REGISTRATION FORM FOR CZECH SCIENTIFIC INSTITUTION

1. Research institution data (name and address):

The Institute of Computer Science, Czech Academy of Sciences
Pod Vodárenskou věží 2/271
182 07 Prague 8, Czech Republic

2. Type of research institution:

Public research institution – Czech Academy of Sciences (veřejná výzkumná instituce – Akademie věd České republiky)

3. Head of the institution: prof. Ing. Emil Pelikán, CSc.

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

Miloš Jodas – project administrator
jodas@cs.cas.cz, +420 266 053 900
The Institute of Computer Science, Czech Academy of Sciences
Pod Vodárenskou věží 2/271, 182 07 Prague 8, 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:

<u>**Holeňa, Martin**</u> **- Pulc, P. - Kopp, M.:** *Classification Methods for Internet Applications*. Springer: Cham, 2020. Studies in Big Data, 69. 281 pp

This book explores internet applications in which a crucial role is played by classification, such as spam filtering, recommender systems, malware detection, intrusion detection and sentiment analysis.

<u>**Kůrková, Věra**</u> **- Sanguineti, M.:** Classification by Sparse Neural Networks. *IEEE Transactions on Neural Networks and Learning Systems*. 2019, 30(9), IF: 8.793 (2019)

The choice of dictionaries of computational units suitable for efficient computation of binary classification tasks is investigated. It is shown that when a priori knowledge of a type of classification tasks is limited, then the sparsity may be achieved only at the expense of large sizes of dictionaries.

Chang, W.C. - <u>**Kudláček, Jan**</u> **-** <u>**Hlinka, Jaroslav**</u> **-** <u>**Chvojka, Jan**</u> **-** <u>**Hadrava, Michal**</u> **-** <u>**Kumpošt, Vojtěch**</u> **- Powell, A. D. - Janča, R. - Maturana, M. I. - Karoly, P. J. - Freestone, D. R. - Cook, M. J. -** <u>**Paluš, Milan**</u> **-** <u>**Otáhal, Jakub**</u> **- Jefferys, J. G. R. -** <u>**Jiruška, Přemysl**</u>: Loss of neuronal network resilience precedes seizures and determines the ictogenic nature of interictal synaptic perturbations. *Nature Neuroscience*. 2018, 21(12), 1742-1752. IF: 21.126 (2018)

The mechanism of seizure emergence and the role of brief interictal epileptiform discharges (IEDs) in seizure generation are two of the most important unresolved issues in modern epilepsy research. We found that the transition to seizure is not a sudden phenomenon, but is instead a slow process that is characterized by the progressive loss of neuronal network resilience. We found that the multifaceted nature of IEDs is defined by the dynamical state of the network at the moment of the discharge occurrence.

Chouzouris, T. - Omelchenko, I. - Zakharova, A. - <u>**Hlinka, Jaroslav**</u> **-** <u>**Jiruška, Přemysl**</u> **- Schöll, E.:** Chimera States in Brain Networks: Empirical Neural vs. Modular Fractal Connectivity. *Chaos*. 2018, 28(4), 045112. IF: 2.643 (2018)

We analyse the collective dynamics of FitzHugh-Nagumo neurons in complex networks motivated by its potential application to epileptology and epilepsy surgery. We qualitatively simulate the dynamics of epileptic seizures and study the influence of the removal of nodes on the network synchronizability, which can be useful for applications to epileptic surgery.

<u>**Martinková, Patrícia**</u> **-** <u>**Drabinová, Adéla**</u> **- Liaw, Y.L. - Sanders, E.A. - McFarland, J.L. - Price, R.M.:** Checking Equity: Why Differential Item Functioning Analysis Should Be a Routine Part of Developing Conceptual Assessments. *CBE-Life Sciences Education*. 2017, 16(2), rm2. IF: 2.413 (2017)

We provide a tutorial on differential item functioning (DIF) analysis, an analytic method useful for identifying potentially biased items in assessments.

Kalina, Jan: On Locally Most Powerful Sequential Rank Tests. *Sequential Analysis*. 2017, 36(1), 111-125. IF: 0.441 (2017)

This paper studies hypotheses tests based on sequential ranks for different situations. The locally most powerful sequential rank test is derived for the hypothesis of randomness against a general alternative, including the two-sample difference in location or regression in location as special cases for the alternative hypothesis.

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:

Interactions and causality in complex systems - Praemium Academiae of the Czech Academy of Sciences (*the most prestigious scientific award of the Czech Academy of Science)*

2020 – 2024

PI: **Milan Paluš**

Source of funding: **Czech Academy of Sciences**

Amount of funding: **24 300 000 CZK**

National Competence Center - Cybernetics and Artificial Intelligence

2019 – 2022

PI: **Vladimír Mařík** (ICS Co-Investigators: Jaroslav Hlinka, Jaroslav Resler, František Hakl, J. Hlinka being also leader of one of sub-projects)

Source of funding: **Technological Agency of the Czech Republic**

Amount of funding: **22 748 000 CZK**

Air quality Research, Assessment and Monitoring Integrated System

2020 – 2026

PI: (ICS Co-Investigator: **Pavel Krč**)

Source of funding: **Technological Agency of the Czech Republic**

Amount of funding: **10 500 000 CZK**

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

The Institute of Computer Science of the Czech Academy of Sciences has its own building with enough office space to accommodate new staff.

For the young people (Ph.D. students and postdocs) the Institute currently use the newly reconstructed large open spaces which seem to be a very inspiring place to discuss and work in teams on new projects problems.

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

- A powerful **ARIEL Computer System** was designed by experts from the ICS and purchased in the year 2019 and further extended in 2020. The cluster uses the powerful Intel Xeon Silver processors and provides a total of 1320 computing cores. The system is complemented by the central control, data, and visualization server with more than 200 TB disk space. The entire system was designed and optimized for the most common tasks solved in our research projects and our experience shows a significant increase in productivity, especially on simulation projects in the field of the environment.

- ICS has also **three servers dedicated for GPU computing**, which are equipped with 6 GPU units Quadro RTX 8000, 48GB, and 6 GPU computing units Nvidia 1080Ti. These servers will be complemented in 2022 by two additional GPU servers equipped with 16 GPU units on the modern Nvidia Ampere architecture.

- The **ICS Library** provides library and information services to members of the staff of the Institute (and to the general public). The most important and most frequent services provided by the Institute Library are: books, journals and electronic sources acquisition, processing and cataloguing of the resources, loan services, remote access to electronic sources, interlibrary loan service, administration of database of publications, search and outputs in citation databases, consultations concerning Open Access, copyright etc. Since 2017, the ICS Library is a member of the Czech consortium CzechELib that manages acquisition and access to electronic information sources, collections and databases. Thus the ICS Library provides access to 10 important collections (general collections of publishers like Elsevier, Springer or Wiley, and also smaller collections focused on mathematical and technical sciences, like Oxford, Cambridge or Taylor & Francis), 4 huge aggregators of scientific sources (like EBSCO or JSTOR) and 2 citation databases (Web of Science and Scopus).

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 Institute maintains several mechanisms supporting work-life balance of its employees. The **Cultural and Social Needs Fund** being one of them, it is mainly for the Institute employees (and in specific cases also for their family members - spouse, partner and children - for part-time employees, the amount is reduced accordingly …).

a. **Home-Office**: Employees who do not have to work directly in their Institute office may apply for work from home (so-called Home-Office mode).

b. **Young families support**: In April 2019 a new crèche was opened in the Institute building. Children aged 1-6 years can be placed here. This will allow young scientists to stay in touch with their research field and facilitate their return to work.

c. **Contribution to meal expenses**.

d. **Recreational benefits**: The Institute offers various recreational benefits to its employees (and their family members …) up to a given limit per year per employee.

e. **Sports and Cultural Activities Support**: The Institute can contribute funds for various sport activities for its employees up to the given limit per year per employee.

Alternatively, the same amount per year can be contributed to an employee for various cultural activities under the same conditions.

It is also possible to combine the benefits from previous paragraphs "b." and "c." up to the given limit per calendar year and per employee.

Regardless of the above-mentioned limit, the Institute also provides tickets for theatrical performances and concerts for employees. The ticket recipients are selected via random drawing.

f. **Contribution to Pension Insurance** (up to a given limit per month).

g. **Financial social support**: at the request of an employee, in exceptional, justified cases approved by management individually:

It is also possible to provide a **monetary or non-monetary gift to an employee or other individual for an extraordinary activity for the benefit of the employer**, e.g. extraordinary humanitarian and social activity, care for employees and their family members.

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

Staff structure from the viewpoint of the international representation

In the recent period, the Institute has substantially increased its international character; currently there are about **20 %** of researchers of foreign nationality, including researchers from Austria, Brazil, Canada, Chile, Croatia, Germany, India, Italy, Latvia, Netherlands, Slovakia, Spain and Ukraine.

As illustration, the post of Tenure Track Position the ICS has opened annually since 2019, has been awarded to **five** researchers of foreigner nationality versus only **two** of the Czech nationality.

On the other side, all internal Institute communication is bilingual (Czech and English) and most important internal documents are translated into English (the remaining ones to be translated soon).

Similarly, all Institute research seminars:

- Applied Mathematical Logic Seminar

- Graph Theory Seminar

- Seminar Hora Informaticae

- ISCB ČR (The Czech National Group of the International Society for Clinical Biostatistics) Seminar

- Seminar of the Department of Statistical Modelling

- Computational Methods Seminar

- Machine Learning Seminar

- Seminar of the Department of Complex Systems

are in English.