Report for lab assignment 3

1. Question:

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:

Dataset:

File name: heart rate.xlsx. Part of our project will do the monitoring of heart rate, then let the Robert do necessary action when the wear has emergent situation.

k-Means

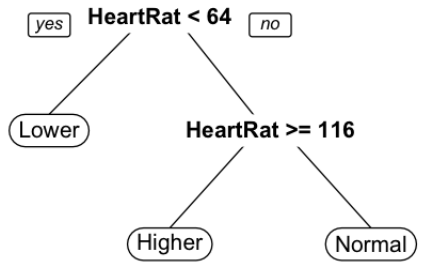
```
> heart = read.csv("Desktop/Heart rate.csv")
> heart.feature = heart
> results <- kmeans(heart.feature, 3)
> results
K-means clustering with 3 clusters of sizes 21, 42, 37

Cluster means:
         X Heat.Rate
1 20.71429 111.57143
2 79.40476  84.54762
3 34.59459  72.89189

Clustering vector:
  [1] 1 1 1 1 1 3 1 1 1 1 3 1 3 3 1 3 3 3 3 3 1 3 3 3 1 3 1 1 1 3 3 3 1 3 3 3 3 3 1 3 3
 [42] 3 3 3 3 3 1 3 3 3 3 1 3 3 3 3 2 1 2 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 [83] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

Within cluster sum of squares by cluster:
[1] 15707.43 19512.52 11782.49
 (between_SS / total_SS =  63.9 %)

Available components:

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
[6] "betweenss"    "size"         "iter"         "ifault"
> heart = read.csv("Desktop/Heart rate.csv")
> heart.feature = heart
> results <- kmeans(heart.feature, 3)
```

```
> results
K-means clustering with 3 clusters of sizes 14, 48, 38

Cluster means:
  Heart.Rate
1  127.57143
2   69.56250
3   91.21053

Clustering vector:
  [1] 1 3 3 3 3 2 1 1 3 3 2 3 2 2 3 2 2 3 2 2 3 2 2 2 3 2 1 1 3 2 3 2 1 2 2 3 2 2 1 2 2
 [42] 2 2 3 3 2 1 2 3 2 2 1 2 2 2 3 3 1 1 2 2 3 2 3 3 3 3 2 3 2 3 2 2 3 3 2 2 2 3 3 1 3
 [83] 2 2 2 2 3 2 3 1 1 3 2 3 3 2 2 3 2 3

Within cluster sum of squares by cluster:
[1] 3563.429 2969.812 2208.316
 (between_SS / total_SS =  81.4 %)

Available components:

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
[6] "betweenss"    "size"         "iter"         "ifault"
```

Decision tree

```
install.packages("rpart")
install.packages("caret")
install.packages("rpart.plot")
library(rpart.plot)
library(rpart)
library(caret)

> model <- rpart(Status~HeartRate, heart)
> pred <- predict(model, heart, type="class")
> c <- confusionMatrix(pred, heart$Status)
> print(c)
> prp(model)
Result:
Confusion Matrix and Statistics

          Reference
Prediction Higher Lower Normal
    Higher      9     0      0
    Lower       0    10      0
    Normal      0     0     81

Overall Statistics

               Accuracy : 1
                 95% CI : (0.9638, 1)
    No Information Rate : 0.81
    P-Value [Acc > NIR] : 7.055e-10

                  Kappa : 1
 Mcnemar's Test P-Value : NA
```

```
Statistics by Class:

                     Class: Higher Class: Lower Class: Normal
Sensitivity                   1.00          1.0          1.00
Specificity                   1.00          1.0          1.00
Pos Pred Value                1.00          1.0          1.00
Neg Pred Value                1.00          1.0          1.00
Prevalence                    0.09          0.1          0.81
Detection Rate                0.09          0.1          0.81
Detection Prevalence          0.09          0.1          0.81
Balanced Accuracy             1.00          1.0          1.00
```



k-Medians

```
> install.packages("flexclust")
> library(flexclust)
> x<-rbind(heart$HeartRate)
> x<- t(x)
> median=kcca(x,3,family=kccaFamily("kmedians"))
> print(median)

Results:
kcca object of family ‘kmedians’

call:
kcca(x = x, k = 3, family = kccaFamily("kmedians"))

cluster sizes:

 1  2  3
10 50 40
```

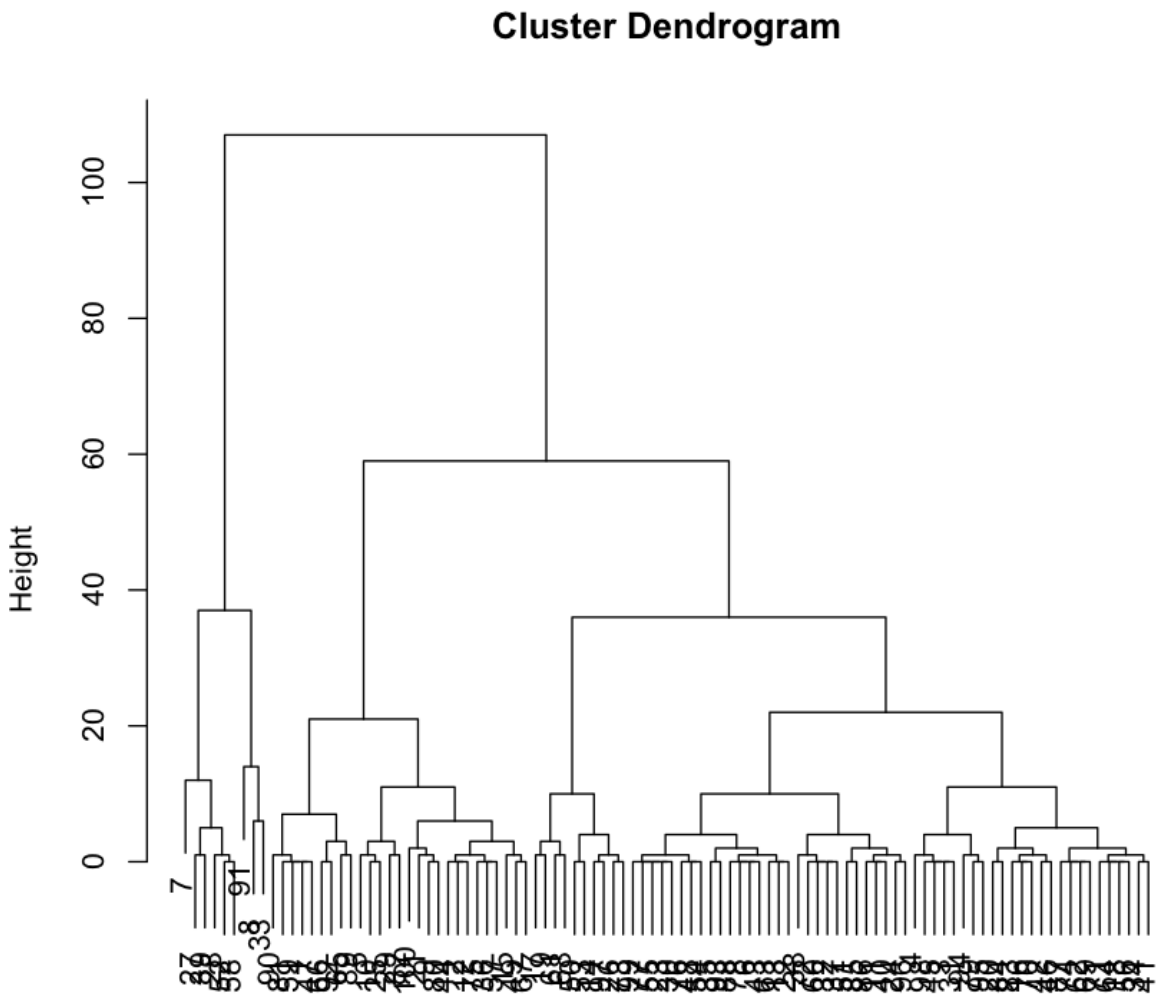
Expectation Maximisation (EM)

```
> install.packages("EMCluster")
> library(EMCluster, quietly = TRUE)
> ret.em <- init.EM(x, nclass = 3, method = "em.EM")
> emobj <- simple.init(x, nclass = 3)
> ret.init <- emcluster(x, emobj, assign.class = TRUE)
> ret.init
Results:
Method:
 n = 100, p = 1, nclass = 3, flag = , logL = -438.7302.
nc:
[1]  9 46 45
pi:
[1] 0.07364 0.39077 0.53558
```

```
>
> ret <- emcluster(x, emobj, assign.class = TRUE)
> summary(ret)
Method:
 n = 100, p = 1, nclass = 3, flag = , total parameters = 8,
 logL = -438.7302, AIC = 893.4605, BIC = 914.3018.
nc:
[1]  9 46 45
pi:
[1] 0.07364 0.39077 0.53558
```

Hierarchical Clustering

```
> d<-dist(as.matrix(x))
> hc<-hclust(d)
> plot(hc)
```



Screenshots:

See graphs above.

2. Question:

Watch Application

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

Description:

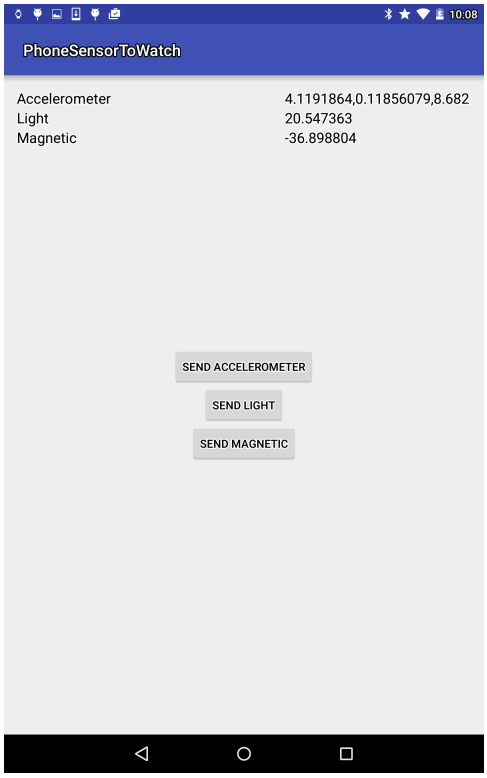
In android studio, it combined the notification method and sensor data collection method to send information from phone sensor to smartwatch.

The information from smartwatch to phone sensor can be sent but it has not been taught. So I just collect the heart rate and step count by smartwatch.

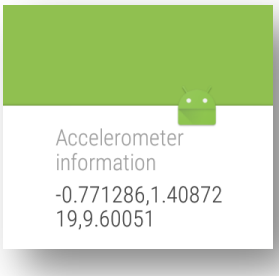
Screenshots:

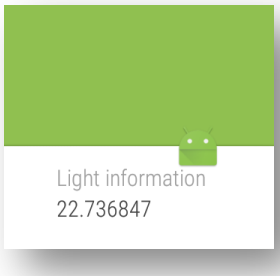
Send information from phone sensor:

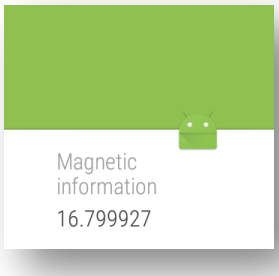
Phone app:



Notification received from smartwatch:







Sensor from smartwatch: