

Projects at the “University”

Project	Description	Required Qualifications	Places Level
Title of Project Responsible Person Department Link to website (If available)	Short description of project	Short descriptions of required qualifications	Number of places Level: [IR II, S-I or MA]*
Grounding abstractness Igor Farkas, prof. Dept. of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	Abstract concepts lie at the core of human cognition, providing it with an immense potential for thinking. Yet, understanding abstractness remains an open challenge in cognitive science, despite an outburst of recent papers published on the topic. The goal of the project is to propose a conceptual framework for concrete and abstract concepts that could be implemented in a neural network, and simulated in a smaller domain.	An ideal candidate would have solid knowledge in linguistics and experience with machine learning (neural networks) and/or programming.	1 S-I
Connectionist modeling in cognitive robotics Igor Farkas, prof. Dept. of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	The goal will be to implement, simulate and analyze a neural network model of a chosen agent's component in a simulated environment. The robotic agent interacts with a human in a block world. E.g., one important component is understanding causality in the physical world, the other one is a robotic theory of mind that is crucial for social interaction. Details will be specified individually.	Systematic work, at least basic programming skills (e.g. Python). Experience with artificial neural networks is an advantage.	1-2 S-I
Automated data analysis for qualitative research Martin Takac, assoc. prof. Dept of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	This is a part of a larger project aiming at exploring the usage of machine learning tools for qualitative research in social sciences, namely processing of free text (sentiment analysis, topic discovery, classification). The students will apply and adapt existing tools and neural network models for tasks such as classification of political speeches to conservative/liberal etc.	Reasonable programming skills, previous experience in Python. Ability to install and adapt existing deep neural network libraries. Previous experience with artificial neural network welcome, but not mandatory.	2 S-I

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Event sequencing module for a model of early social cognition Martin Takac, assoc. prof. Dept of Applied Informatics, Faculty of Math, Physics and Informatics, CUB web	The goal of this project is reimplementation of an existing model of episode sequencing and planning in Python. This is a part of a larger project of computational modeling of early development of social skills in human-robot interaction. The module would serve for intention recognition and collaborative action execution.	Previous experience with programming in python required. Previous experience with artificial neural network welcome, but not mandatory.	1 S-I
Mindfulness meditation, electroencephalography and brain stimulation Barbora Cimrová, PhD. Dept of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	Mindfulness meditation (MM) is a well-known practice with a positive impact on well-being, cognitive functions (attention, working memory, executive functions), immunity, and other aspects of practitioners' life. The effects of MM includes structural and functional changes of the brain. The goal of the project is to make a theoretical overview of the state of the art research on mindfulness meditation and potential combination of this method with brain electrical stimulation; to design and eventually perform an experiment regarding this topic.	Experience with an EEG is an advantage	1 S-I
Human-robot Interaction in Virtual Reality Kristína Malinovská, PhD. Dept of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	HRI becomes one of the most popular interdisciplinary topics highly related to cognitive science. The domain of cognitive robotics studies and offers natural ways of building humanlike robots in the way they will understand and align with their human users. However, such robotic platforms are not in abundance and often trained using their simulated counterparts. This project is an assignment spanning from dense literature review up to experimental design and/or programming of the HRI-VR experiments.	This project is a good opportunity for joint work. One student should have a background in psychology, or linguistics, and the other one experience with machine learning and/or programming.	1 S-I
Language games Kristína Malinovská, PhD. Dept of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	The so called language games are a very powerful tool of studying emergence of communication and grounding of meaning. Stemming from the game theory, they can be used in a computer simulation with agents as well as for behavioral experiments with human subjects. This yet not well explored field in cognitive science requires further attention in many respects. This project is an assignment spanning from dense literature review up to experimental design and/or programming of experiments.	This project is a good opportunity for joint work. One student should have a background in psychology, or linguistics, and the other one experience with machine learning and/or programming.	1 S-I

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Project	Description	Required Qualifications	Places Level
Biologically plausible learning in neural networks Kristína Malinovská, PhD. Dept of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	The deep neural networks have become immensely popular in last 10 years. Despite their rapid development and super-human performance, they are still many research prospects to be studied in this area including the algorithms used for training the networks. Usually deep networks are trained using standard error backpropagation, a method developed in 1980's along with the multilayer perceptron. However powerful, the BP has been shown to be biologically implausible and new algorithms have been proposed and are still being developed. This project is an assignment spanning from dense literature review up to the experimental work with existing novel algorithms and/or being a part in proposing new ones.	Mathematics and programming skills required at least on a basic level. Experience with artificial neural networks is an advantage.	1-2 S-I
Few-shot learning and prototype theory of categorization Kristína Malinovská, PhD. Dept of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	The few-shot learning approach in artificial neural networks has recently become a popular way to address the problem of large labeled dataset requirements of traditional deep architectures. Simply said, in this paradigm we rather endow the network with some learning and generalization abilities than train it to generalize over a particular kind of data. The prototype theory of Eleanor Rosch and others have been proposed quite a long time ago, yet currently it can find a lot of use in so popular deep learning. This project is an assignment spanning from dense literature review up to the experimental work with existing models and/or being a part in proposing new ones.	Mathematics and programming skills required at least on a basic level. Experience with artificial neural networks is an advantage.	1 S-I
Cognitive and brain mechanisms of semantic memory retrieval Martin Marko, PhD. Centre for Experimental Medicine, Slovak Academy of Sciences web	A challenge in the research on human cognition is to understand the mechanisms enabling fluid retrieval of semantic knowledge that is suitable for current contexts and situational demands. This project is aimed to investigate these (domain-general and domain-specific) mechanisms and processes that underpin semantic memory retrieval in healthy participants, using experimental manipulation of relevant cognitive or neurobiological systems. Such manipulations may involve either various forms of cognitive load and interference or (optionally) non-invasive brain stimulation (tES), depending on the availability of the required device(s) and the currently ongoing experiments in our lab at that time. Note: this is an empirical assignment that includes duties associated with data collection. Thus, students taking this project will be expected to recruit participants, administer experimental sessions (on their own or in collaboration with each other), and analyze the empirical data (under the supervision).	The ability to manage and execute experimental sessions and assess the findings. For this, experience in empirical/experimental research and quantitative methodology is an advantage.	1-2 S-I

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Project	Description	Required Qualifications	Places Level
Brain simulation, sensory gating and cognitive inhibition Igor Riečanský, PhD. Centre for Experimental Medicine, Slovak Academy of Sciences web	Cognitive inhibition is essential for goal-directed behavior. This project will investigate the possibilities of modulating brain inhibitory processes using non-invasive transcranial direct current brain stimulation. An experimental approach will be adopted using behavioral and electrophysiological methods (EEG, EMG).	Experience in experimental research and quantitative methodology is an advantage.	1-2 S-I
Barriers of people's climate change beliefs and pro-environmental behaviors Jakub Šrol, PhD. Center of Social and Psychological Science, Slovak Academy of Sciences jakub.srol@savba.sk web	Despite the fact that people around the world voice their concern over negative consequences of climate change, their actual engagement in pro-environmental behavior is rather low. Researchers uncovered many barriers that people report as reasons for not engaging more with environmental issues, spanning from the lack of understanding of climate change, resulting from cognitive biases that increase psychological distance from the issue, or barriers driven by feelings of helplessness and guilt. The aim of the project is to gain further insight into barriers of people's climate change beliefs and pro-environmental behaviors, and to find ways to improve people's engagement with this issue.	Background in psychology is an advantage	1 S-I
Interventions to reduce people's susceptibility to fake news and conspiracy theories Jakub Šrol, PhD. Center of Social and Psychological Science, Slovak Academy of Sciences jakub.srol@savba.sk web	Media, politicians, and scientists voice their concern over large proportions of people being susceptible to fake news and conspiracy theories. Although some debiasing methods, such as inoculation by counterarguments, have already proved effective in this regard, they all have their limits – e.g. successful inoculation has to occur before the exposure to conspiracy theory content. The aim of the project is to create and test the effectiveness of various new interventions – such as increasing information and scientific literacy or priming critical thinking about social media content – in reducing the belief in various popular conspiracy theories and trust in fake news.	Background in psychology is an advantage	1 S-I

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Studying effects of virtual reality training on motor rehabilitation and visual working memory enhancement Roman Rosipal, PhD. Institute of Measurement Science, Slovak Academy of Sciences web , web1	Technological advancements based on virtual reality (VR) offer various challenges for research and medical treatment. The study focuses on two objectives related to healthy subjects and hemiparetic patients after stroke. First, we test the hypothesis of whether cognitive training using an appropriately designed VR environment enhances perceptual and cognitive performance in healthy subjects. Second, we test the hypothesis whether experience with training in VR (in combination with motor-imagery based brain-computer interface) will enhance narrow-band scalp-recorded EEG oscillations. Semestral projects will carry a vital practical and analytical component connected to real EEG data recorded during the VR-based experiments.	Systematic work, basic principles of statistical analysis and testing, programming in Matlab is an advantage.	1-2 S-I
AI biases Tomas Gal, PhD Dept of Applied Informatics, Faculty of Math, Physics and Informatics, Comenius Uni. web	Human cognitive biases are mostly considered as a burden from pre-civilized times. They help us, however, to solve everyday practice, routinely. The aim of this research projects focuses on two questions (1) whether the AI should be stripped from all human-like biases and (2) if not, what kind of biases should be mimicked. Practical output of this research will be a conceptual model of economically profitable ethical AI.	Background in psychology or philosophy is an advantage.	1-2 S-I
Development of beliefs by artificially modulated states of mind Tomas Gal, PhD Faculty of Math, Physics and Informatics, Comenius Uni. web	Research into altered states of mind, done by various methods, like dance, meditation or controlled stress.	Background in psychology is an advantage	1 S-I
Human being and information technology Emil Visnovsky, prof. Faculty of Philosophy, Comenius University web	Project will focus on the analysis and functions of information technology and its varieties in human life from a philosophical point of view based on contemporary cognitive science and AI.		1-2 S-I

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