UNIVERSIDAD POLITÉCNICA DE MADRID

Expression of Interest – UPM Supervisor

Marie Skłodowska Curie Action –Postdoctoral Fellowship 2023 (MSCA-PF-2023)

Contact Person/Scientist in charge	**Name**	Alexander
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Department /Institute /Centre	**Name**	Centro de Tecnología Biomédica
	Address	Campus Montegancedo, Pozuelo de Alarcón
	Province	Madrid
Research Area		Social Sciences and Humanities (SOC) / **Life Sciences (LIF)** / Economic Sciences (ECO) / Mathematics (MAT) / Information Science and Engineering (ENG) / **Physics (PHY)** / Environment and Geoscience (ENV) / Chemistry (CHE)
Brief description of the Centre/Research Group		The project will be carried out at Centro de Tecnología Biomédica (CTB), Universidad Politécnica de Madrid (UPM). CTB was created on February 13, 2008. Its mission is multidisciplinary research in the areas of biomedical technology and neuroscience. CTB is part of the "CEI Montegancedo I2Tech", which holds the title of "Campus de Excelencia Internacional", with the purpose of creating a place of high quality and great facilities to draw the best students and researchers, as well as foster the settlement of companies. One of the main objectives of CTB is the development of new methodologies in neuroscience, including a study of human brain activity for brain-computer interface (BCI) applications. The project will be implemented at the **Ageing Lab, Methods group** (http://ageinglab.ctb.upm.es/human-cognitive-abilities-and-brain-to-brain-interfaces) working with EEG, neuroimage, modelling of biological systems, BCI, etc. Among many facilities involved in studying brain functioning, CTB has several supporting units, such as clinical trials support, design and management; TIC infrastructure and support; technology transfer, including spin-off temporal nurturing; financing office; biomedical technology documentation center; education area management, including Master and PhD programs and Continuous Education programs. CTB also has administrative staff to help manage project finances and technical staff to maintain computers and Internet servers. In addition, the group has a 16-channel wireless LIVEAMP EEG system by Brain Products (Germany). Thus, the laboratory infrastructure, equipment and materials allow the complete execution of the project.

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Project description	The project is aimed at solving an urgent scientific problem at the intersection of nonlinear dynamics, cognitive neuroscience and convergent technologies, related to the development of physical and mathematical methods for analyzing neurophysiological data using the concepts of modern nonlinear dynamics, neuropsychology, and data science. The main objectives of the proposal include the creation of efficient algorithms for express analysis of electrical brain activity, reflecting the relationship between the brain state during the perception of ambiguous stimuli and performance efficiency of the task. The scientific novelty of the project lies in the development of an integrated approach to the combined analysis of neurophysiological signals, as well as the characteristics of human brain states associated with visual perception and attention. The project implies the development of EEG-based noninvasive brain-computer interface (BCI) and brain-to-brain interface (BBI) which will allow real-time brain state monitoring, as well as voluntary and involuntary control of visual perception and attention. BBI will be developed to control visual perception and attention of the assistant using the leader's brain activity while performing a cognitive task. The created BCI and BBI will be tested by volunteers in laboratory conditions and strategies will be formulated for their use by people with partial cognitive impairments. The results of this project will make a significant contribution to the use of BCI and BBI for real-time monitoring and controlling cognitive functions (mainly perception and attention), as well as to improve interaction between people with cognitive impairments. The project will provide significant progress in understanding cognitive functions and practical implementation of advanced BCI technologies for identifying related changes in the human brain activity associated with visual perception, based on the methods and approaches of nonlinear dynamics, neuroscience, and big data analysis.
Applications: documents to be submitted and deadlines	CV, letter of motivation, letter of references, deadline **April 30, 2023**