Objective

Utilize intermuscular coherence (IMC) and corticomuscular coherence (CMC) as features to an online BCI for the purpose of developing a motor rehabilitation therapy for stroke survivors.

Background

- In recent years work has been done on the addition of alternative signals such as EMG to traditionally EEG based brain machine interfaces (BCI’s). These are known as hybrid BCI’s.
- Intermuscular coherence (IMC) and corticomuscular coherence (CMC) are measures of connectivity and synchronization of neural pathways within the body and are calculated using the cross power spectrum of EEG-EMG or EMG-EMG pairs.
- In particular, according to Colamarino et. al. 2021, CMC and IMC show promise in classification for post-stroke motor rehabilitation.

Methods

- Binary classification was done on hand open/hand closed movements
- Recording of EEG signals was done according to the 10-20 international system, and EMG signals were be recorded for extensor digitorum and flexor digitorum superficialis muscles
- IMC and CMC were calculated and averaged over 3 frequency bands (alpha, beta, gamma)
- A k-nearest neighbors model was utilized to classify selected features into the two movement classes

Results

- Utilizing both IMC and CMC the model was able to classify between flexion/rest and extension/rest with 95-100% accuracy
- Utilizing IMC, the model was able to distinguish between flexion and extension with a validation accuracy of 80.4% and a test accuracy of 83.3%

Conclusion

- The BCI was able to successfully utilize IMC to classify extension/flexion movements to a reasonable degree of accuracy
- Further studies should be done on the use of CMC in this specific application. In particular the positioning and relaxation of the hand/arm may need to be adjusted.