and biometrics;
- The European Organization for Nuclear Research – CERN (Switzerland);
- Chinese Academy of Sciences (China) – joint Chinese-Slovenian virtual laboratory for high performance computing;
- Kyungpook National University (South Korea) – joint research in computer vision and wireless computing and a double degree study programme;
- University College London (UK) – joint research in bioinformatics and mobile computing;
- Baylor College of Medicine (USA) – joint research in bioinformatics;
- DFKI, Saarbrücken (Germany) – joint research in computer vision;
- Alpe-Adria University Klagenfurt (Austria) – joint research in computer compilers and algorithmics;
- University of Belgrade (Serbia) – joint research in sport statistics and computational linguistics.

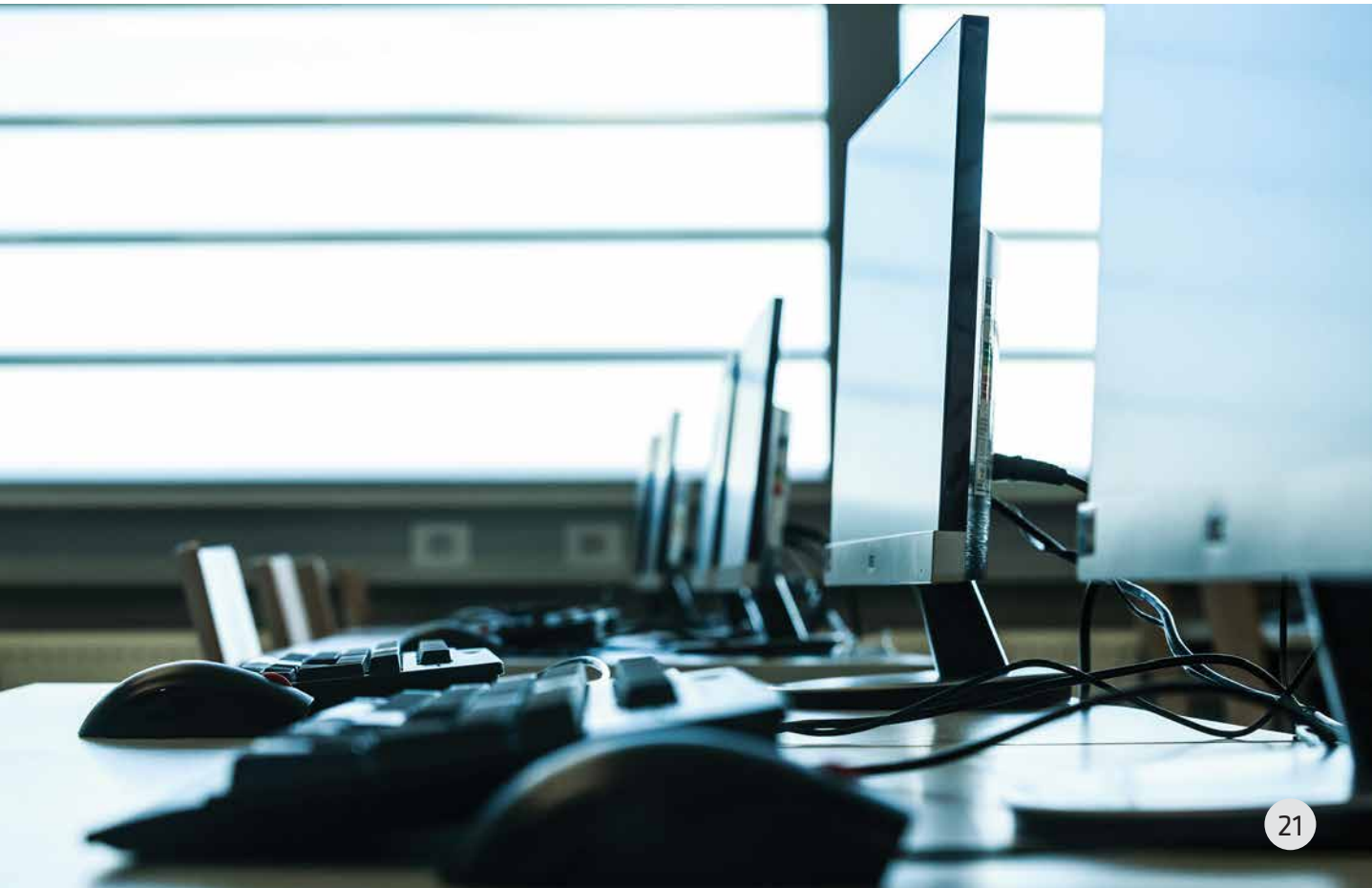
Modern Facilities

In 2014, the Faculty moved to a new building in Ljubljana - Brdo. This followed a several-year construction project of new buildings for the Faculty of Chemistry and Chemical Science and the Faculty of Computer and Information Science. This is the largest investment in the history of the University of Ljubljana and the largest project in Slovenia to be co-financed by European funds.

The new construction comprises three buildings, with the Faculties sharing the central one. This contains a large lecture hall with 300 seats, a large modern library with a reading room, a copy shop, and a restaurant.

The Faculty of Computer and Information Science's main building has a lecture hall with 200 seats, 8 smaller lecture halls, 12 computer rooms, over 20 research labs, a faculty lounge, and offices for support staff.

By moving the whole faculty under one roof, the academic community has been strengthened and invigorated, as there is more interpersonal communication and collaboration. In the new open and well lit design, a lot of space is reserved for informal socialisation and exchanging ideas, while the modern Faculty hosts external lecturers, conferences, workshops, and summer schools, which enrich the educational and research processes with new ideas, experiences, and best practices.



University of Ljubljana

The University of Ljubljana is an institution with a very rich tradition. It was established in 1919 on the foundations of a long-established pedagogical tradition. It is a very large university, with around 50 000 undergraduate and postgraduate students, and over 300 undergraduate and postgraduate study programmes. It employs approximately 6000 higher educatioon teachers, researchers, assistants and administrative staff in its 23 faculties and 3 arts academies.

Slovenia

Slovenia is a small country in central Europe, known for its natural beauties and picturesque architecture. Being a member of the European Union, Slovenia is characterized by its high life quality and relaxed way of living. Computer Science and IT is a flourishing area in the country, with a lot of opportunities to be explored by young researchers and entrepreneurs.

Useful Information

Student Life in Ljubljana

During their stay in Ljubljana all students are entitled to food and transport subsidies. The price for a meal in a restaurant is 2-5€ and 20€ for a monthly bus ticket.

International students should find a private room as there are no dormitories available for international students. The average price for a room is 150–250€. Living expenses (rent, food, public transport, books) in the Republic of Slovenia roughly amount to 500€ per month.

Students from EU countries and countries with which Slovenia has an agreement can enter without a visa and stay up to 90 days. They can apply for the residence permit in Slovenia. Non-EU students need a visa to enter the Republic of Slovenia.

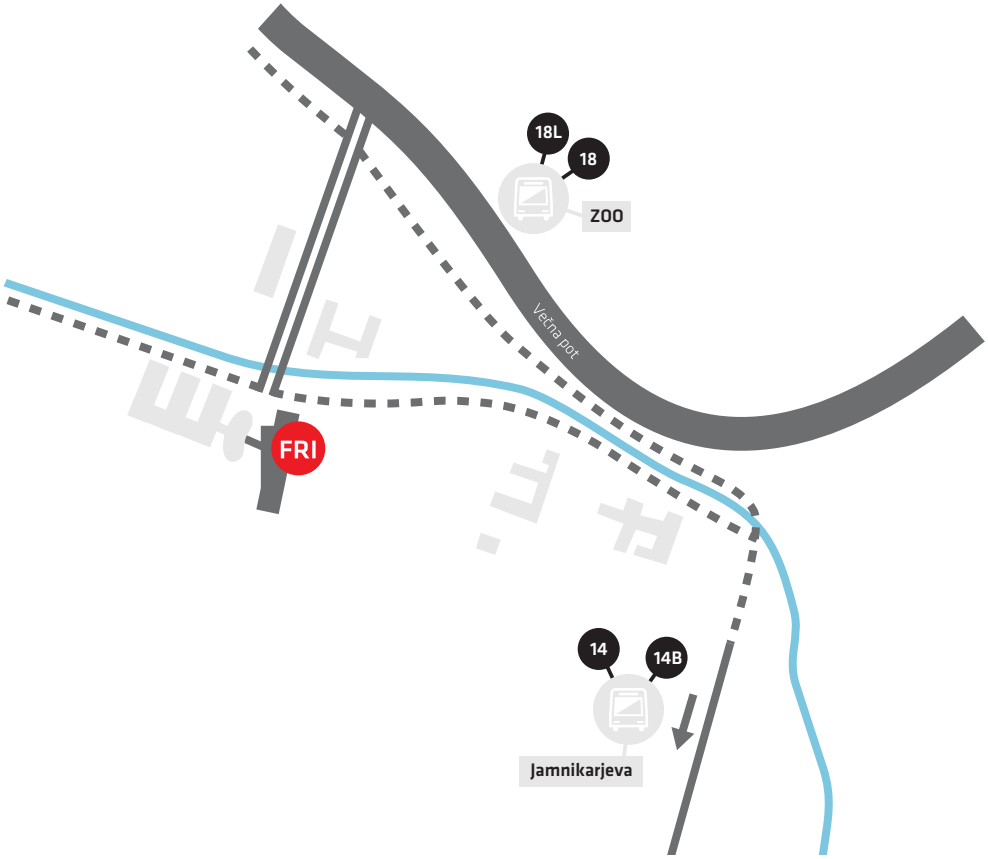
Contact Information

Faculty of Computer and Information Science
International Office

Ms. Vesna Gračner
international.office@fri.uni-lj.si
Phone: +386 1 479 8249

The Faculty of Computer and Information Science of the University of Ljubljana is located in the South-West part of the city, in a pleasant green environment next to the Rožnik hill. The area has been evolving into a hub, connecting technology and natural science students and researchers.

The Faculty can be accessed by city bus routes nr. 14, 14B, 18 and 18L. Leading to the Faculty are also a nice bike and walking trail.



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Fakulteta za računalništvo in informatiko

Alumni klub FRI