



University of Ljubljana  
Faculty of Computer and  
Information Science

2022/2023



# Doctoral Study Programmes



Computer and Information Science • Biosciences







# An Adventure Awaits You



The world of today is in need of qualified professionals who are capable of developing new computer and information technologies and implementing them in innovative environments. Computer and information science is changing the economy, education, culture, administration and other disciplines. Have you got what it takes to be a part of it?

At the Faculty of Computer and Information Science we offer a doctoral study programme in Computer and Information Science that meets the needs of young people who intend to carry out demanding and innovative research or intend to pursue a career in academia.

The study is designed to further your knowledge of computer science and information technology, combining scientific and professional areas with elective courses and an academic mentor programme. The main focus is on research, interdisciplinarity and cooperation with domestic and foreign experts.

Each student is free to find and propose his or her own relevant research topic and devote to it. Whatever you choose will be the key to your own adventure and career path.

State-of-the-art courses

Research-focused programme

Lectures are held in English

Modern facilities

# Doctoral Study Programme in Computer and Information Science



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 presentation, copyright and patent laws, ethics in science, writing project proposals and the like.

## 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.

## Elective Courses

The candidate chooses four elective courses, two of which are selected from these elective courses: Machine Learning for Language and Graphs • Advanced Algorithms for Search and Planning • INFOSEC of Socio-Technical Systems • Incremental Learning from Data Streams • Modern Cryptography and Computer Security • Advanced Topics in Ubiquitous Sensing and Learning • Predictive Analytics for Structured Data • Optimization Methods for Large Networks • Heterogeneous Computing Platforms • Computer Graphics and Visualization • Low-Power Hardware Designs for Next-Generation Signal Processing and Machine Learning Applications • Selected Topics in Analysis of Sound Signals • Tensor Networks for Machine Learning.

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 combined workload of at least 10 ECTS credits.

## Seminars

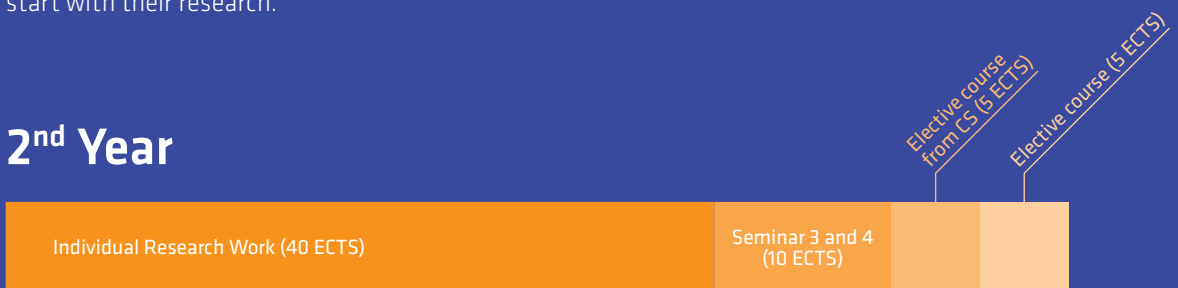
Seminars are a compulsory part of the study programme and serve to ensure regular doctoral student meetings and discussions about their research. There are five seminars in total: one in each of the first four semester and one in the last semester of the study programme. The seminars are closely related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

## 1<sup>st</sup> 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 with their research.

## 2<sup>nd</sup> 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.

## 3<sup>rd</sup> Year



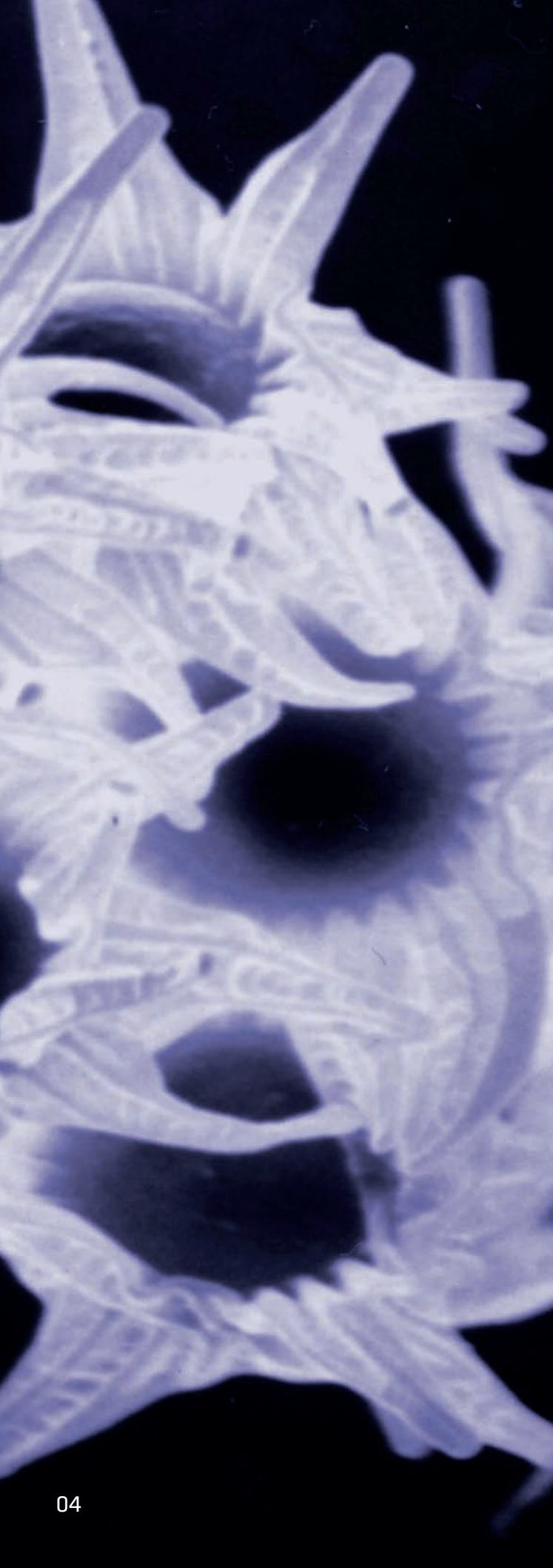
The third year is reserved for research.

## 4<sup>th</sup> 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.





# Interdisciplinary Doctoral Study Programme in Biosciences

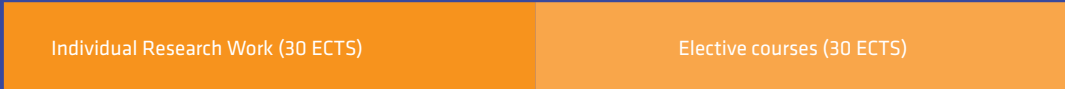


In addition to our core Doctoral Programme Computer and Information Science, we also offer the Interdisciplinary Doctoral Study Programme in Biosciences.

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 consist of organised learning (lectures, practicals, presentations of doctoral thesis topic, 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>

# 1<sup>st</sup> Year



# 2<sup>nd</sup> Year



# 3<sup>rd</sup> Year



# 4<sup>th</sup> Year



# Research Work



The research work at the faculty is carried out by 120 researchers in 19 laboratories and is very diverse. Doctoral students are an important part of it, gaining international experience as a result.

The research 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.

Our work is particularly intense in the 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. Various other research fields and projects can also be seen on the next pages.







Computer science, engineering, software development and statistics not only contribute to capital gains, but also fuel deeper understanding of society and the environment.

Over the years, I have been involved in designing mathematical models of processes within living cells - gene regulation, interactions with the environment and their diversity in humans and other organisms. Machine learning and data analysis play a key role in medicine, ecology, and - nowadays crucial - public health. The graduate programme allows for significant freedom, but also responsibilities in research conduct. By far the largest value are connections to several international experts, with whom we collaborate on a daily basis.

dr. Martin Stražar  
Broad Institute of MIT and Harvard,  
Cambridge, MA, USA



In the course of doctoral studies, I have gained a lot of knowledge about scientific research, participation and organisation of conferences, contributing as an author on research papers, and similar. However, the most outstanding experience was the international collaboration with worldwide recognized experts and research groups on state-of-the-art projects, cutting-edge approaches, and research papers. The doctoral study program is less constrained and mostly dedicated to scientific research, giving a doctoral candidate plenty of room for creativity and inventiveness. Although the doctoral study requires significant dedication and commitment, it opens new career opportunities in Academia and Industry as well.

dr. Polona Štefanič  
former researcher assistant and teacher  
at Cardiff University



# Research Projects



## Machine Learning and Data Mining

**Orange Data Mining** – open source machine learning and data visualization tool

## Society

**XFlex** – Integrated energy solutions and new market mechanisms for an eXtended FLEXibility of the European grid

**OBJEM** – Reading literacy and development of Slovenian Language

**Secure use of smart devices among the elderly:** Towards education-based cybercrime prevention

Sustainable digital preservation of the Slovenian new-media art

Conceptualization and application of an analytical model for increasing well-being in Slovenia

## Biomedical research

Computational Toolbox for Discovery of Prognostic Biomarkers for Survival Analysis

**xAIM** – eXplainable Artificial Intelligence in healthcare Management

**PARENT** – PremAtuRe nEwborn motor and cogNitive impairments: Early diagnosis

**Predicting Cognitive Diseases** – machine learning tools for diagnostic practice

## Biometry

**Ear Biometrics** – ear detection and person recognition

**Biometric Recognition Based on Eye Information** – deep learning methods

**Deidentification of Faces** – using generative neural networks for privacy protection

## Language Resources and Technologies

**RSDO** – Development of Slovene in a digital environment

Empirical foundations for digitally-supported development of writing skills

## Internet of Things

Context-aware on-device approximate computing

## Computer and Machine Vision

**Visual Object Tracking (VOT) Challenge** – leading an international initiative for evaluation of visual trackers

**Obstacle Detection for Unmanned Surface Vehicles** – detectors for robotic boats

**MV4.0** – Data-driven framework for development of machine-vision solutions

**DeepBeauty** – Deep generative neural networks for beauty and fashion industry

## High Performance Computing

**EUROCC** – National Competence Centres in the framework of EuroHPC

### Join our research 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

<https://fri.uni-lj.si/en/career-faculty>.

## Research Laboratories

Laboratory for Mathematical Methods in  
Computer and Information Science

Assoc. Prof. dr. Žiga Virk

TCSMM

Laboratory for Ubiquitous Systems

Dr. Andrej Brodnik

TCSMM SN

Computer Structures and Systems Laboratory

Prof. dr. Nikolaj Zimic

SN CB

Bioinformatics Laboratory

Prof. dr. Blaž Zupan

CB MLAI

Laboratory for Biomedical Computer  
Systems and Imaging

Prof. dr. Franc Jager

CB MPM

Visual Cognitive Systems Laboratory

Prof. dr. Danijel Skočaj

MLAI MPM

Computer Vision Laboratory

Prof. dr. Peter Peer

MPM

Artificial Intelligence Laboratory

Asst. Prof. dr. Aleksander Sadikov

MLAI

Laboratory for Cognitive Modelling

Prof. dr. Igor Kononenko

MLAI

Laboratory for Data Technologies

Prof. dr. Marko Bajec

SEI MLAI

Software Engineering Laboratory

Sen. Lect. dr. Igor Rožanc

SEI

Information Systems Laboratory

Assoc. Prof. dr. Damjan Vavpotič

SEI

Laboratory of Algorithmics

Prof. dr. Borut Robič

TCSMM

Laboratory for Cryptography and Computer Security

Prof. dr. Aleksandar Jurišić

TCSMM SN

Computer Communications Laboratory

Assoc. Prof. dr. Mojca Ciglarič

SN

Laboratory for Adaptive Systems  
and Parallel Processing

Prof. dr. Branko Šter

SN MLAI

Laboratory of e-media

Prof. dr. Denis Trček

SN SEI

Laboratory for Computer Graphics and Multimedia

Assoc. Prof. dr. Matija Marolt

SEI MPM

Laboratory for Integration of Information Systems

Prof. dr. Matjaž Branko Jurič

SEI

TCSMM Theoretical computer science and mathematical models

SN Systems and networks

CB Computational biology

SEI Software engineering and informatics

MLAI Machine learning and artificial intelligence

MPM Machine perception and multimedia

More information on

<https://fri.uni-lj.si/en/research/laboratories>



# Mentors



Selecting the right mentor is one of the most important decisions you can make at the start of your doctoral study. The role of the mentor is to help you choose your field of research, to formulate the topic, select courses, to monitor your work and provide helpful advice.

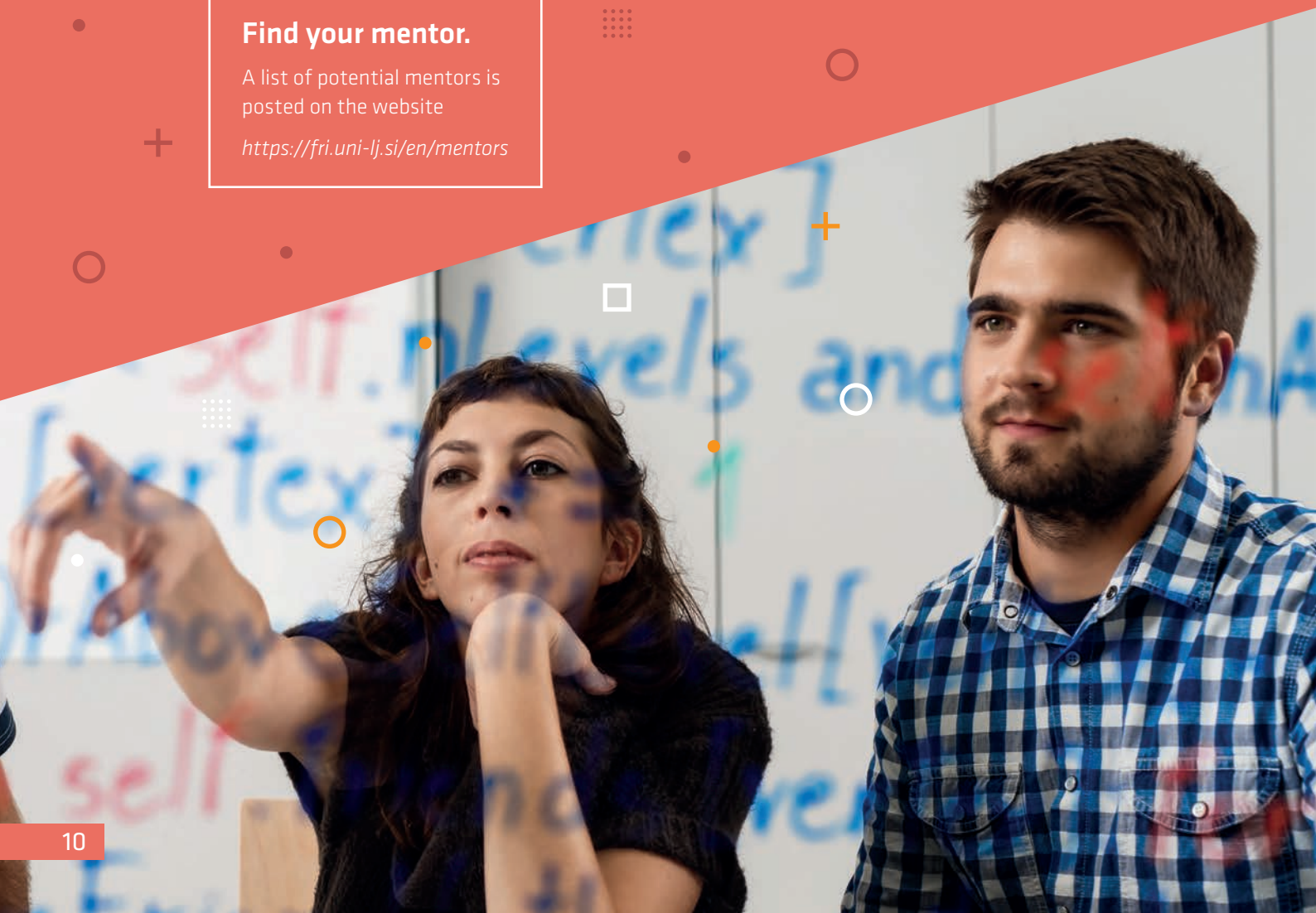
You will be in continuous contact with your mentor; you will collaborate with members of the laboratory and use the equipment it offers. The mentor will help you formulate your doctoral thesis so that your original contributions to computer and information science will be evident in it.

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

## Find your mentor.

A list of potential mentors is posted on the website

<https://fri.uni-lj.si/en/mentors>



# How to Apply?



Students apply for studies via eVŠ web portal at <http://portal.evs.gov.si/prijava>. The application deadline is 1st June 2022. Application process includes recognition of foreign education. Detailed information regarding application process is available in the call for enrolment.

## Tuition Fees

In the academic year of 2022/2023 the tuition fee for the Doctoral Study Programme Computer and Information Science is 4200€ for the first two years and 3000€ for the last two years. 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.

## 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 statutes. 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 and 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
- Mentor's statement of accepting mentorship in doctoral studies and a short conceptual design of the research work

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



# Scholarships and Research Positions



There are several scholarships available for doctoral students. The Public Scholarship, Development, Disability and Maintenance Fund of The Republic of Slovenia and other agencies offer several scholarships to foreign citizens for doctorate studies in Slovenia. Please carefully read the requirements published on website [www.sklad-kadri.si/en/](http://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](mailto:international.office@fri.uni-lj.si).

## The Faculty offers positions for:

- Teaching assistants
- Junior researcher positions
- Researcher positions

Follow open calls on website  
<https://fri.uni-lj.si/en/career-faculty>



# Employment Opportunities



Employment opportunities for Computer and Information Science doctoral graduates are very broad. Students who have completed their doctorates found jobs without any difficulty.

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, research and development.

The employability of doctoral students who complete the programme is very high, due to a great need for such professionals at home and around the world. This is an additional motivation to enrol in this study programme.



We are working in a knowledge-intensive 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.

Tomi Ilijaš, CEO and founder of Arctur



# 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)**

**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

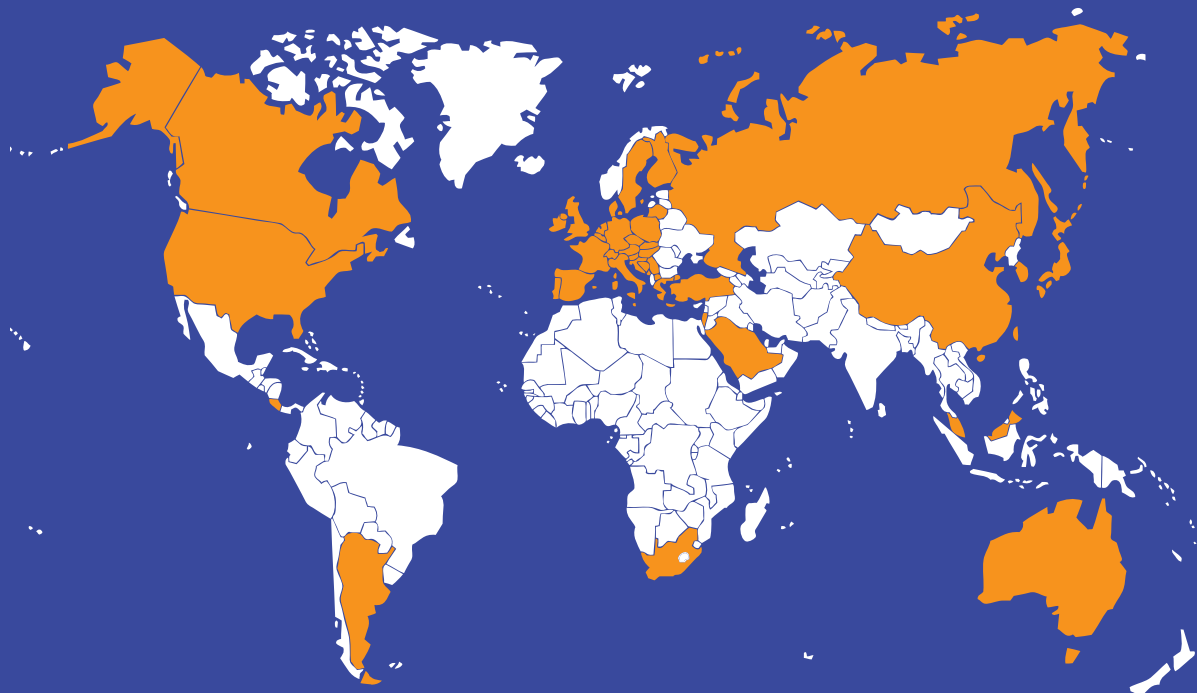
**Baylor College of Medicine (USA)** – joint research in bioinformatics

**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

**King Abdullah University of Science and Technology (Saudi Arabia)** – computer graphics and visualization technology for depicting the life forms from atoms to organisms



# Student Life in Ljubljana



During their stay in Ljubljana all students are entitled to food and transport subsidies.

**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.

Living expenses (rent, food, public transport, books) in the Republic of Slovenia roughly amount to 500€ per month.

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€.

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.





# University of Ljubljana



The University of Ljubljana is an institution with a very rich tradition. It was established in 1919.

It is a very large university, with around 40 000 undergraduate and postgraduate students, and over 300 undergraduate and postgraduate study programmes. It employs approximately 6000 higher education teachers, researchers, assistants and administrative staff in its 23 faculties and 3 arts academies.

# Faculty of Computer and Information Science



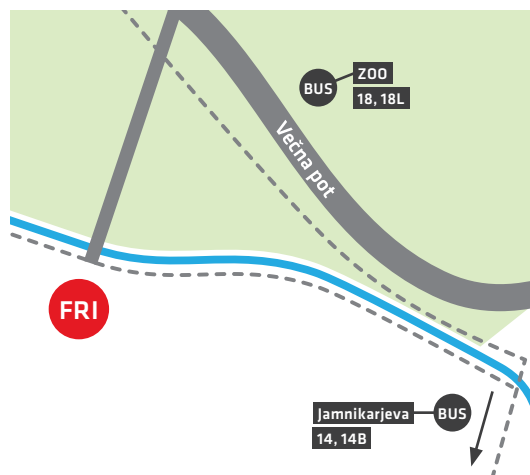
The Faculty of Computer and Information Science has a long history in artificial intelligence, data mining and computer vision research.

It was established in 1996, however computer study programme at the University of Ljubljana dates back to 1973.

## Location



The Faculty 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.









University of Ljubljana  
Faculty of Computer and Information Science

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 Fakulteta za računalništvo in informatiko

 [fri.ul](https://www.instagram.com/fri.ul)