

REGISTRATION FORM FOR CZECH SCIENTIFIC INSTITUTION

1. Research institution data (name and address):

Faculty of Mathematics and Physics
Charles University
Ovocný trh 560
116 36 Praha 1

2. Type of research institution: Public university (veřejná vysoká škola)

3. Head of the institution: Prof. MUDr. Milena Králíčková, Ph.D. – Rector

4. Contact information of designated person(s) for applicants:

Jan Hajič – professor
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Institute of Formal and Applied Linguistics MFF UK
Malostranské nám. 2/25, CZ-11800 Praha 1, Czech Republic

5. Research discipline in which the strong international position of the institution ensures establishing a Dioscuri Centre:

Natural Sciences and Technology: *Computer science and informatics* - informatics and information systems, computer science, scientific computing, intelligent systems

6. Description of important research achievements from the selected discipline from the last 5 years including a list of the most important publications, patents, or other results:

The Computer Science School of the Faculty of Mathematics and Physics that is looking for applications is the home of several excellent interdisciplinary research teams, primarily in Theoretical Computer Science, in Artificial Intelligence and Robotics, Computer Graphics, Computational Neuroscience, in Computational Linguistics, and Smart Software Systems. In **Computational Linguistics**, which covers all topics from theoretical linguistics, Deep Learning and applications of Natural Language Processing, We have succeeded in developing machine translation system that outperforms human translators in accuracy (Nature Comm., 2020), patented a novel approach to automatic speech translation (Bojar et al., U.S. Patent No. 11,037,028), and won several European Commission awards for projects ranging from building language technology platforms to machine translation and conversational systems, such as the European Live Translator project (<https://elitr.eu>). In **Theoretical Computer Science**, research produces large number of results, particularly in Theory of algorithms, complexity, discrete mathematics, graph theory, cryptography, combinatorics, optimization, computational geometry and topology, game theory, theory of systems. The group holds an “A” ranking in the international ranking of Charles University and it is the site of two ERC and two ERC-CZ grants as well as numerous awards, particularly, the nationally coordinated Centre of Excellence ITI. For example, P. Hubáček with his collaborators established an unexpected close connection between the computational complexity of central problems in algorithmic game theory and the security of practical techniques for minimising the communication in cryptographic protocols. M. Koucký with his collaborators designed the first subquadratic and nearly linear-time algorithm for approximating edit distance breaking the quadratic barrier. In optimization (Crisdis project coordinated by M. Loeb), a distribution system for crises based on an autonomous behaviour of participants is being developed. Members of the Department recently won Ministry prizes, Neuron fund prizes and Hlávka Foundation awards. In **Artificial intelligence and Robotics**, we focus mainly on symbolic AI, namely automated planning, constraint satisfaction, knowledge representation and compilation, and nature-inspired computations. We developed the leading technique for verifying hierarchical plans (ICAPS 2018), are leaders in multi-agent pathfinding (AAAI 2020), and cooperate with the industry to solve complex scheduling and routing problems (ECAI 2012). The **Computer Graphics** Group specialises in highly accurate predictive rendering, both for visual effects and 3D print optimization use, collaborating with a wide range of national and international partners. The **Computational Systems Neuroscience** Group (CSNG) was only established a year ago, but it has since grown to 6 members and published two scientific articles in high-impact journals. We build models of visual systems at various levels of abstraction, using a variety of computational techniques including deep-neural networks. The group on **Smart Software Systems** focuses on modern performance-aware self-adaptive (e.g. high-performance clouds, edge clouds, IoT). We collaborate with different industries and are active in multi-national industrial driven projects.

All groups and teams publish in top-level impact journals or Core-A-level international conferences, and have very rich international cooperation on all continents. Strong and very active international life of the school is a perfect setting for the Dioscuri program.

7. List of no more than 3 important research projects in the selected discipline awarded in national and international calls to the institution in the last 5 years:

ERC Starting Grant

„Next-Generation Natural Language Generation“

2022-2027

PI: prof. Ondřej Dušek

Project on human-level natural language production (not only) in the context of dialogue (conversation) systems

Project received funding from the European Commission EUR 2,500,000

ERC Synergy Grant

"DYNASNET: Dynamics and Structure of Networks"

2019-2025

co-PIs: prof. Jaroslav Nešetřil

total EUR 9,315,000/ Charles University: EUR 2,031,000

ERC Consolidator Grant

"CoCoSym: Symmetry in Computational Complexity"

2018-2023

prof. Libor Barto

EUR 1,211,000

8. Description of the available laboratory and office space for a Dioscuri Centre:

Depending on the size and scientific focus of the successful applicant's team, space in either the main building (Malostranské nám. 25, Prague 1, in the historic city centre) or in the newly built "IMPAKT" building in the Troja campus of the Faculty of Mathematics and Physics will be provided. A team of up to 6-7 researchers (as defined by the Dioscuri budget rules) can be accommodated. Both places are served by public transport and close to the efficient Prague Metro system. Both places are accessible for persons with disabilities. The Troja campus-located building provides also lab space for robotics experiments, otherwise access to the computer cluster is remote and provided from every office

9. List of the available research equipment for a Dioscuri Centre:

In computer science in general, and in the fields offered for the Dioscuri Centre in particular, research equipment is mostly computers and large data for the experiments. The computer cluster of the Institute of Formal and Applied Linguistics offers 200 GPUs and 1500 CPUs organised in a cluster equipped with the SGE scheduling and execution system. The Faculty is currently building a shared highperformance computing cluster that will be available in 2023-4. In addition, employees have access to META-CENTRUM, a country-wide computing grid which can be used in case the local cluster's capacity is full. Also, university employees can use the compute available at IT4Innovations, a HPC centre as part of the Czech nationwide e-INFRA-CZ Research Infrastructure.

On the data side, the Computer School hosts the LINDAT/CLARIAH-CZ Research Infrastructure that provides data and expertise for using those data for all Natural Language Processing experiments. For example, it is the main host of the Universal Dependencies collection of annotated data in 100+ languages, provides data for the Shared Tasks in various NLP tasks (machine translation, parsing, deep meaning representation analysis), and can host resulting data and even run services for other researchers to replicate or follow-up on the research results. The repository is CLARIN and CTS certified and offers permanent storage for such results.

A new robotic lab has been recently opened on the Troja faculty campus. It provides good support for practical robot-oriented projects, featuring space for both desktop and floor-operating mobile robots. The lab is equipped with variable furniture, allowing for decent free space configuration and several individual computer desks or a seminar configuration. From the technical point of view, it can serve for fast development purposes and robot repair and development, featuring several 3D printers, 40W CO2 laser cutter, equipment for PCB prototyping and electronics small-scale development, and a sufficient inventory of manual and electrical hand tools.

As for the robots used for research and education, the lab offers several drones, a herd of tiny Ozobot robots, 30 microcontroller-controlled BoeBot educational robots, and a range of mobile platforms of different sizes: several homebrewed mobile sub-feet to two feet sized robots, Roomba-style robots adapted for robot-oriented extensions like small manipulators or payload options, semi-autonomous RC model car, a kids car rebuilt for autonomous drive, a differential drive robot designed for 80kg payload and equipped with UR-5 manipulator. Also, a range of typical control units, actuators, and sensors is available for testing and prototype use - microcontroller boards, embedded SOM boards (NVidia Jetson family), Linux-powered PC-like systems; DC, BLDC, stepper motors, and servos; laser rangefinders at various scales including automotive-grade lidars, cameras, etc.

The staff will help the incoming teams to get acquainted with both the hardware and the data infrastructure to efficiently use all the available resources from the very start.

10. List of the additional benefits (other than listed in the conditions for hosting a DC, see invitation) that the Institution declares to provide for a Dioscuri Centre (i.e.: additional funds, personal benefits, dual career options, relocation support or other):

The Computer Science School offers all employees additional benefits according to the rules of the School, and all benefits that the University provides as a whole; Charles University is the European HR Award (Human Resources Award) holder. Part-time and temporary contracts are common and easily amended according to the needs of employees. Among the benefits, supplemental pension fund contribution is offered to permanent staff, as are meal subsidies, personal development days and sick days, and all the benefits according to Labour Law (min. 5 weeks of vacation (8 for teaching/academic staff), full social security and healthcare insurance, etc.).

International relocation staff at the school will help with securing visa (if necessary), initial health insurance, information on suitable accommodation, personal mobile phone and data services, establishing bank account, etc. Depending of the country of origin, relocation support might be offered.

11. Other information about the internationalization of the research institution, international researchers employed at the institution, the availability of English language seminars etc.:

The Computer Science School as a whole, and especially the Institute of Formal and Applied Linguistics and the Computer Science Institute of Charles University and CE-ITI are fully prepared to take international employees. In fact, there are already several employees from abroad, and the staff is English speaking to take care of any additional hires. Ph.D. students are international at least by 50 percent, from all parts of the world. Naturally, all seminars, Institute meetings and other scientific and research events are held in English. In addition, all Master-level Programmes and Bachelor-level specializations are taught in English (in parallel with Czech, and some only in English).

Additional information about the faculty can be found at <https://www.mff.cuni.cz/en> and more specific information about the Institutes and Departments offering to host the Dioscuri Centre is here:

<https://www.mff.cuni.cz/en/iuuk>

<https://ufal.mff.cuni.cz>

<https://ktiml.mff.cuni.cz>

<https://lindat.cz>