IDP: Master Informatics
Tremor Detection and Reduction System

Short description of Noxon:

Noxon combines mass printing processes with functional printing inks to create an array of bionic sensors directly on textiles. By integrating our bionic sensors into sportswear, we enable novel medical solutions in mobility. For example, Noxon's bionic sensors can be integrated into an arm sleeve to suppress tremors in Parkinson's patients. The IDP will be an integral part of the development of this solution.

Goal of IDP:

The goal is to build a tremor detection system based on electromyography data and movement data from an IMU sensor.

Context:

Tremor is an involuntary motion which is a common complication of Parkinson's disease and Multiple Sclerosis. In general, tremors are rhythmic pseudo-periodic oscillations at the limps, that make the activities of daily life (ADL) harder.

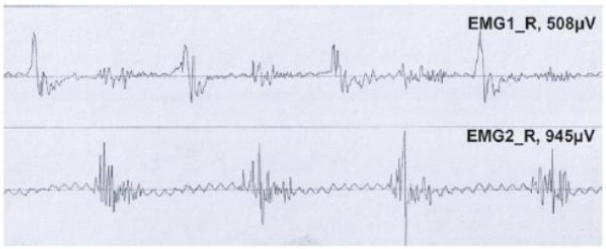

FIGURE 1: Patterns of muscle contraction in Parkinson's disease tremor.

Functional muscle stimulation is a promising technique that can reduce tremor amplitude by over 80%. In this project you will provide a tremor period estimation from IMU and EMG data. This data will be used in a first step to perform antagonist muscle stimulation to change the limb impedance[1]. The future step will include an out-off-phase stimulation, to decrease muscle fatigue, discomfort and increase tremor amplitude reduction.

[1] Activte all muscles and try to shake your fingers. Now be relaxed and shake your fingers now

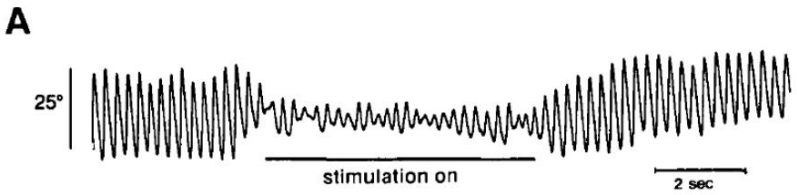

Abbildung 4.10.: Tremor reduction [57]

Currently, these experiments are performed in the lab. Through the mobile electrode system of NOXON, this treatment could be brought to every patient in their everyday life.
One example is seen here: https://youtu.be/emACl7nyG6U

Project Roadmap:

- Literature review and organization of sample data
- Interviews with experts and patients
- Classification of sample data
- Installation of EMG and IMU system in mobile arm sleeve
- Data collection
- Data transfer, server backend, and online classification algorithms
- Error loops
- Presentation

Optional:

- Control via mobile app
- Integration of antagonist muscle stimulation in arm sleeve based on Hill-Modell
- Out-off-Phase stimulation
- Pitch of results at events

Tech Stack:

VS Code, C++, Python, Github, Copilot, Firebase, Flutter / React, ESP32

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We are looking forward to hearing from you!