Myo Armband Virtual Keyboard

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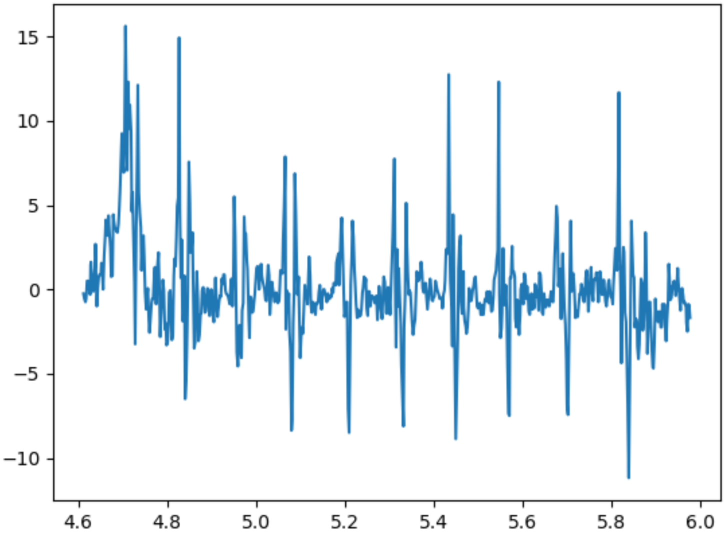
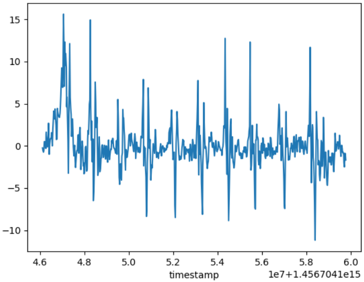
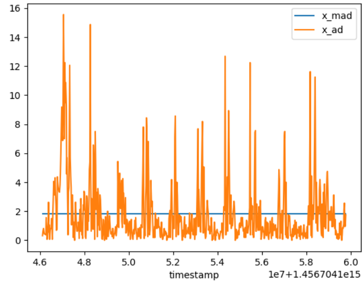
Data Splitting

Gyroscope X-Axis

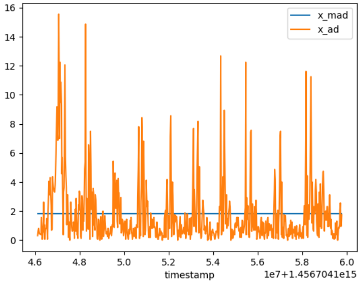


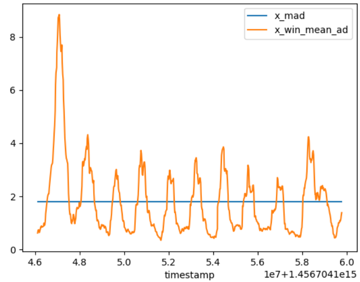
Mean Absolute Deviation



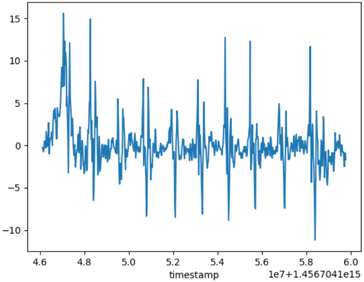


Windowed Mean Absolute Deviation

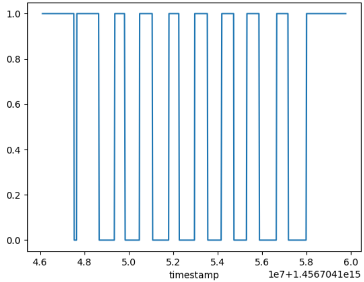




Activity

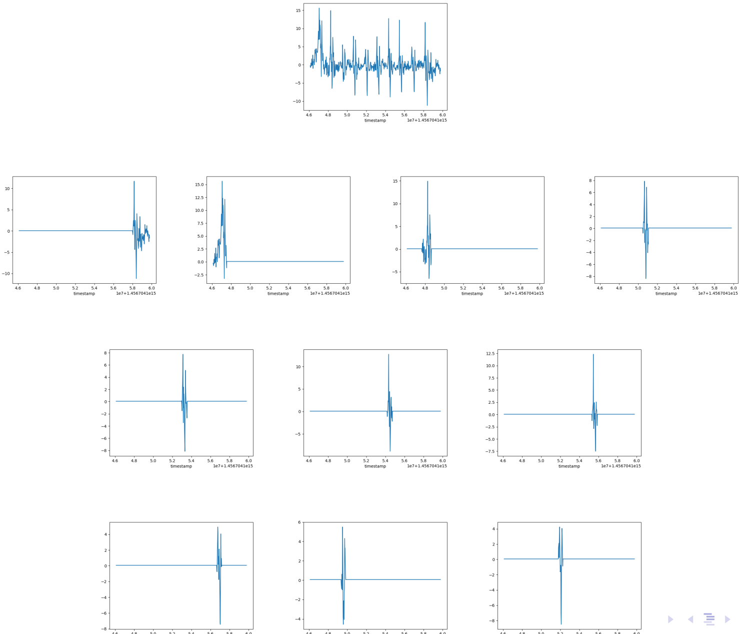


15
10
5
0
−5
−10
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
timestamp
1e7+1.4567041e15



1.0
0.8
0.6
0.4
0.2
0.0
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
timestamp
1e7+1.4567041e15

Split Points



Feature Extraction

Physical Data Feature Extraction

We use the following statistics as features:

- *Median*
- *Mean Absolute Deviation* $= \frac{\sum_{i=1}^{N} |x_i - \mu|}{N}$
- *Magnitude* $= \frac{\sum_{i=1}^{N} \sqrt{x_i^2 + y_i^2 + z_i^2}}{N}$

Person Recognition using Smartphones' Accelerometer Data

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***Abstract*—Smartphones have become quite pervasive in various aspects of our daily lives. They have become important links to a host of important data and applications, which if compromised, can lead to disastrous results. Due to this, today's smartphones are equipped with multiple layers of authentication modules. However, there still lies the need for a viable and unobtrusive layer of security which can perform the task of user authentication using resources which are cost-efficient and widely available on smartphones. In this work, we propose a method to recognize users using data from a phones embedded accelerometer sensors. Features encapsulating information from both time and frequency domains are extracted from walking data samples, and are used to build a Random Forest ensemble classification model. Based on the experimental results, the resultant model delivers an accuracy of 0.9679 and Area under Curve (AUC) of 0.9822.**

actions for authentication purposes. For the task of user recognition, we train a Random Forest ensemble classifier on a 31-features dataset extracted from accelerometer data recorded during walking.

The presented work is organized as follows. Section II introduces existing literature in gait analysis and use of embedded sensors for activity and person recognition. The methodology of the proposed work is described in section III. The subsections describe the feature extraction process, the Random Forest model and the validation method. This is followed by section IV which presents the results achieved by the model, followed by conclusion and future work in section V.

EMG Data Feature Extraction

We use the following statistics as features:

- $Variance = \frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}$
- $Mean\ Absolute\ Value = \frac{\sum_{i=1}^{N}|x_i|}{N}$
- $Waveform\ Length = \sum_{i=1}^{N}|x_i - x_{i+1}|$

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Comparison of Five Time Series EMG Features Extractions Using Myo Armband

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Abstract—**Feature extraction is meant to get representation and information that embedded in the signals, this is necessary to minimize complexity of implementation and reduce the cost of information processing. Recently, there are many methods for features extraction. This research is comparing five feature extractions from eight channels electromyography (EMG) signals that obtained from Myo Armband located on forearm muscles in order to get significant differences when hand do some movements. The time series features extraction that evaluated are Mean Absolute Value (MAV), Variance (VAR), Willison Amplitude (WAMP), Waveform Length (WL), and Zero Crossing (ZC). The variety of hand movement are fist, rest, half-fist, gun-point, and mid-finger fold. Moreover, the result shows that the rank of evaluated features extraction always showhs same results in four experiment, MAV is always giving the best performance WL. From this finding, MAV and WL are two recommendation for time series features extraction. This rank of time series features extraction gives worthiness when process information in future development research.**

and Kuu Young Young [5] perform four features extraction MAV, VAR, ZC, and WAMP in upper-arm to classify the movements.

Obtaining EMG signals from traditional surface electrodes has advantages in selecting muscles that moves the hand. Features extraction from this EMG signals already has significant differences in each channel that generate the signals. But nowadays, application that use traditional surface electrodes is less popular. This research use Myo armband that consist of eight channels electrodes and sends the EMG signals trough wireless connection. So the application based on Myo armband is more compact and has better appearance. But Myo's electrodes cannot select proper muscles in forearm. Beside that Myo armband already has five default gestures to perform, they are fist, rest, wave-in, wave-out, and click.

Results

Results on Physical Data

	CV-Accuracy	Train-Accuracy	Test-Accuracy
Tree	91%	100%	100%
RF	93%	100%	100%
NN	93%	100%	100%

Results on EMG Data

	CV-Accuracy	Train-Accuracy	Test-Accuracy
Tree	62%	100%	100%
RF	82%	100%	100%
NN	91%	100%	100%

Results on Both EMG and Physical Data

	CV-Accuracy	Train-Accuracy	Test-Accuracy
Tree	89%	100%	100%
RF	93%	100%	100%
NN	97%	100%	100%

Decision Tree