DSP Hackathon

TrackU!

Project Overview

- We used the 'AndroSensor' app for the activity data.

- Number of steps were counted with the zero-crossing of absolute values of acceleration.

- K- means algorithm was used to solve the clustering problem. The procedure followed a simple way to classify a given data set through 4 clusters.

Activities - 4 clusters

1. Walking

2. Running
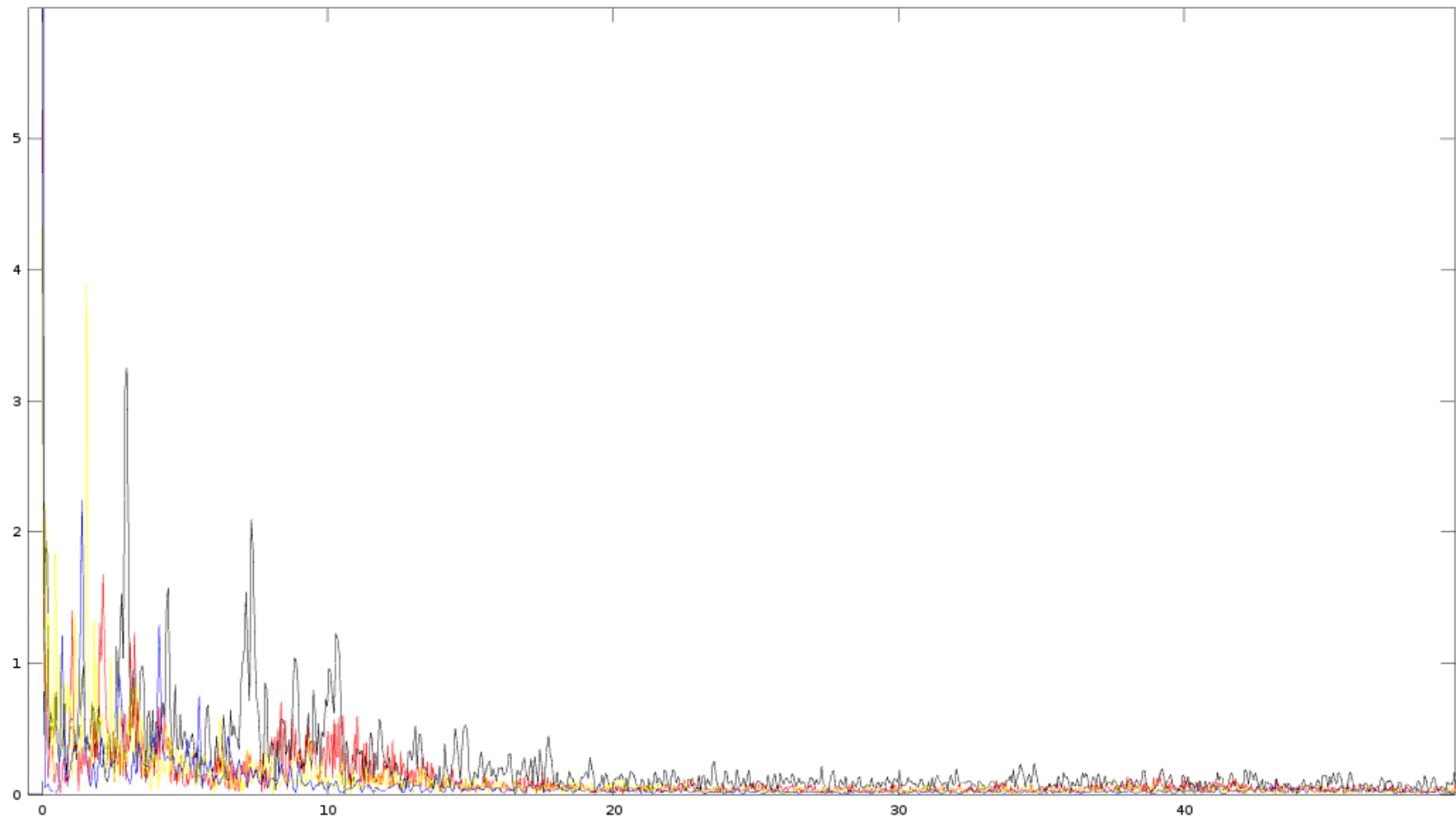
3. Jumping

4. Climbing Stairs

Activity Graphs (Frequency Domain)

The red plot corresponds to the climbing data in frequency domain.

The black plot corresponds to the running data in frequency domain.
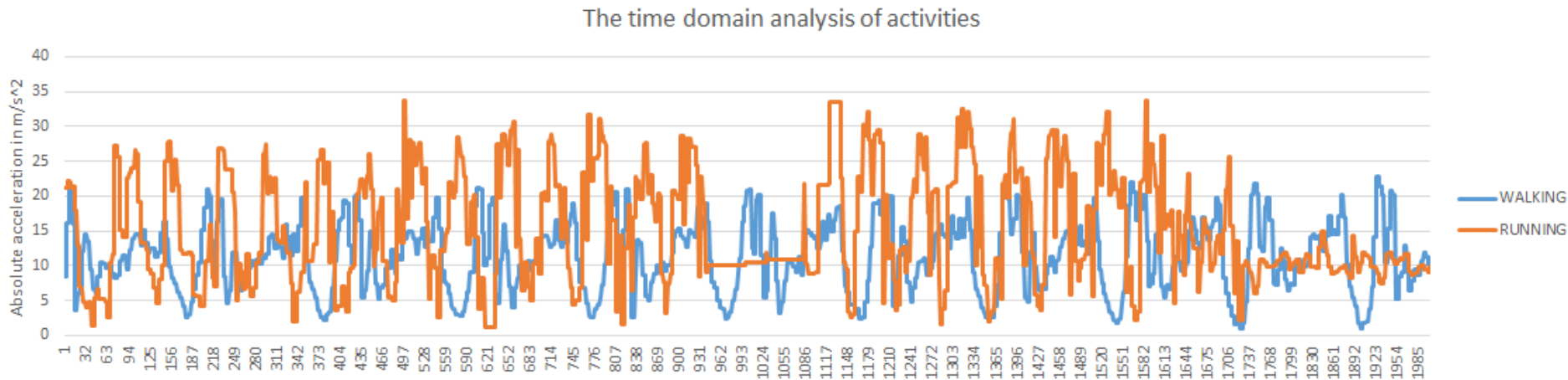
The yellow plot corresponds to the jumping data in frequency domain.

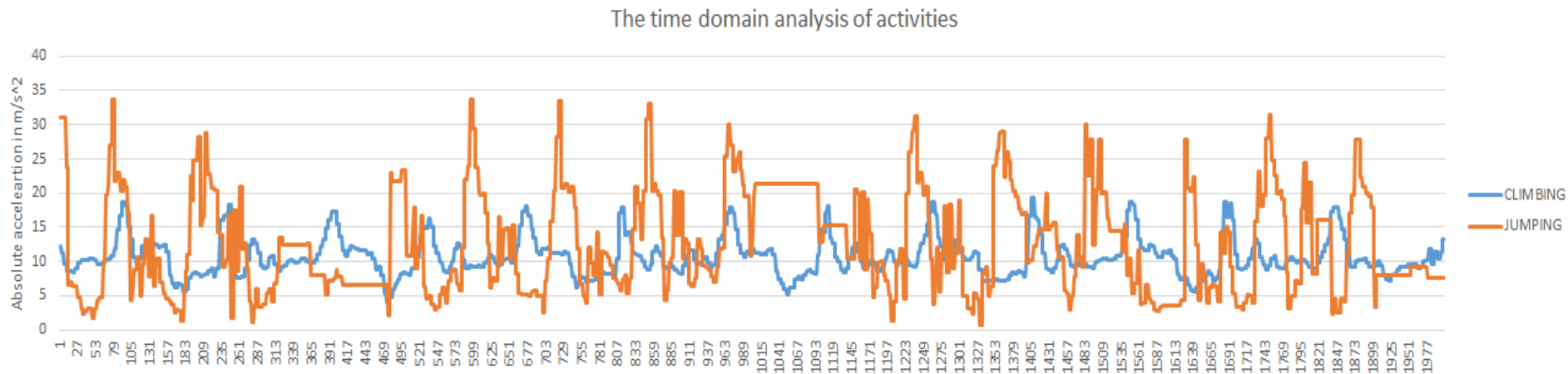The blue plot corresponds to the walking data in frequency domain.

Activity graphs (Time Domain)

1) Comparison between the activities - Walking and Running

Activity graphs (Time Domain)

2) Comparison between the activities - Climbing and Jumping

Task 1 - Step Count

Step Count

Procedure:

1) Magnitude of data, i.e., sqrt(accel_x^2 + accel_y^2 + accel_z^2) calculated

2) Mean of magnitude of data subtracted to get new 0 mean

3) Number of zero crossings calculated to get number of steps

Task 2 - Activity Detection

Data Collection

Procedure:

    1) 1500 samples collected for each activity

    2) Windowed into groups of size 150 to generate 6 features for each window

    3) Gives (1500/150) = 10 training data samples for each activity, each of dimension 6

    4) Final training data matrix of size 40 X 6 supplied to clustering algorithm

Feature Extraction

6 features used - 3 in time, and 3 in frequency domain (NOTE - magnitude of data is sqrt(accel_x^2 + accel_y^2 + accel_z^2))

1) Feature 1: mean of magnitude of data

2) Feature 2: sum of magnitude of data below 25 percentile

3) Feature 3: sum of magnitude of data below 75 percentile

4) Feature 4: peak frequency in spectrum of magnitude of data below 5 Hz

5) Feature 5: number of peaks in spectrum of magnitude of data below 5 Hz

6) Feature 6: sum of spectrum of magnitude of data from 0 to 5 Hz

Clusters - Only Time Domain Features

Each numerical entry in the table corresponds to

the cluster that sample has been assigned to.

Walking	Running	Jumping	Climbing
4	4	4	4
4	2	4	4
4	2	4	4
4	2	4	4
4	4	4	4
4	2	4	4
4	2	4	4
4	2	4	4
4	2	4	4
4	4	4	4

Clusters - Time + Frequency Domain Features

Walking	Running	Jumping	Climbing
2	3	4	2
2	3	4	2
2	3	4	2
1	3	4	2
1	2	4	2
1	3	4	2
2	3	4	2
1	3	4	2
1	3	4	2
1	1	4	2

Observations

- Using only time domain features we get distinct clusters for walking and running (cluster 4 and 2 respectively). Jumping and climbing are not well separated

- Using both time and frequency domain features we get clear classification of climbing and jumping (clusters 4 and 2 respectively). Although not as clear, distinct clusters for walking and running can also be seen (clusters 1 and 3 respectively)

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Thank You!