Abstract

In this day and age, wearable devices have been evolved greatly over the last years. The possibility of carrying integrated sensors on them, encourages the scientists to use them more frequently in their projects as they are cheaper and efficient than other specialized medical devices. In the current master thesis, we will use a gesture control armband called Myo. Myo is equipped with a gyroscope, magnetometer, accelerometer and a set of electromyographic (EMG) sensors. Along with the Myo we will use a cell phone which helps in receiving the signals from the Myo. The focus point of this master thesis is to research different features based only on EMG signals coming from finger movements. EMG is a signal measurement of the electrical activity of the muscles and is one of the most common sources of information used to study muscle function and neurological disorders. By only focusing on finger movements, we leave the wrist movement out of the equation. One of the main reasons behind that, is that we want to research the muscles that are associated only with finger gestures and not with any wrist intervention. Also, the existing literature is limited on finger gesture recognition using non-intruding device like Myo. Furthermore, we will try to research a range of finger gestures that have been little or no covered by other scientists so far. The goal of this master thesis is to apply the earned knowledge to mzo controlled prosthetic arms worn by amputees that have lost some or all of their fingers or patients that have deficiency of moving their fingers due to a stroke, tendinitis, or peripheral neuropathy. By observing the fingers we can realise that each finger has different degree of freedom (DoF). That makes us consider of how many and what types of finger gestures are possible. The most trite ones which we will examine are the extension and the flexion of a finger or a group of fingers. In particular, the thumb can be flexed and extended in more than one direction (2 DoF). The rest of the fingers can be flexed and extended in one direction (1 DoF). The need of a solid classification between these two different kind of movements is imperative. What’s more, there can be more combinations such as holding three fingers (thumb excluded) as a cluster and moving forward backward the remaining free finger. The variability and diversity between the different gestures plays a significant role in order to cover the whole spectrum of finger gestures. After the collection of the recordings, we will introduce a preprocessing stage which will help us in extracting features from the raw data. In this master thesis, we will use a range of methods such as root mean square (RMS), moving average (smooth), Short-Time Fourier Transform (STFT) and a variety of discrete wavelet transforms. The collection of all feature extraction vectors will then be passed into classifiers and classification errors from each feature will be compared with each other in order to locate the best performance. In the implemented framework we will examine the approach of SVM, kNN and ANN classifier.