Spectral Power and Mutual Information between 2 EMG Channels

Rujul Kapadia, , Master of Science in Computer Science

University of Dublin, Trinity College, 2019

Supervisor: Prof. Bahman Honari

Measuring associations in motor neurons through electrophysiological monitoring methods like electromyography is integral to neuroscience as it helps in understanding the underlying synchrony between the muscles and the brain. This can be useful in the diagnosis of several neuromuscular and genetic disorders like the ALS and the Duchenees muscular dystrophy.

Information theory provides tools to estimate these interdepedencies, of which non-linear measures like the mutual information can provide the best results, given to it being the independent of the structure of data along with its average being meaningful. Calculation of mutual information using the newly established denity-based approach is performed in this study to understand the interactivity between two hand muscles. The results of these are validated against the traditional bin-based approach which requires much larger quantities of data to arrive at precise estimations. Finally a comparison with the linear methods - the Power Spectrum and the Coherence is made to determine the overall performance of the used method.

The results of this dissertation can be used to conduct detailed studies in a wide range of neuroscientific experiments as much lesser quantities of data is required for studying the neural interactions than that of conventinally used. Moreover, these can also be employed to design advanced prosthetics.