

Thesis Project Offer

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

Thesis type*

<input type="checkbox"/> BSc	<input checked="" type="checkbox"/> MSc	<input type="checkbox"/> PhD	Intended starting date (approx.): summer 2023
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Contact details of supervisor/responsible host at Forschungszentrum Jülich

Title*	Degree	First name*	Surname*
Mr.	Dr.	Jürgen	Dammers

Phone*	E-mail*
+49 2461 612106	j.dammers@fz-juelich.de

Function*	Institute and homepage of institute*
Group Leader Neuroimaging Data Science	https://www.fz-juelich.de/de/inm/inm-4/forschungsgruppen/nids

University affiliation in Germany*
RWTH Aachen / FH Aachen

Co-Supervisor at Palestinian university (if applicable)

Title	Degree	First name	Surname
Mr.	Dr.	Ahmad	Hasasneh

Phone	E-mail
+972 2 2941999 Ext. 1939	Ahmad.Hasasneh@aaup.edu

University/institution	Department/faculty/institute
Arab American University - Palestine	Department of Natural, Engineering, and Technology Sciences

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.

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

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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.

Date*

Signature*

31.01.2023

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