Patient in the Loop: Tremor Control using Deep Brain Stimulation and Wearable Motion Sensors

Available topic for a DAAD Scholarship application period 2020-2024

Deadline for PhD-Start in October 2020: **01.06.2019**

**Description:**

Deep brain stimulation (DBS) is a treatment method for symptoms of movement disorders like Parkinson’s disease, essential tremor and dystonia. During a neurosurgical intervention, small electrodes are implanted into specific regions of the basal ganglia, which are responsible for control of motor functions. Through electrical impulses emanating from the electrodes, the regions of interest are excited such that symptomatic movement patterns are significantly reduced.

The IPANEMA body sensor network is a tool for synchronized measurement of physiological and biomechanical parameters. It has been developed at the Institute for Medical Information Technology (MedIT) during several research projects. The sensor nodes contain motion sensors like accelerometer, gyroscope and magnetometer and can arbitrarily be attached to different body locations.

The aim of this PhD work is an automatic detection of the motor symptoms using distributed wearable motion sensors and the control design of DBS using motion signals as sensor feedback. The contents of this project include:

- Modelling of mechanisms of electrical stimulation in the human brain for control of motor functions
- Implementation of algorithms for automated detection of motor symptoms, such as tremor, using wireless wearable motion sensors
- Development of an interface between sensor output and the external DBS device
- Implementation and investigation of control strategies for adapting the excitation level of DBS
- Validation of the closed-loop approach conducting a clinical trial (using feedback of the control strategy to the patient)

PhD-Candidate from different disciplines (Electrical Engineering, Control Engineering, Biomedical Engineering, Human-Computer-Interaction, Biomedical Physics and Computer Science) are welcome to apply for the work. The candidate should have:

- Strong background in programming and/or control design and/or data analysis and/or electronic hardware design.
- Commitment to independently develop and apply new scientific methods.
- Strong English skill for reading and writing scientific publications.
- Fascination to work in a professional environment with world-class scientists in the field of biomedical engineering.

The RWTH Aachen University, a research university located in North Rhine-Westphalia, Germany, is the largest technical university in Germany. National rankings regularly identify RWTH Aachen as the best university in Germany in the fields of engineering. The Institute for Medical Information Technology (MedIT) has been founded in 2003 and belongs to the Faculty of Electrical Engineering and Information Technology at RWTH Aachen University. Main
research fields of the chairs are "Automation Technology for Medicine", "Physiological Measurement Technology", and "Personal Healthcare".

**Notifications:**

1) The application will go through two phases: First, the application form will be sent to MedIT for selection of the candidate. An online interview and if needed, an online presentation of your previous work will be requested. In the second phase, together with MedIT you will apply for DAAD scholarship.

2) Your first application form should include:
   - A curriculum vitae
   - A motivation letter states why you want to join the program
   - A proof of sufficient English skills (TOEFL IBT 95 or equivalent)
   - Your education certificate and records

   Please send your application form directly to medit@hia.rwth-aachen.de. The contact person is Dr.-Ing. Chuong Ngo (ngo@hia.rwth-aachen.de)

3) Time schedule:
   - Application in summer of this year leads to the beginning of German Language Courses in May/June next year and a start of a PhD work at MedIT in October next year.
   - Be aware of your national DAAD application deadline

4) DAAD committees decides in a final round about the scholarship.