EDA Case Study - Understanding Human Activity with Smart Phones

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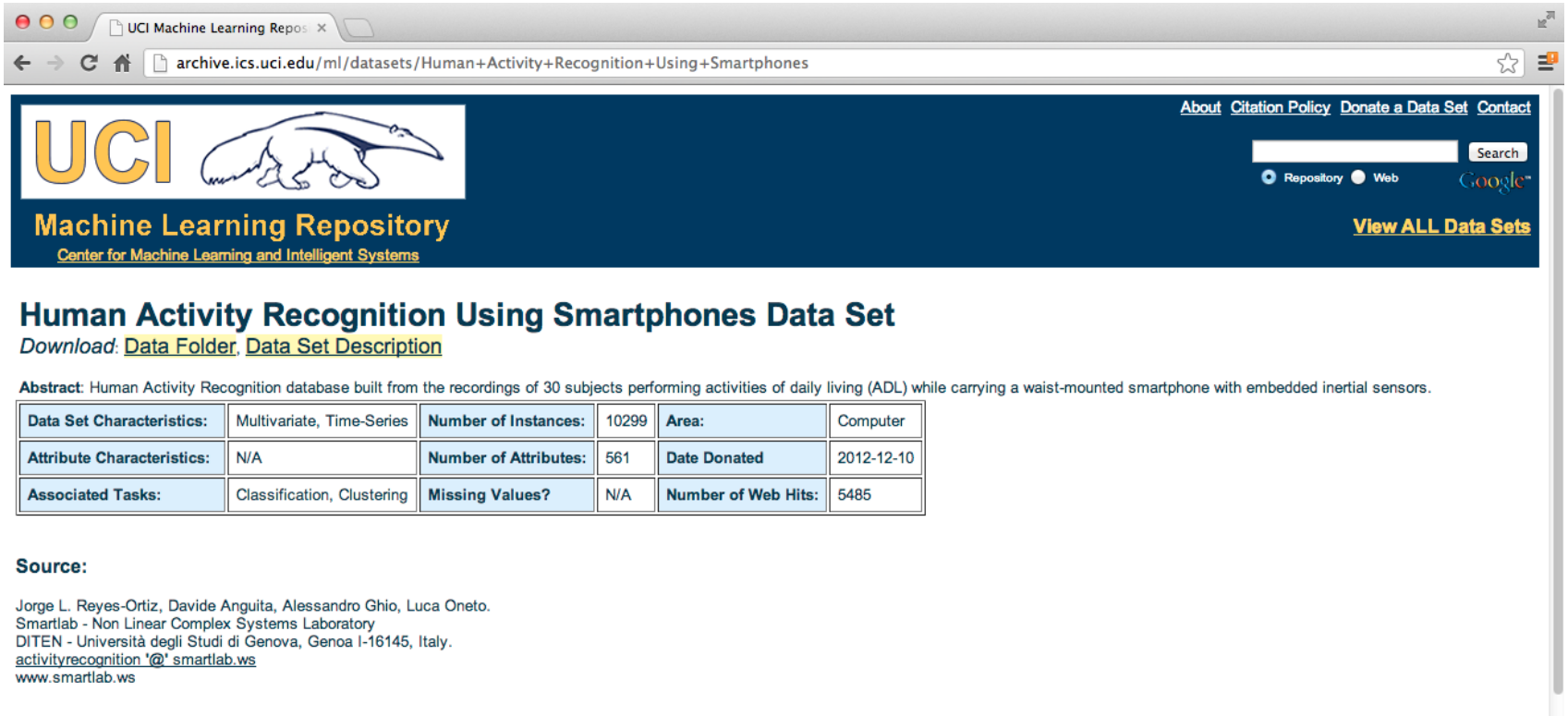
Samsung Galaxy S3

http://www.samsung.com/global/galaxys3/

Samsung Data



http://archive.ics.uci.edu/ml/datasets/Human+Activity+Recognition+Using+Smartphones

Slightly processed data

Samsung data file

```
load("data/samsungData.rda")
names(samsungData)[1:12]
```

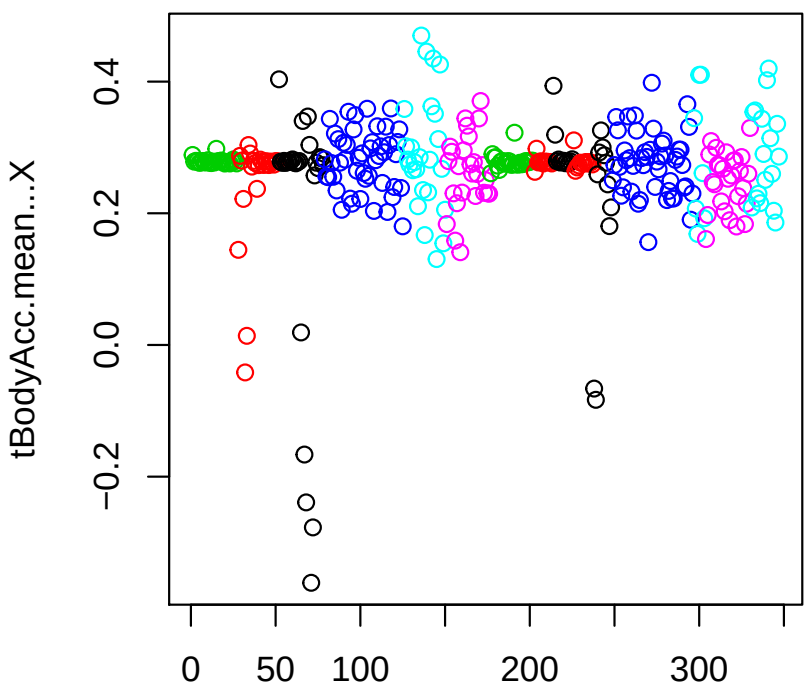
```
##  [1] "tBodyAcc-mean()-X" "tBodyAcc-mean()-Y" "tBodyAcc-m
##  [4] "tBodyAcc-std()-X"  "tBodyAcc-std()-Y"  "tBodyAcc-s
##  [7] "tBodyAcc-mad()-X"  "tBodyAcc-mad()-Y"  "tBodyAcc-m
## [10] "tBodyAcc-max()-X"  "tBodyAcc-max()-Y"  "tBodyAcc-m
```

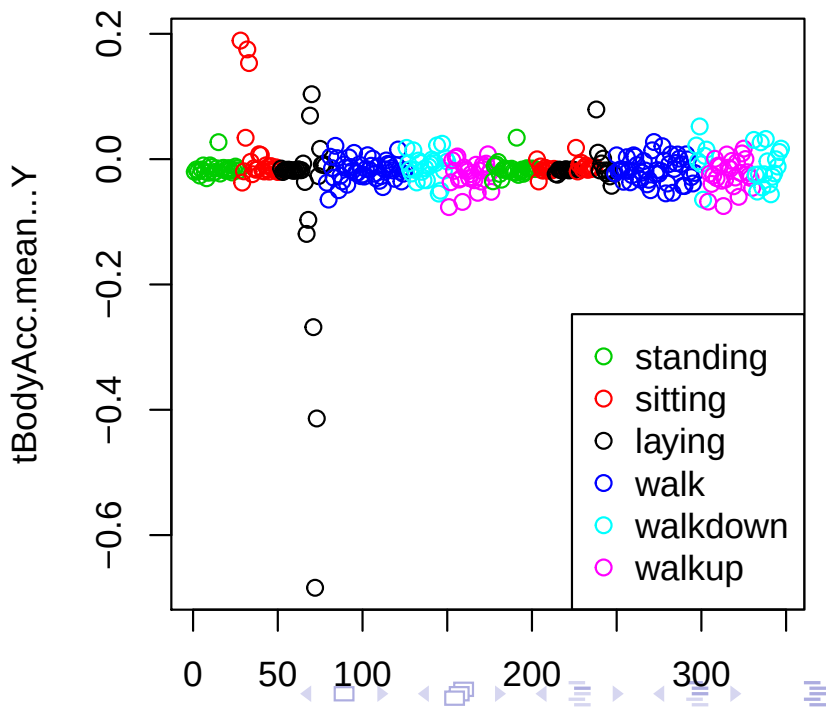
```
table(samsungData$activity)
```

```
##
##   laying  sitting standing     walk walkdown   walkup
##     1407     1286     1374     1226      986     1073
```

Plotting average acceleration for first subject

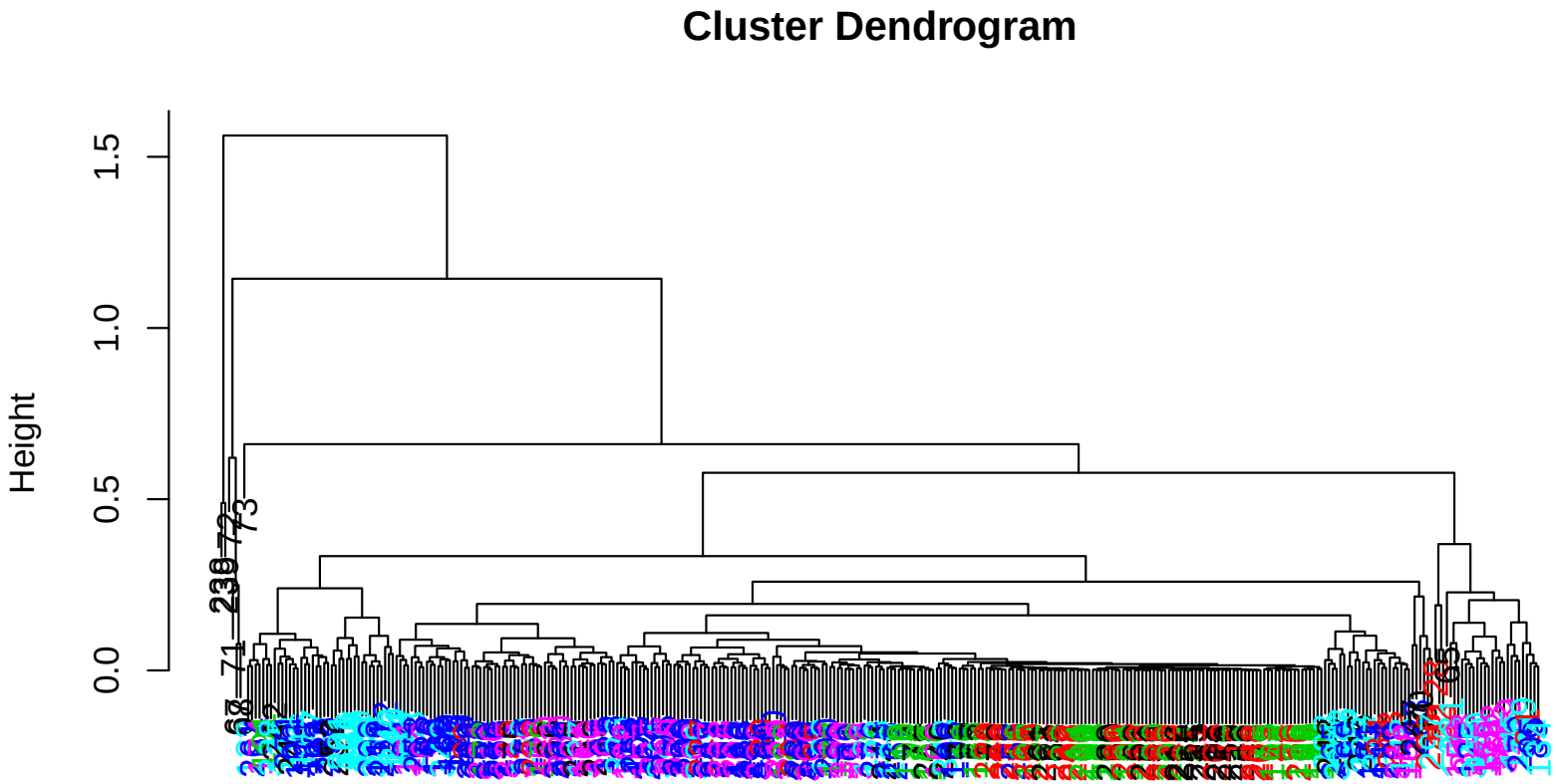
```
par(mfrow = c(1, 2), mar = c(5, 4, 1, 1))
samsungData <- transform(samsungData, activity = factor(act
sub1 <- subset(samsungData, subject == 1)
plot(sub1[, 1], col = sub1$activity, ylab = names(sub1)[1])
plot(sub1[, 2], col = sub1$activity, ylab = names(sub1)[2])
legend("bottomright", legend = unique(sub1$activity), col =
    pch = 1)
```





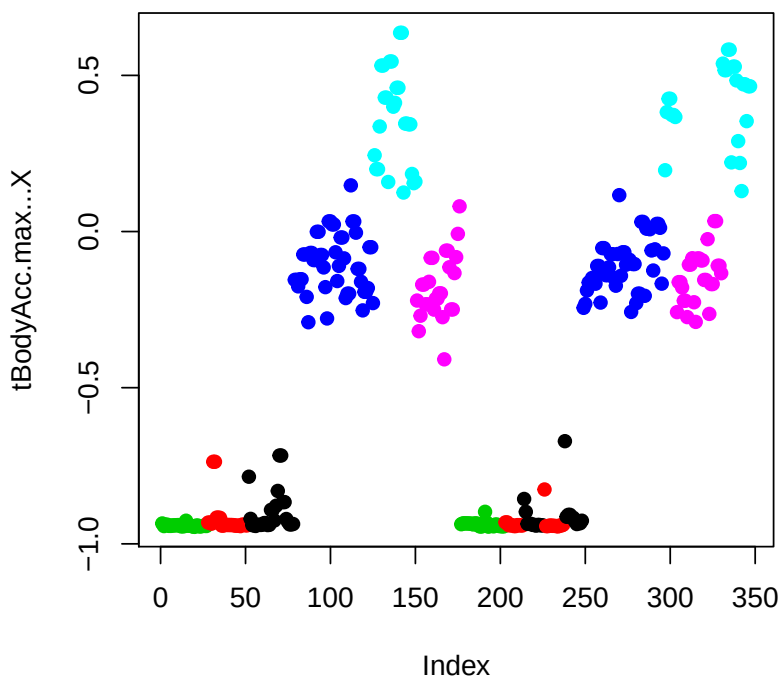
Clustering based just on average acceleration

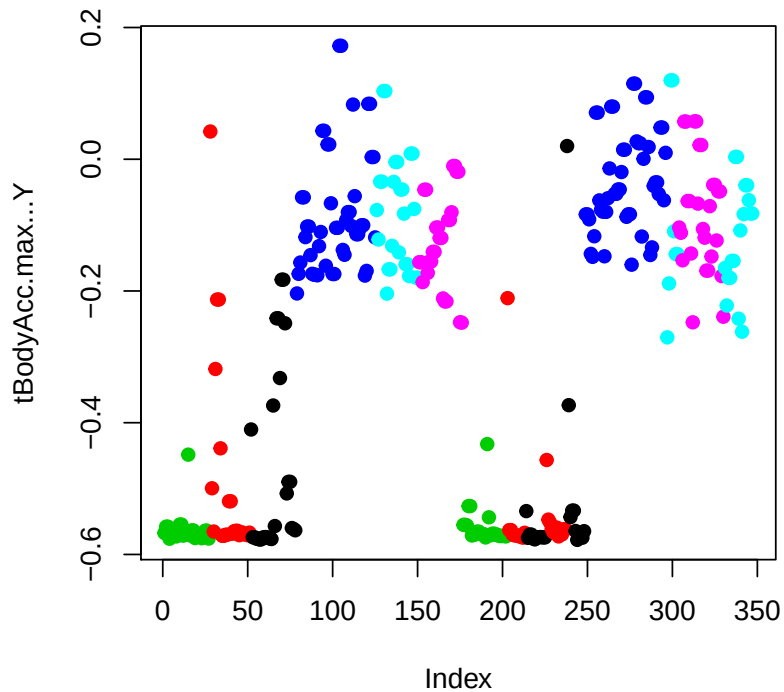
```
source("myplclust.R")
distanceMatrix <- dist(sub1[,1:3])
hclustering <- hclust(distanceMatrix)
myplclust(hclustering, lab.col = unclass(sub1$activity))
```



Plotting max acceleration for the first subject

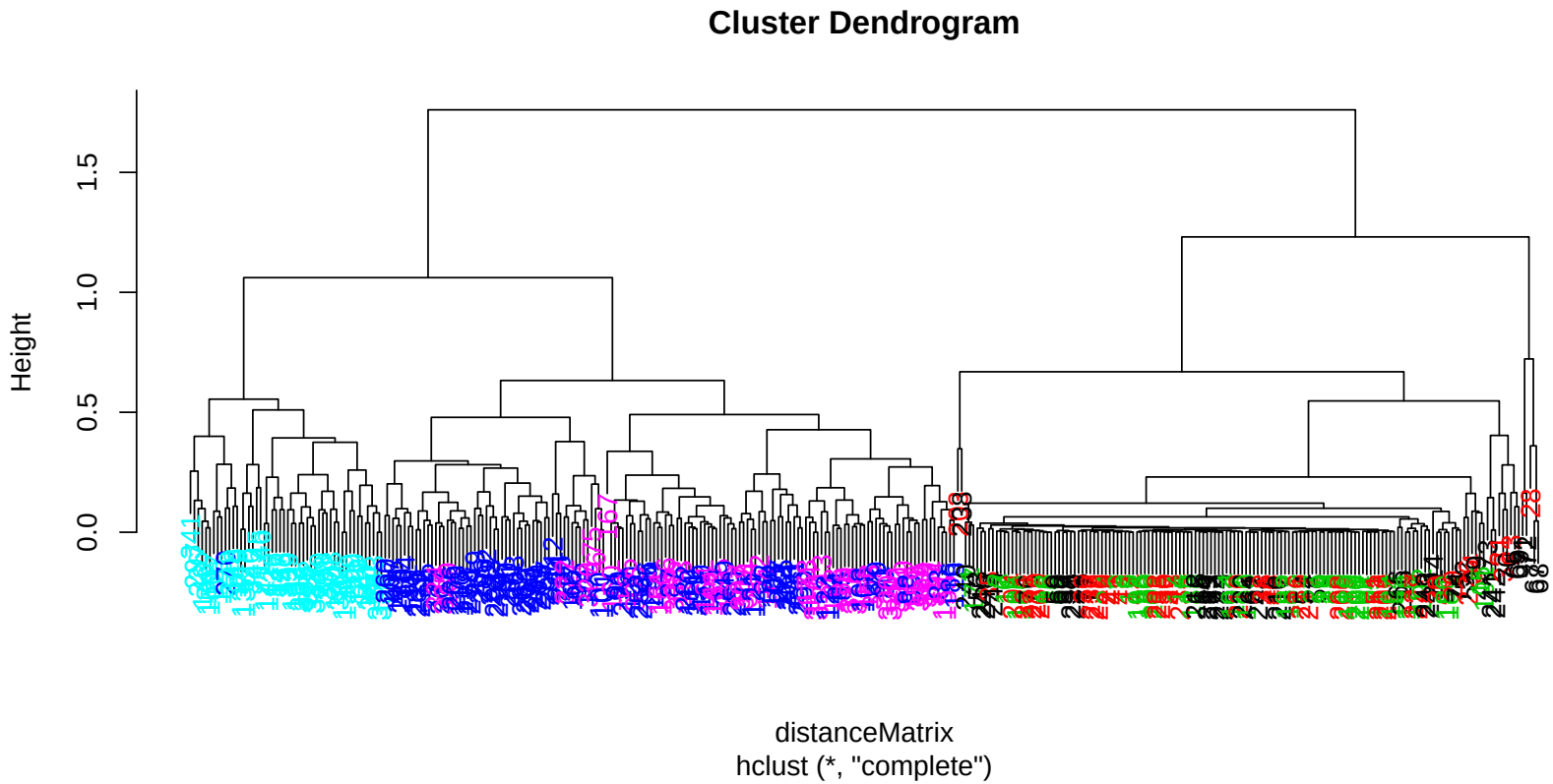
```
par(mfrow=c(1,2))
plot(sub1[,10],pch=19,col=sub1$activity,ylab=names(sub1)[10
plot(sub1[,11],pch=19,col = sub1$activity,ylab=names(sub1)
```





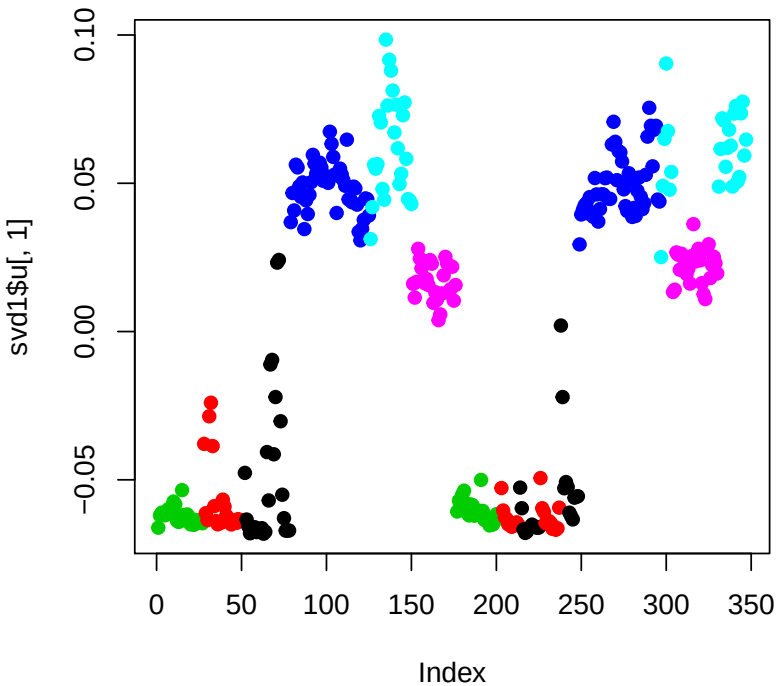
Clustering based on maximum acceleration

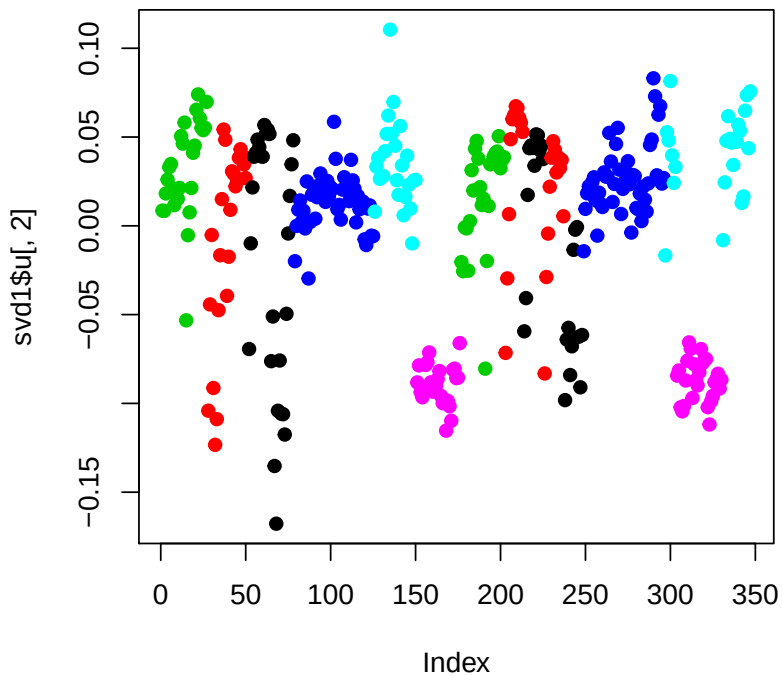
```
source("myplclust.R")
distanceMatrix <- dist(sub1[,10:12])
hclustering <- hclust(distanceMatrix)
myplclust(hclustering,lab.col=unclass(sub1$activity))
```



Singular Value Decomposition

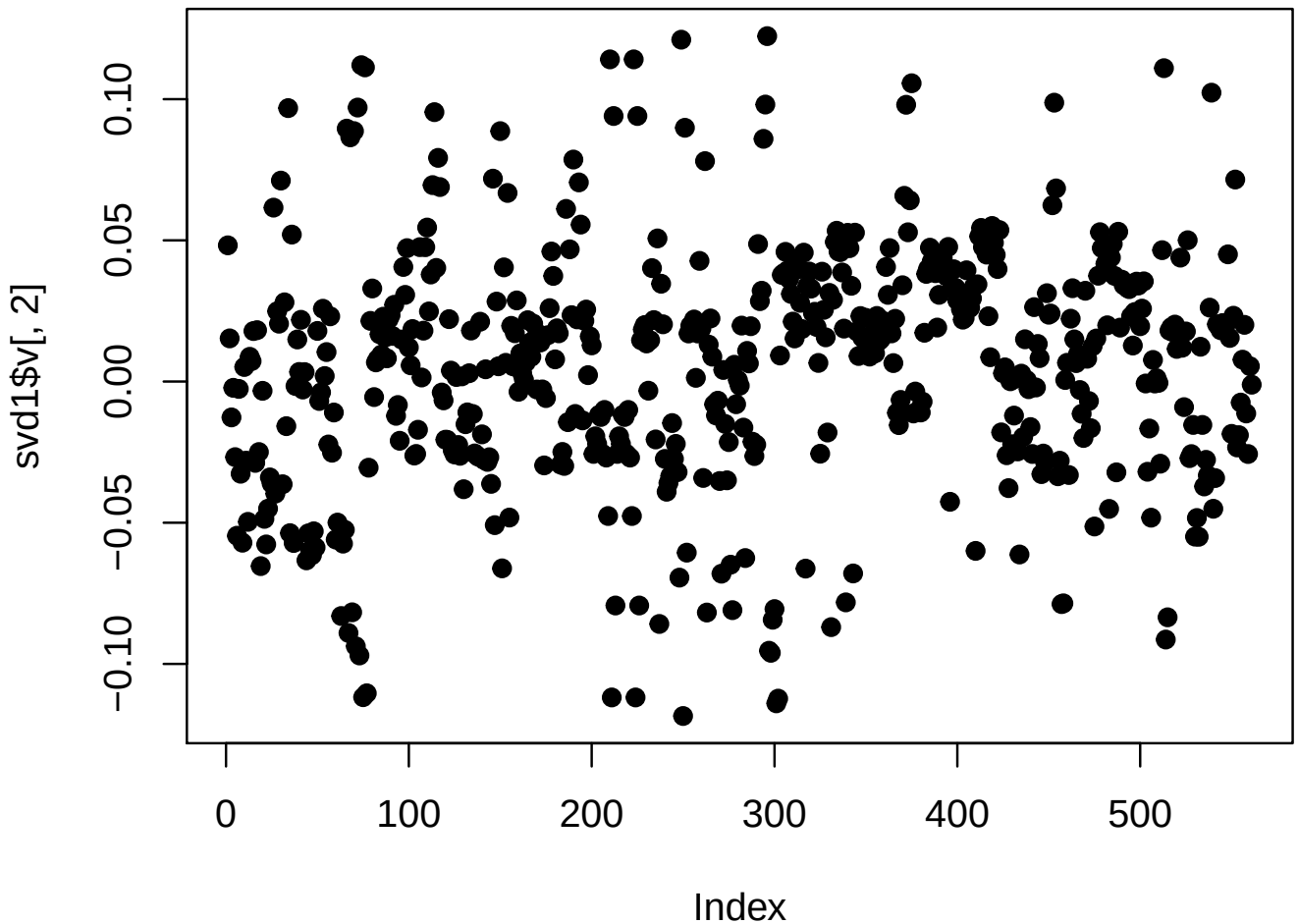
```
svd1 = svd(scale(sub1[, -c(562, 563)]))
par(mfrow = c(1, 2))
plot(svd1$u[, 1], col = sub1$activity, pch = 19)
plot(svd1$u[, 2], col = sub1$activity, pch = 19)
```





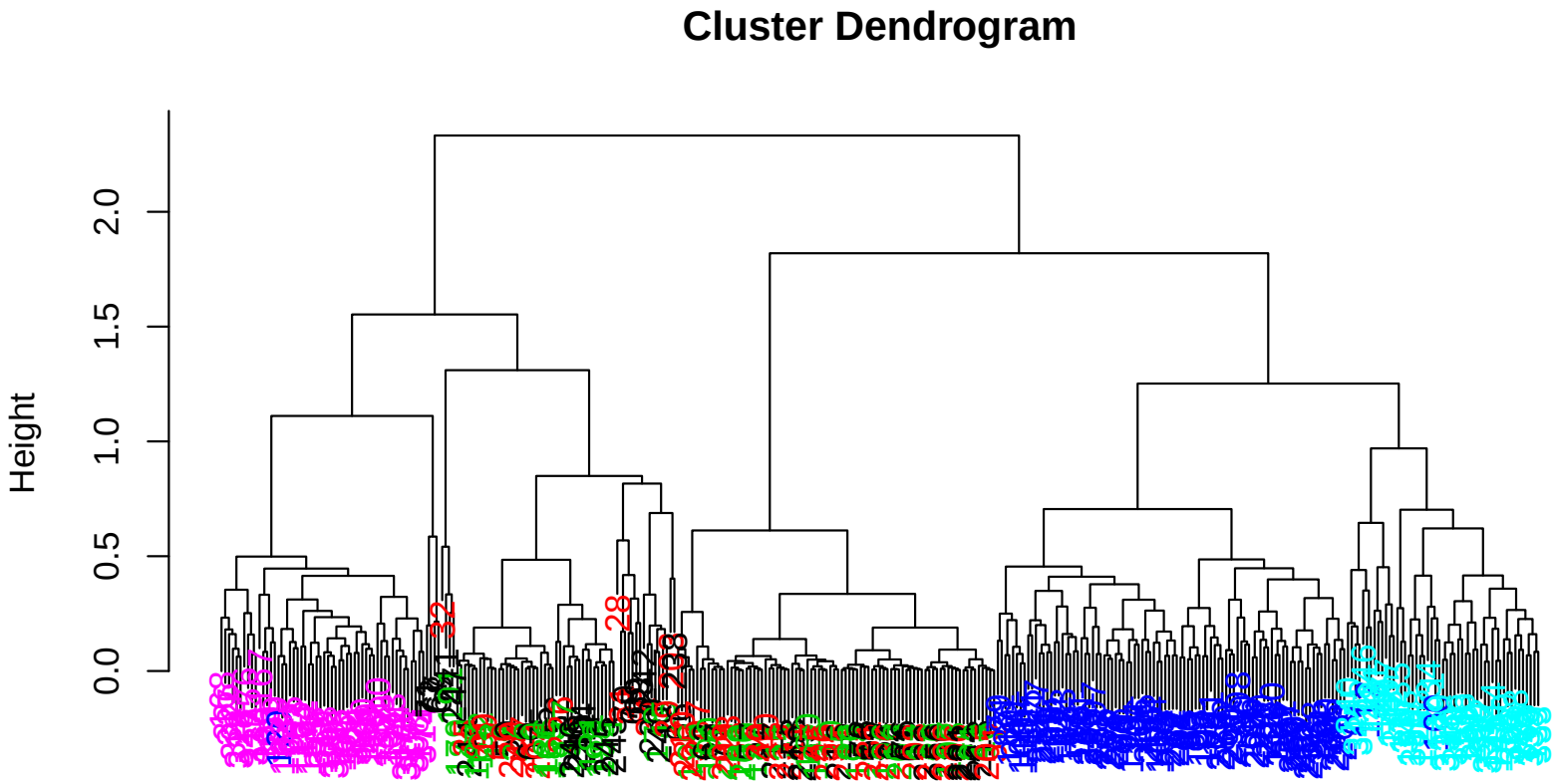
Find maximum contributor

```
plot(svd1$v[, 2], pch = 19)
```



New clustering with maximum contributer

```
maxContrib <- which.max(svd1$v[, 2])
distanceMatrix <- dist(sub1[, c(10:12, maxContrib)])
hclustering <- hclust(distanceMatrix)
myplclust(hclustering, lab.col = unclass(sub1$activity))
```



New clustering with maximum contributer

```
names(samsungData)[maxContrib]
```

```
## [1] "fBodyAcc.meanFreq...Z"
```

K-means clustering (nstart=1, first try)

```
kClust <- kmeans(sub1[,-c(562,563)],centers=6)
table(kClust$cluster,sub1$activity)
```

```
##
##      laying sitting standing walk walkdown walkup
##   1       0       0        0   95        0      0
##   2      10       2        0    0        0      0
##   3      16      12        7    0        0      0
##   4       0       0        0    0       49      0
##   5      24      33       46    0        0      0
##   6       0       0        0    0        0     53
```

K-means clustering (nstart=1, second try)

```
kClust <- kmeans(sub1[, -c(562, 563)], centers = 6, nstart
table(kClust$cluster, sub1$activity)
```

```
##
##      laying sitting standing walk walkdown walkup
##   1      29       0        0    0        0      0
##   2      18      10        2    0        0      0
##   3       3       0        0    0        0     53
##   4       0      37       51    0        0      0
##   5       0       0        0   95        0      0
##   6       0       0        0    0       49      0
```

K-means clustering (nstart=100, first try)

```
kClust <- kmeans(sub1[,-c(562,563)],centers=6,nstart=100)
table(kClust$cluster,sub1$activity)
```

```
##
##      laying sitting standing walk walkdown walkup
##   1       0      37       51    0        0      0
##   2       0       0        0   95        0      0
##   3      29       0        0    0        0      0
##   4       0       0        0    0       49      0
##   5       3       0        0    0        0     53
##   6      18      10        2    0        0      0
```

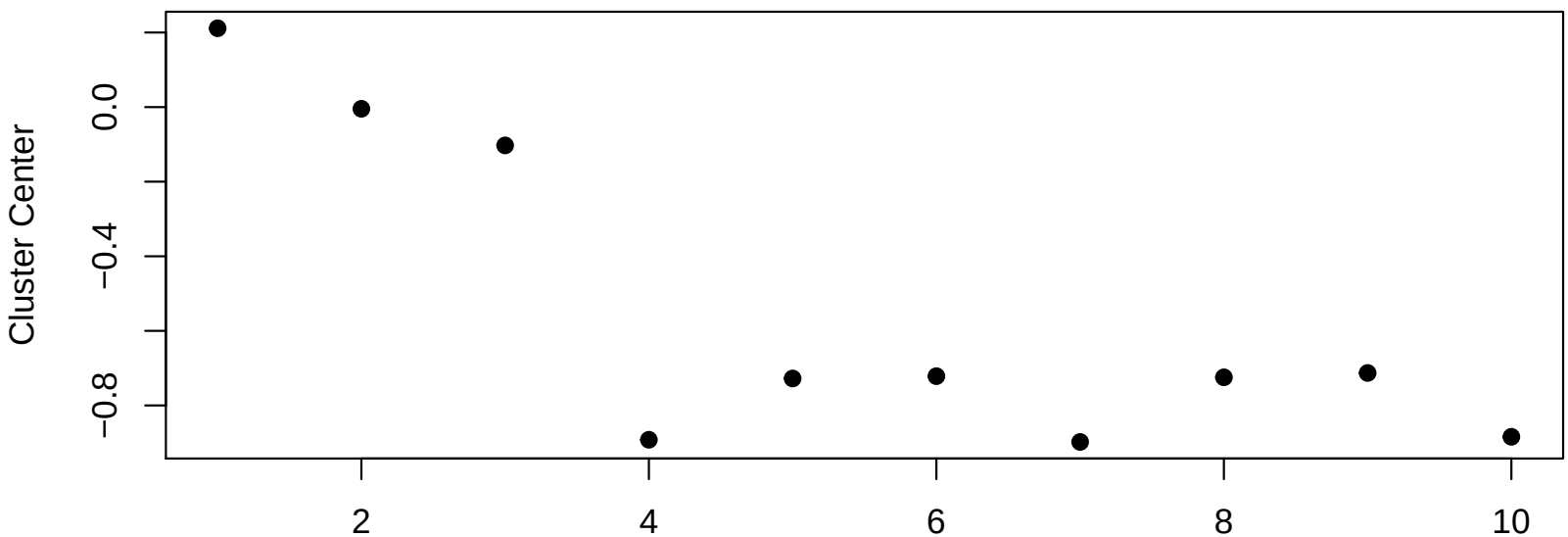
K-means clustering (nstart=100, second try)

```
kClust <- kmeans(sub1[, -c(562, 563)], centers = 6, nstart
table(kClust$cluster, sub1$activity)
```

```
##
##      laying sitting standing walk walkdown walkup
##   1      18      10        2    0        0      0
##   2       3       0        0    0        0     53
##   3       0      37       51    0        0      0
##   4       0       0        0    0       49      0
##   5      29       0        0    0        0      0
##   6       0       0        0   95        0      0
```

Cluster 1 Variable Centers (Laying)

```
plot(kClust$center[1, 1:10], pch = 19, ylab = "Cluster Cent
```



Cluster 2 Variable Centers (Walking)

```
plot(kClust$center[4,1:10],pch=19,ylab="Cluster Center",xla
```