Report for Lab Assignment 3

Question 1: R Project

> Prepare a dataset related to your own project and perform k-Means, k-Medians, Expectation Maximisation (EM), Hierarchical Clustering and report the results.

Description:

In this lab assignment, I am going to use the clustering techniques mentioned above to try and classify Accelerometer movements. What I really want to do here is see if clustering techniques will automatically classify activities without having to give input knowledge. If we can distinguish specific activities, then it will be must easier for the machine to learn of changes in routine without having prior knowledge of a trend.

For this example, I wanted to keep it simple, so I used three activities that I would not think have similar range of movements. I chose eating, climbing the stairs, and brushing teeth.

Screenshots:

Kmeans:

The three clusters:

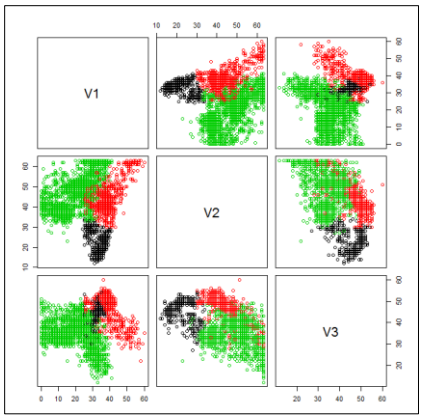
```
K-means clustering with 3 clusters of sizes 771, 3931, 2613

Cluster means:
        V1       V2       V3
1 33.79637 20.69520 45.99092
2 39.41999 40.68965 49.13559
3 20.48794 46.78263 34.65595
```

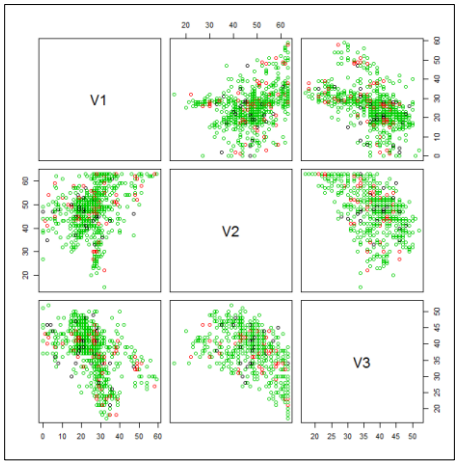
Measuring Sum of Squares:

```
Within cluster sum of squares by cluster:
[1]  35959.34 150819.69 508913.10
 (between_SS / total_SS =  65.2 %)
```

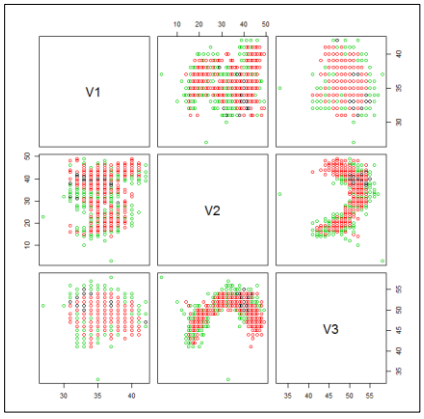
The Training plot:



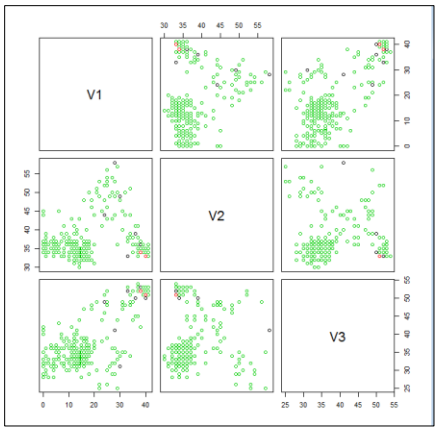
Testing teeth brushing data:



Testing eating:



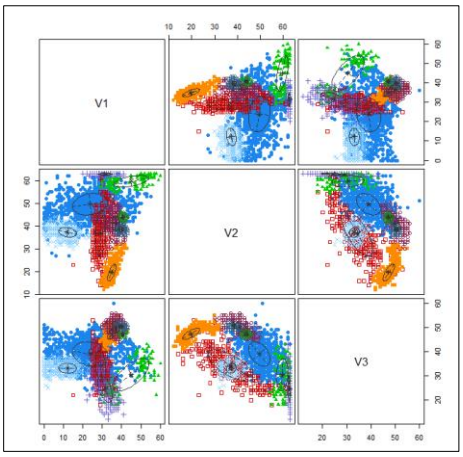
Testing Stairs:



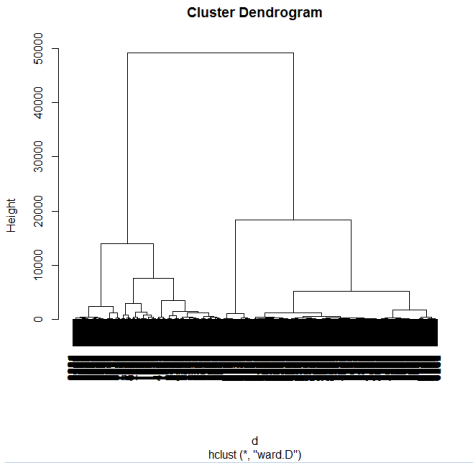
Conclusion for Kmeans:

From a qualitative perspective, the activities seem to follow homogenous clusters. It may not be great at distinguishing between similar activities, but would be useful for narrowing down possibilities.

Expectation Maximization: (note that this algorithm took a long time to complete, and did not correctly estimate the right clusters. I would not choose this method for this type of problem, since we know exactly how many clusters we need, and have several data points.



Hierarchial clustering:



The code:

```
brush_teeth<-read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/Brush_teeth/Accelerome

climb_stairs<-read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/Climb_stairs/Acceler
climb_stairs<-rbind(climb_stairs,read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/C
climb_stairs<-rbind(climb_stairs,read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/C

eat_meat<-read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/Eat_meat/Accelerometer-2

x<-rbind(brush_teeth,climb_stairs,eat_meat)

km <- kmeans(x, 3, 15)
plot(x, col = km$cluster)
print(km)

d <- dist(x, method = "euclidean")
fit <- hclust(d, method="ward.D")
plot(fit)



testing_teeth<-read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/Brush_teeth/Acceler
testing_stairs<-read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/Climb_stairs/Accele
testing_meat<-read.table("C:/Users/Mark Schulz/Documents/School/BDA/Lab 3/Code/HMP_Dataset/Eat_meat/Accelerometer


plot(testing_stairs,col=fit$cluster)

library(mclust)
x_ = x[,1]          # get the first column of the faithful data set
y_ = x[,2]          # get the second column of the faithful data set
z_ = x[,3]
plot(x_,y_)                 # plot the spread points before the clustering
model <- Mclust(x) # estimate the number of cluster (BIC), initialize (HC) and clusterize (EM)
data = x           # get the data set
plot(model, x)     # plot the clustering results
model <- Mclust(x)
```

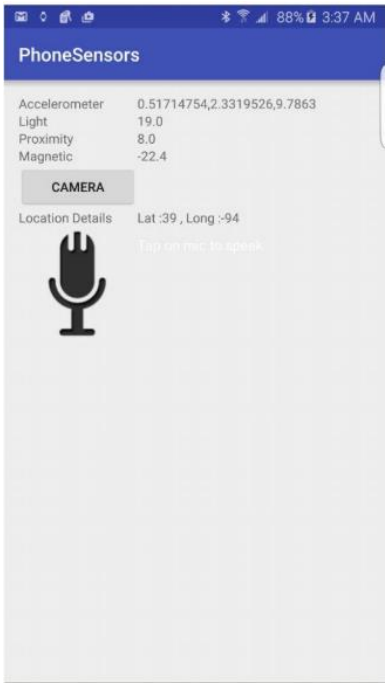
Question 2: Watch Application

Data collection related to your own project through Smart Phone and Watch, send notifications to watch using intuitive data analysis.

Description:

For our project, we need location data and accelerometer data to determine the location and activity, therefore, our mobile device collects this information for storage.

Screenshots:


88% 3:37 AM
PhoneSensors
Accelerometer
0.51714754,2.3319526,9.7863
Light
19.0
Proximity
8.0
Magnetic
-22.4
CAMERA
Location Details
Lat :39 , Long :-94
Tap on mic to speak