EEG and STN analysis for automatic sleep stages detection

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Requirements	3rd year / Master 2
Duration	6 months
Location	Clinatec – bat 43 – 17 avenue des Martyrs - 38054 Grenoble Cedex

Background:

Parkinson's disease (PD) is the second most common neurodegenerative disease after Alzheimer's. In addition of the very well-known motor symptoms (tremor, muscle stiffness, akinesia…), around 70% of patients affected by PD suffer from sleep disorder and this is highly affecting their quality of life. In order to treat these patients, we are studying subthalamic nucleus (STN, brain structure) deep brain stimulation's (DBS) impact on sleep disorder. This tratment is already used to alleviate motor symptoms, but knowing the key role that the STN could be playing in the wake/sleep behavior, we believe that we might treat sleep disorders by finding the right stimulation parameters.

If we want to enhance the efficiency of the stimulation we need to detect the different sleep stages easily in order to be more precise when stimulating. One of the main tool to distinguish the different sleep stages is the cortical electrical activity (the cortex is the brain's superficial structure) wich contains specific patterns for each sleep stage.

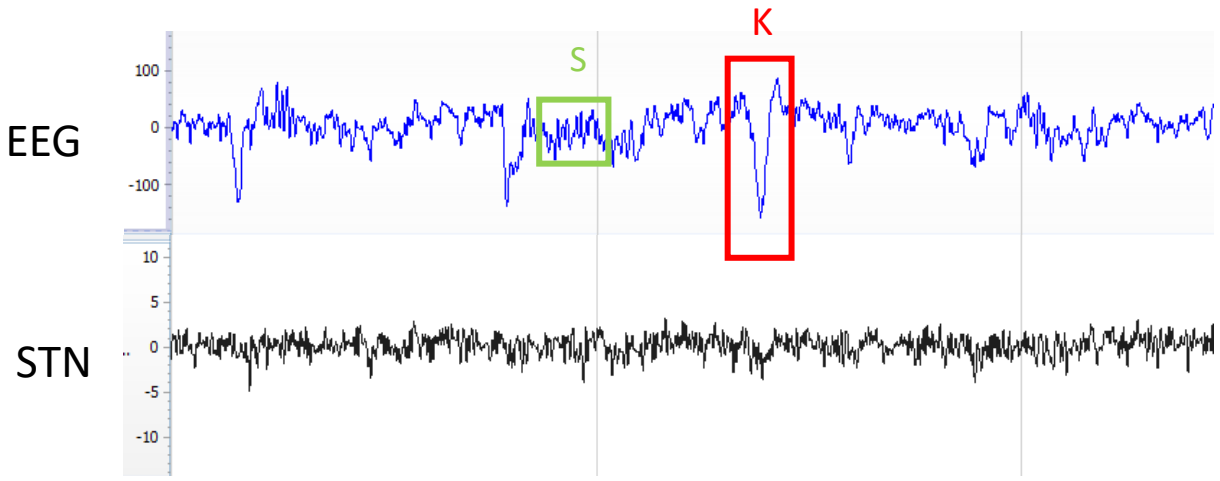

Figure 1 Illustration of cortical (EEG) and subthalamic (STN) activity typical of the second stage of sleep. With K : Kappa complex and S : sleep spindle.

Knowing that cortex and STN are closely linked, if we can find in the STN's activity the same specific patterns of sleep stages that the one in the cortex, we could put into place closed-loop stimulation. This kind of stimulation allows better customization for each patient hence better efficiency.

Tasks:

Code an app that automatically detects and quantify specific patterns of each sleep stage.

Code an app to analyse characteristics of the signals (wavelenght, power…).

Code an app that automatically scores sleep stages of 30s epochs of STN activity.

Required skills:

Ability to code in Matlab

Signal processing

Reading and understanding scientific articles

Location:

The Edmond J. Safra biomedical research center located in Grenoble works in collaboration with the CEA-Leti, the teaching hospital of Grenoble, Tne University of Grenoble Alpes and the Fonds de Dotation Clinatec. This unique center gathers technologists, biologists and clinicians and aims at developping and optimizing new treatments for patients. Nowadays, several projects going after new treatments for neurodegenerative diseases and handicap are ongoing at CLINATEC.
So several instruments will be available during the internship's duration.
The Fonds de dotation CLINATEC welcomes today 10 researchers, postdocs, engineers and PhD students. Collaborations are in process with the CEA, HEPIA at Geneva, the neuroscience institue of Grenoble, the Laboratory of psychology and neurocognition of the University of Grenoble Alpes and the Institute of mollecular and cellular pharmacology of Nice.

Remuneration :

Depending on the internship agreement and minimum legal wage.

Contact :

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