Examensarbete 30 hp i Medicinsk Teknik

Development of methods to segment active muscle cells
- The "Virtual needle-EMG" project

Medicinsk teknik FoU är en forsknings- och utvecklingsavdelning vid Centrum för Informationsteknik och Medicinsk teknik på Norrlands universitetssjukhus, Region Västerbotten. Avdelningen bedriver internationell forskning, utveckling och utbildning inom det medicintekniska området, med kompetens inom exempelvis sensorer och mätsystem, bild- och signalanalys och biomekaniska modeller. MT-FoU står också bakom kompetenscentret AI for Medicine in Northern Sweden, AIM North, som stöttar kliniska forskningsprojekt med teknisk metodkompetens inom maskininlärning och AI.

Background

Skeletal muscle diseases are today diagnosed with invasive techniques, such as using a needle electrode inside the muscle (needle electromyography, EMG). In the "Virtual needle-EMG" project at Region Västerbotten/Umeå University, we are developing non-invasive, ultrasound imaging techniques that should be able to do a "virtual needle EMG" using ultrasound imaging. This means that we image the whole muscle and examine the whole muscle simultaneously, without doing multiple sticks with the needle. We have already developed methods to accomplish this using the (subtle/invisible) tissue motions that occur during activation (Blind source separation model: Rohlén et al, SciRep, 2020; and 3D CNN model Ali et al., 2020). However, the performance is not optimal and we are seeking new ways to detect the muscle cell activation.

Hypothesis: Ultrasound imaging is based on sending short pulses of sound into the tissue. When the pulses propagate through the tissues in the body, the different states of tissues modulate and changes the frequency content of the sound and reflects it back to the sensor. In this project, we hypothesise, that the reflected sound changes its frequency components in regions where muscle cells are activated. As the muscle cells are activated, they become thicker, and this changes the frequency characteristics of the backscattered sound signal.

Aim

Develop and evaluate methods for segmentation of regions with contracting muscle cells in ultrasound images. Methods may include signal and/or image processing tools, or machine learning approaches.

Work description

Details will be decided together with the master student.

References

Rohlén et al., Scientific Reports, Nature Publishing Group, 2020

Handledare vid Medicinsk teknik FoU
Christer Grönlund
CIMT, Medicinsk teknik – FoU, Region Västerbotten
E-post: christer.gronlund@regionvasterbotten.se
Web: https://www.regionvasterbotten.se/medicinsk-teknik-forskning-och-utveckling