Thesis Project Offer

Joint Research and Education Programme "Palestinian-German Science Bridge PGSB"
Forschungszentrum Jülich GmbH & Palestine Academy for Science and Technology

Thesis type*

☐ BSc	☒ MSc	☐ PhD	Intended starting date (approx.): summer 2022

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Project description*

Deep learning-based analysis in functional neuroimaging

Neuroimaging recordings, such as magneto- and electroencephalography (MEG, EEG) or functional magnetic resonance (fMRI) provide information about the underlying neuronal processes at different spatial and temporal scales. Tackling the aim of decoding the mechanisms underlying specific brain functions, the challenge lies in combining such complementary information as these different activation profiles act on different spatial and temporal scales.

In this project, we aim at characterizing resting state and task related networks from neuroimaging data in the living human brain utilizing novel deep learning techniques. To study the functional network of the brain in patient and control groups it necessary to identify the so-called network nodes (brain areas involved in processing information). In a second step, we will use the developed techniques for multimodal data integration by means of combining different strategies from machine and deep learning to optimally extract the spatial and temporal features of neurophysiological processes [1].

For analysis, we will use existing recordings of mainly from MEG and EEG and but also from simultaneous fMRI and EEG recordings recorded in patients and healthy volunteers. The developed algorithm will be applied to the analyze task related data (i.e., auditory, visual and motor tasks), as well as, so-called resting state activity from multimodal neuroimaging recordings for cross-modal data integration.

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The major focus of this project is twofold: 1) we will train a model to learn how the network in healthy controls differs from data recorded in patient groups such as, Depression or other neurological diseases 2) we will investigate if the identified spatio-temporal maps can be used as biomarkers to classify neurological disorders.

Reference:[1]
A. Hasasneh, N. Kampel, P. Sripad, N. J. Shah, and J. Dammers, "Deep Learning Approach for Automatic Classification of Ocular and Cardiac Artifacts in MEG Data," *J. Eng.*, vol. 2018, pp. 1–10, May 2018.

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