

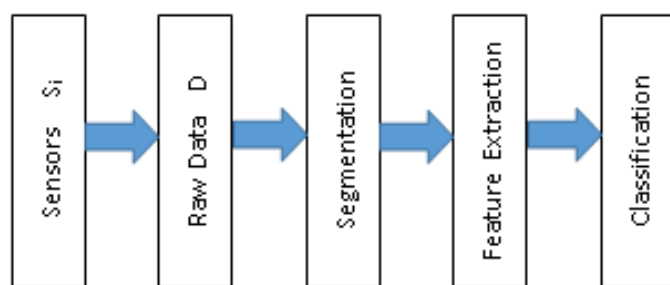


Feature Extraction using PCA on Wearable Multimodal Wireless Sensor Data in HAR

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Introduction

The feature extraction and classification is an important stage in human activity recognition (HAR) using wearable wireless sensors. Principle Component Analysis (PCA) is used for the feature extraction from the well known time domain and frequency domain features. Reduced features are further subjected for supervised learning algorithms based on support vector machines for recognition of movement patterns.

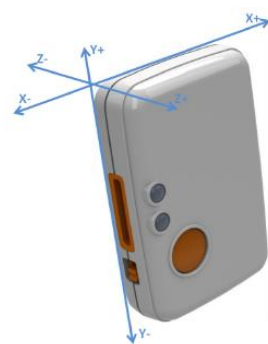


Objective

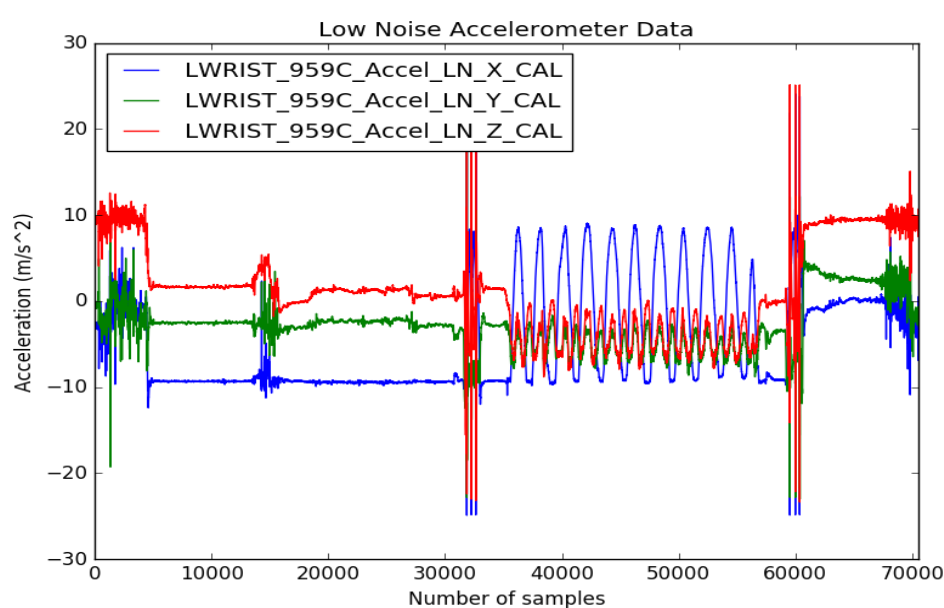
To select a minimum number of features, that account to an accuracy of 99% of the human activity, from a large set of time – frequency domain features.

Data Capture

- 3 MHz MSP430 CPU, Bluetooth connectivity
- Tri-axial low noise accelerometers $\pm 16g$
- Tri-axial wide range accelerometers $\pm 16g$
- Tri-axial gyroscope 2000dps
- Shimmers are calibrated with 9 DoF v2.8

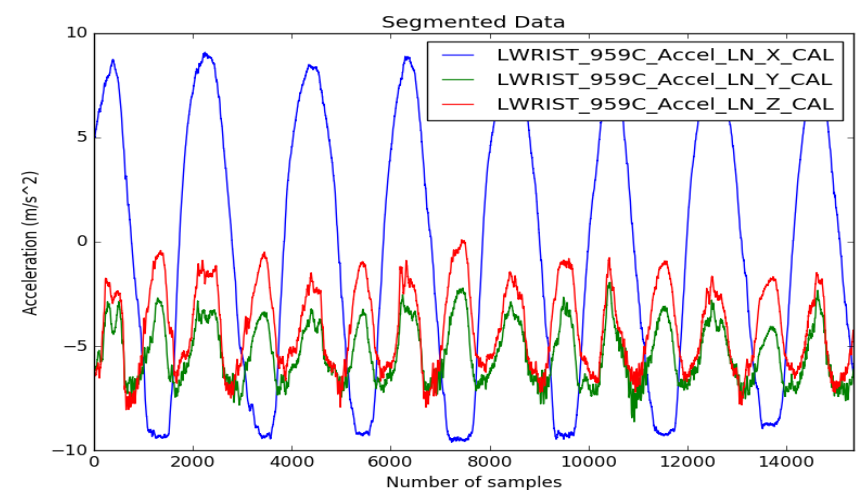


15 Local Muscular Endurance (LME) exercises are carried out with six healthy subjects and each exercise is performed for a duration of 40 seconds with a start and a stop indication. Shimmers are placed on left wrist and right wrist of individual subject and data captured at a sampling rate of 512 Hz.



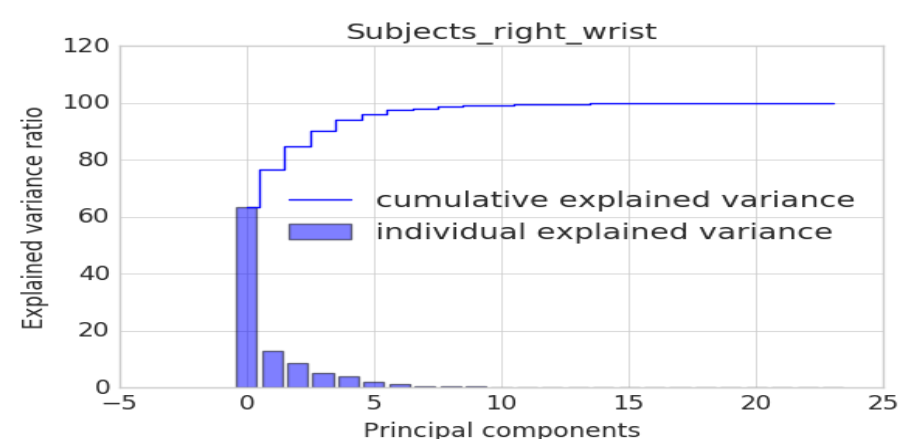
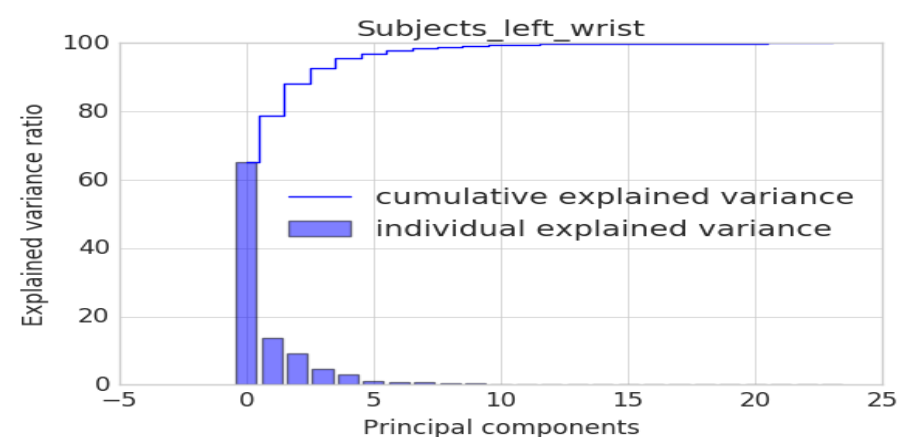
Segmentation

Sliding window of duration of 1second (512 Samples) with a 50% overlap (256 samples) is used to segment a 30 second data.



Feature Extraction and PCA

A total of 24 time-frequency features are extracted from normalized segmented data and correlation matrix among the features are computed. PCA is a linear supervised learning algorithm and is a powerful linear transformation tool for analysing data. Main understanding of usage of PCA is to identify the patterns in data by evaluating correlation between the features. The features with strong correlation between are retained (PCA also acts as a basic dimensionality reduction). Eigen values (and thus corresponding) vectors are sorted out in descending order. The Eigen values or Principle components containing 99% of the information are to be retained.



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