

## Brain State Decoding Lab / Dr. Tangermann

### About the project

Deep brain stimulation (DBS) is an established therapy for Parkinson's disease (PD). Currently, after electrode implantation, DBS parameters (for example, amplitude or frequency) are tuned by hand by an expert clinician. This infrequent tuning has been found insufficient to adapt to fast changes in the disease progress or varying symptoms intensity due to e.g. medication.

These challenges call for research on closed-loop DBS systems that allow to adapt stimulation parameters in real time as a function of brain signals such as EEG, ECoG or LFPs. To this end, we seek to develop state-of-art control systems (based for example in reinforcement learning) able to cope with complex non-stationary brain dynamics, which in the context of PD, are mainly caused by disease progress, stimulation, and medication.

We investigate such closed-loop approaches in collaboration with our partners at the University Medical Center Freiburg---where the implantation surgeries and inpatient visits take place---and with a company focussing on neural implant technology.

### Working areas (among others):

- Development of theories (mathematics, probability theory) and algorithms in the field of machine learning for closed-loop control of neurostimulation systems.
- Evaluation of control strategies in simulations.
- Paradigm development, software implementation, execution and analysis of open- and closed-loop experiments with (German speaking) patients.
- Scientific dissemination of results.

### Your background:

#### Requirements:

- MSc degree in mathematics or computer science with excellent grades in one of the following fields: artificial intelligence, machine learning, reinforcement learning, control theory.
- Profound mathematical knowledge (specifically probability theory, statistics, linear algebra).
- Fluent in Python and practical experience with Matlab.

**Nice to have:**

- Hands-on experience in the design, execution and analysis of psychophysical or electrophysiological experiments
- Knowledge about time series signal processing, ideally hands-on experience with brain signals (EEG-, EMG-, EOG-, ECoG, LFP data)

## The Brain State Decoding Lab:

The Brain State Decoding lab under the lead of Dr. Michael Tangermann has a profound history of brain-computer interface (BCI) research. It is embedded into the Computer Science Dept. and part of the cluster of excellence BrainLinks-BrainTools (BLBT). The lab's research activities range from method development to applications in the clinical context and for healthy users. The lab has tight collaborations with other labs of the Computer Science Dept., as machine learning / AI is one of the emphasized research directions in Freiburg. Common projects with the University Medical Center are the basis for investigating novel machine learning approaches for the real-time analysis of brain signals and their use in novel clinical applications.

Implementing an equal-chances policy and family-friendly working conditions, the Brain State Decoding lab explicitly encourages the application of female researchers with the above qualifications. Handicapped applicants will be given priority to non-handicapped applicants, if they have comparable qualifications.

([www.bsdlab.uni-freiburg.de](http://www.bsdlab.uni-freiburg.de), [www.brainlinks-braintools.uni-freiburg.de](http://www.brainlinks-braintools.uni-freiburg.de))

## The University:

The University of Freiburg was founded in 1457. Alma mater of many famous philosophers, top researchers, and Nobel laureates, it offers undergraduate and graduate studies in all important disciplines for more than 21,000 students from over 100 nations. ([www.uni-freiburg.de](http://www.uni-freiburg.de)). The University Medical Center is one of the largest medical facilities in Europe and host of the Faculty of Medicine, a top ranking German medical school.

## The position:

- Payment level: TV-L E13 (100%)
- Start date: immediately
- Duration: 24 months (prolongation possible)



## How to apply:

Please send your written application in the format of the download form ([http://www.we-are.de/applications/phd\\_application\\_form.doc](http://www.we-are.de/applications/phd_application_form.doc)) via email to [michael.tangemann@blbt.uni-freiburg.de](mailto:michael.tangemann@blbt.uni-freiburg.de) stating the position code **PhD-aDBS**.