Rochester Institute of Technology

Bio-Robotics/Cybernetics: Project Proposal

Virtual Numpad Design for On-the-Go Calculator using EMG Signals

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1 Problem Statement

The project proposes to design a virtual numpad using EMG signals. The movement of muscles result in electrical pulses that are detected to identify gestures and predict the number on the pad that was desired by the user. The project aims to accurately distinguish between very close and fine movement of fingers while typing on a number pad of a standard keyboard. The current implementations for similar applications have been done using camera sensors, and shadow detection. This project aims to use no such hardware and is based purely on biological signals with the aid of machine learning algorithms. The design will also include calibration and customized training based on individual users' finger movements.

2 Hardware Solution

The Myo arm band and the PPG sensors will be used for data collection. The myo band is slid over the hand and is fixed on the area which is below the elbow. This is the place where the muscle signals are strongest. The sensors in the myo arm band then capture the data. Additionally, data from PPG sensors will be used to predict the blood flow when a particular finger is flexed. This is to get a more accurate prediction.

3 Software Solution

The Lab Stream Layer will be used for data acquisition and synchronization for event marking. This will be imported into MATLAB and processed by removing noisy artifacts from the signal. The features such as mean, standard deviation, Root mean squared zero order moment, root squared second and fourth order moments, sparseness, irregularity factor, Waveform Length ratio and many more will be extracted to be able to classify the signals. We will be using regression algorithm (SVM) and Decision Tree for determining the extent of finger flexing, and predict the output into 12 classes each pertaining to a number key, and a 13th class that will include the reject class.