Quantitative evaluation of hypertonia and rigidity by acceleration and force measurements

Background:
Rigidity and hypertonia (abnormally increased muscle tone) are typical symptoms of different neurological diseases such as Parkinson's disease. Depending on the type of disease different rating scales are available in clinical practice allowing the neurologist to estimate the severity degree of the symptoms. The disadvantage of those scales is that they are subjective and semi-quantitative which makes comparison between physicians and reproducibility difficult.

Aim:
The aim of the Master thesis will be to evaluate the feasibility of using force and acceleration sensor measurements to make the above described evaluations more objective. Recorded data for healthy subjects and patients will have to be analyzed and objective statistical parameters describing the state of the patient and changes due to different treatments should be defined. One specific issue will be the repeatability of the measurements as the grip of the patient's limbs might change between measurements.

Method:

With an already existing prototype - a glove including force sensors for different fingers and an acceleration sensor (see figure) - existing data will be analyzed and new data will be acquired in healthy subjects and in patients during the Master thesis. During the clinical symptom evaluation the physician wears the glove and performs specific movements with the patients' arms and legs. The signal should be processed and statistical parameters describing the severity of the symptoms should be extracted from the signal and compared to the physician's subjective evaluation. The repeatability of the measurements should be analyzed based on those measurements. In addition, an option for the Master thesis will be to further improve the prototype and to implement new ideas increasing data quality.
Organisation:
Supervisor at the University of Applied Sciences, Institute for Medical and Analytical Technolo-
gies: Dr. Simone Hemm-Ode (Docent at Linköping University):
http://www.fhnw.ch/lifesciences/ima/institute-for-medical-and-analytical-
technologies?set_language=en
Our international office will help to find accommodation in the vicinity of the University.

Infrastructure:
Acceleration measurements have already been performed to evaluate tremor in Parkinson's
disease. In consequence our group has already an expertise in such evaluations. Lab infra-
structure, Matlab licence and PC are available.

References:
1. SHAH A., COSTE J., LEMAIRE J., SCHKOMMODAU E., HEMM S. A Method To Quantitatively
2. SHAH A., COSTE J., LEMAIRE J., SCHKOMMODAU E., HEMM-ODE S. A method to quantita-
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3. HEMM S., WÄRDELL K., Stereotactic implantation of deep brain stimulation electrodes: a review
   of technical systems, methods and emerging tools. Medical and Biological Engineering and