UNIVERSITY of GUELPH

COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

MSc Seminar

Tuesday February 14, 2023 at 1:30pm via Zoom [Remote]

Kevin Sullivan

Re-engineering an Electromyography Simulator for Further Advancements in Clinical Studies

Advisor: Dr. Andrew Hamilton-Wright
Advisory: Dr. Judi McCuaig

Abstract:

Electromyography is a diagnostic procedure to assess the health of muscles and the nerves that control them. Electromyographic signal analysis uses needle electrodes to detect voltage changes caused by the electrical activity of muscle fibers. The characteristics of these signals can be used in the diagnosis of neurophysiological disorders.

In order to explore the muscle and find out exactly which motor units produce the signal, the needle must be moved around inside the muscle. Movement of the needle inside a muscle would destroy the living muscle which is not an appropriate strategy. Simulating the diagnostic procedure overcomes this limitation and validates clinical tools by using “gold standard” data.

The physiologically based simulator from Hamilton-Wright realistically simulates these clinical trials and produces valuable data that can be used in the advancement of understanding the relationship between muscle structure and the extracted EMG data - ultimately allowing the study and possible development of clinical EMG techniques.

The simulator requires action to remain usable and accessible for further advancements in clinical studies. The simulator is written in the legacy language of C++ which throttles the usability and accessibility for researchers. A redesign in the Python language will help to increase accessibility and allow for easier extension.. This research contribution will explore the difficulties and optimizations uncovered to aid in reimplementing the simulator. Following successful compliance testing in the reimplementation, the simulator will aim to be used on Neurokit2 - a python toolbox for neurophysiological signal processing.