Two PhD Positions in Machine Learning/Neuroimaging at Charité

The Brain and Data Science Lab of Dr. Stefan Haufe at Charité – Universitätsmedizin Berlin is looking to recruit two highly motivated PhD students. Appointments can be made for four years starting immediately. Applications will be considered until positions are filled. See braindata.charite.de for further information.

1. Theory and practice of interpreting machine learning models
   Machine learning systems have recently set new standards for solving a wide range of problems by leveraging vast amounts of training data. But they have remained “black boxes” whose internal workings are too complex to be comprehensible by a human. Especially in the health domain, it is desirable to explain and visualize the decisions of ML models. Recently, it has been shown that many existing explanation methods can be misleading even when using simple linear ML models [Haufe et al., 2014; Kindermans et al., 2018]. In this PhD project, a bottom-up approach will be performed, in which correct interpretation will be defined axiomatically in mathematical terms, and used to benchmark novel and existing explanation methods using synthetic ground-truth data. The results will also be applied to clinical use cases. This project can be carried out in collaboration with Prof. Klaus-Robert Müller at TU Berlin.

2. Estimating and characterizing EEG/MEG functional connectomes in aging and dementia
   The study of functional brain interactions promises to greatly enhance our understanding of mental diseases. EEG and MEG make it possible to brain dynamics at high temporal scales but suffer from low spatial resolution, which induces false detections of brain connectivity. While the problem has been overcome for linear connectivity metrics [Nolte et al., 2004; Haufe et al., 2013] it still persists for non-linear interactions such as phase-amplitude and amplitude-amplitude coupling. This PhD project will establish a best practice to reconstruct non-linear connectivity from EEG/MEG data. The developed pipeline will be applied to study brain connectivity in aging and neurological conditions (dementia) using large EEG/MEG datasets. Moreover, interpretable machine learning will be used to relate functional connectome data to behavioral and clinical variables.

The Brain and Data Science Group at Charité
We develop machine learning and signal processing methods for the analysis of non-invasive brain signals in health and disease. We are located at the Berlin Center for Advanced Neuroimaging (BCAN) on the historic Charité Campus Mitte in the center of Berlin (see picture), and are embedded in a stimulating inter-disciplinary research environment. The group is funded by an ERC starting grant of the European Union.

Requirements
Candidates are expected to hold a very good MSc or equivalent degree preferably in a technical field (machine learning, computer science, statistics, mathematics, computational (neuro) science, data science, physics, electrical/biomedical engineering, etc.). All positions require a solid math/statistics background, proficiency in written English, and good coding skills (e.g., Matlab, Python, C++, Java). Prior experience with functional neuroimaging data is a plus. Applications should include a letter of motivation, a CV, transcripts and degree certificates, as well as (if available) references, an English-language writing sample, and a coding sample (e.g. link to a github project). Applications should be sent by email to stefan.haufe@charite.de. All documents should be contained in a single pdf.

PS: Inquiries about MSc projects, lab rotations and postdoctoral fellowship applications are also welcome.