

IDENTIFYING WRIST GESTURES USING EMG SIGNALS

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Abstract – This lab investigated wrist gesture classification using electromyography (EMG) signals from a flexor carpi radialis (FCR) and extensor carpi radialis (ECR). EMG data was collected from a three-channel setup as the participant performed three gestures (flex, extend, and squeeze) twice. The data was processed using BCI2000, and a bipolar ECR signal was created in MatLab by subtracting the two ECR channels. Visual inspection of the rectified FCR signal and bipolar ECR signal identified the gesture order as squeeze, extend, extend, flex, flex, squeeze. These findings have potential applications in human-computer interaction technologies like prosthetics and virtual reality. Future work may incorporate feature extraction and machine learning to enhance the accuracy and efficiency of gesture recognition.

I. METHODS

EMG data was collected from three channels, each referencing an electrode placed on the wrist. Channel 1 measured EMG from the FCR muscle (FCR1 signal), Channels 2 and 3 measured EMG from the ECR muscle (capturing ECR1 and ECR2 respectively). The data was recorded using the BCI2000. A bipolar EMG signal was created by subtracting ECR1 from ECR2. The FCR signal was used as-is. Then the signals were rectified by taking absolute values, improving signal visualization. Finally, the gestures were identified by visually inspecting the rectified signals for characteristic patterns. Specifically, a squeeze was identified by a high FCR and

low ECR response, an extend by a low FCR and high ECR response, and a flex by a moderate FCR and low ECR response.

II. RESULTS

The analysis revealed six distinct peaks corresponding to each muscle gesture in both the FCR and ECR signals. The order of gestures was squeeze, extend, extend, flex, flex, squeeze (Fig. 1).

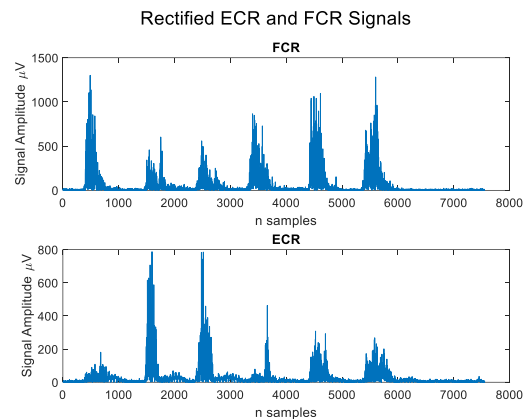


Fig. 1 The peaks represent, from left to right, squeeze, extend, extend, flex, flex, squeeze gestures.

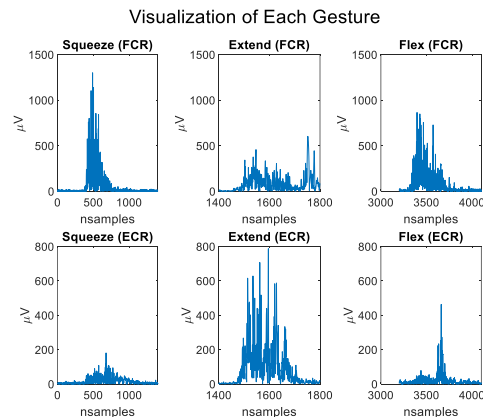


Fig. 2 Single example of squeeze, extend, and flex gestures on the ECR and FCR channels (rectified).