

Real-time movement data acquisition and analysis software for patients with DBS for movement disorders

Project Management and Software Development
for Medical Applications

General Info

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Project Abstract

In this project, a python-based software will be developed to acquire, process, and analyze real-time data measured from movement sensors attached to the limbs of Parkinson/Essential Tremor patients. The software should be able to record data and provide a report about the status of the patient.

Background and Motivation

CereGate is a young, neurotechnology company developing novel communication interfaces with the nervous system. The key components of our interfaces are the software platforms that we develop.

We are currently working on improving symptom control for patients who receive Deep Brain Stimulation (DBS) implants for movement disorders, such as Parkinson's Disease or Essential Tremor [2, 3]. These conditions are presently successfully treated with DBS but there is room for further improvement, for instance related to how the therapy addresses freezing of gate (common in Parkinson's) or tremor control while mitigating side effects induced by stimulation itself. The goal of the

project is to give more insight into and optimize the DBS programming techniques. To achieve this, we intend to use information acquired through motion sensors and detect patient states to be used as feedback to adjust the therapy.

Wearable motion sensors system (figure 1) is a portable, modular IMU sensor network which collects motion data from multiple limbs in real-time. The system is widely used for quantifying movement behavior such as gait or balance in movement disorders [1].

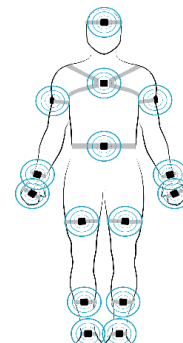


Figure 1. Motion sensor network [1]

Student's Tasks Description

The student will

- Develop python API for data acquisition from wearable movement sensors
- Design a UI for the app using Qt Creator
- Develop a PyQt-based desktop app for data acquisition and analysis
- Computation of quantitative measures of tremor/movement data

Please send the completed proposal to ardit.ramadani@tum.de, lennart.bastian@tum.de and tianyu.song@tum.de. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.



- Develop a (realtime) tremor/FOG detector
- Add a feature to generate reports
- (Unit) test and documentation

In addition to learning how to analyze motion data from Parkinson's patient, the student will also learn about best practices in software development, software architecture and design patterns.

Technical Prerequisites

complete this project, the student should have following skills:

- Python programming
- Experience with version control systems such as Git
- Experience in Qt/PyQt (nice to have)
- UI design (nice to have)
- Experience with unit test (nice to have)

References

[1] <https://apdm.com/wearable-sensors/>

[2] Krauss, J. K., Lipsman, N., Aziz, T., Boutet, A., Brown, P., Chang, J. W., ... & Lozano, A. M. (2021). Technology of deep brain stimulation: current status and future directions. *Nature Reviews Neurology*, 17(2), 75-87.

[3] Koeglsperger, T., Palleis, C., Hell, F., Mehrkens, J. H., & Bötzel, K. (2019). Deep brain stimulation programming for movement disorders: current concepts and evidence-based strategies. *Frontiers in neurology*, 10, 410.