Assignment 5

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https://github.com/ankita1598/Walmart

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```
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library("plyr")
library("ggplot2")
library(RColorBrewer)
library("dplyr")
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:plyr':
##
##     arrange, count, desc, failwith, id, mutate, rename, summarise,
##     summarize
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library("geosphere")
```

```
dataset = read.csv("data.csv", header= T)
head(dataset)
```

```
##   Store Dept       Date weeklySales isHoliday Type   Size Temperature
## 1     1    1 2010-02-05    24924.50     False    A 151315       42.31
## 2     1    1 2010-02-12    46039.49      True    A 151315       38.51
## 3     1    1 2010-02-19    41595.55     False    A 151315       39.93
## 4     1    1 2010-02-26    19403.54     False    A 151315       46.63
## 5     1    1 2010-03-05    21827.90     False    A 151315       46.50
## 6     1    1 2010-03-12    21043.39     False    A 151315       57.79
```

```
##   Fuel_Price MarkDown1 MarkDown2 MarkDown3 MarkDown4 MarkDown5      CPI
## 1      2.572        NA        NA        NA        NA        NA 211.0964
## 2      2.548        NA        NA        NA        NA        NA 211.2422
## 3      2.514        NA        NA        NA        NA        NA 211.2891
## 4      2.561        NA        NA        NA        NA        NA 211.3196
## 5      2.625        NA        NA        NA        NA        NA 211.3501
## 6      2.667        NA        NA        NA        NA        NA 211.3806
##   Unemployment
## 1        8.106
## 2        8.106
## 3        8.106
## 4        8.106
## 5        8.106
## 6        8.106
```

We can see that there are few null values in the data set for column Markdown 1 - 5. We will also split the data column in 3 as Day, Month and Year.

```
dataset$Year <- year(ymd(dataset$Date))
dataset$Month <- month(ymd(dataset$Date))
dataset$Day <- day(ymd(dataset$Date))
dataset$Dept = as.factor(dataset$Dept)
dataset$Store = as.factor(dataset$Store)
dataset$MarkDown1[is.na(dataset$MarkDown1)] = 0
dataset$MarkDown2[is.na(dataset$MarkDown2)] = 0
dataset$MarkDown3[is.na(dataset$MarkDown3)] = 0
dataset$MarkDown4[is.na(dataset$MarkDown4)] = 0
dataset$MarkDown5[is.na(dataset$MarkDown5)] = 0
dataset = fastDummies::dummy_cols(dataset, select_columns = "Type")
dataset$IsHoliday[dataset$isHoliday == "False"] = 0
dataset$IsHoliday[dataset$isHoliday == "True"] = 1
head(dataset)
```

```
##   Store Dept       Date weeklySales isHoliday Type   Size Temperature
## 1     1    1 2010-02-05    24924.50     False    A 151315       42.31
## 2     1    1 2010-02-12    46039.49      True    A 151315       38.51
## 3     1    1 2010-02-19    41595.55     False    A 151315       39.93
## 4     1    1 2010-02-26    19403.54     False    A 151315       46.63
## 5     1    1 2010-03-05    21827.90     False    A 151315       46.50
## 6     1    1 2010-03-12    21043.39     False    A 151315       57.79
##   Fuel_Price MarkDown1 MarkDown2 MarkDown3 MarkDown4 MarkDown5      CPI
## 1      2.572         0         0         0         0         0 211.0964
## 2      2.548         0         0         0         0         0 211.2422
## 3      2.514         0         0         0         0         0 211.2891
## 4      2.561         0         0         0         0         0 211.3196
## 5      2.625         0         0         0         0         0 211.3501
## 6      2.667         0         0         0         0         0 211.3806
##   Unemployment Year Month Day Type_A Type_B Type_C IsHoliday
## 1        8.106 2010     2   5      1      0      0         0
## 2        8.106 2010     2  12      1      0      0         1
```

```
## 3        8.106 2010     2  19      1      0      0         0
## 4        8.106 2010     2  26      1      0      0         0
## 5        8.106 2010     3   5      1      0      0         0
## 6        8.106 2010     3  12      1      0      0         0
```

```
sapply(dataset, function(x) sum(is.infinite(x)))
```

```
##        Store         Dept         Date  weeklySales    isHoliday         T
ype
##            0            0            0            0            0
0
##         Size  Temperature   Fuel_Price    MarkDown1    MarkDown2    MarkDo
wn3
##            0            0            0            0            0
0
##    MarkDown4    MarkDown5          CPI Unemployment         Year        Mo
nth
##            0            0            0            0            0
0
##          Day       Type_A       Type_B       Type_C    IsHoliday
##            0            0            0            0            0
```

```
sapply(dataset, function(x) sum(is.na(x)))
```

```
##        Store         Dept         Date  weeklySales    isHoliday         T
ype
##            0            0            0            0            0
0
##         Size  Temperature   Fuel_Price    MarkDown1    MarkDown2    MarkDo
wn3
##            0            0            0            0            0
0
##    MarkDown4    MarkDown5          CPI Unemployment         Year        Mo
nth
##            0            0            0            0            0
0
##          Day       Type_A       Type_B       Type_C    IsHoliday
##            0            0            0            0            0
```

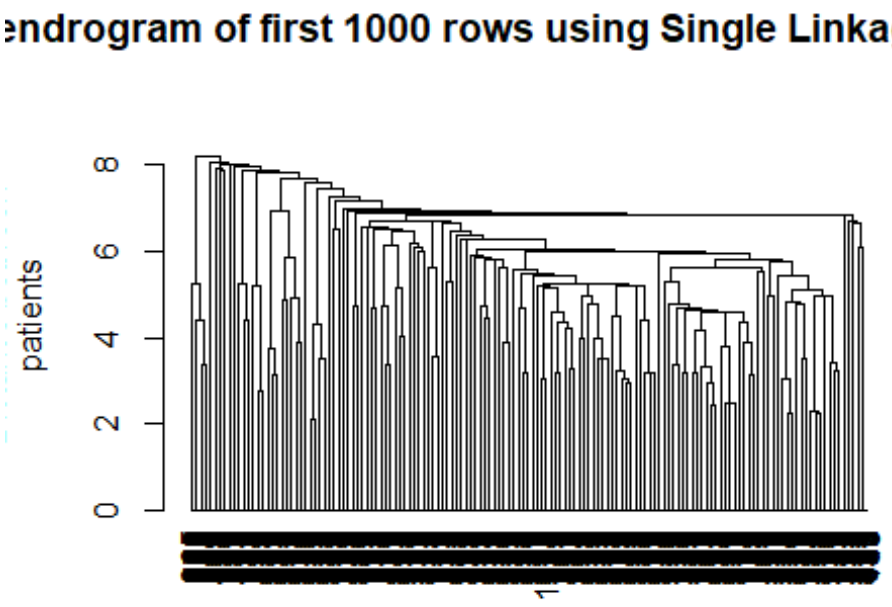
```
features = c("IsHoliday","Type_A","Type_B","Type_C","Size","Temperature","Fue
l_Price","CPI","Unemployment","Year","Month","Day")
dataset2  = select(dataset,features)  %>% slice(1:1000)
```

```
## Note: Using an external vector in selections is ambiguous.
## i Use `all_of(features)` instead of `features` to silence this message.
## i See <https://tidyselect.r-lib.org/reference/faq-external-vector.html>.
## This message is displayed once per session.
```

```
dim(dataset2)
```

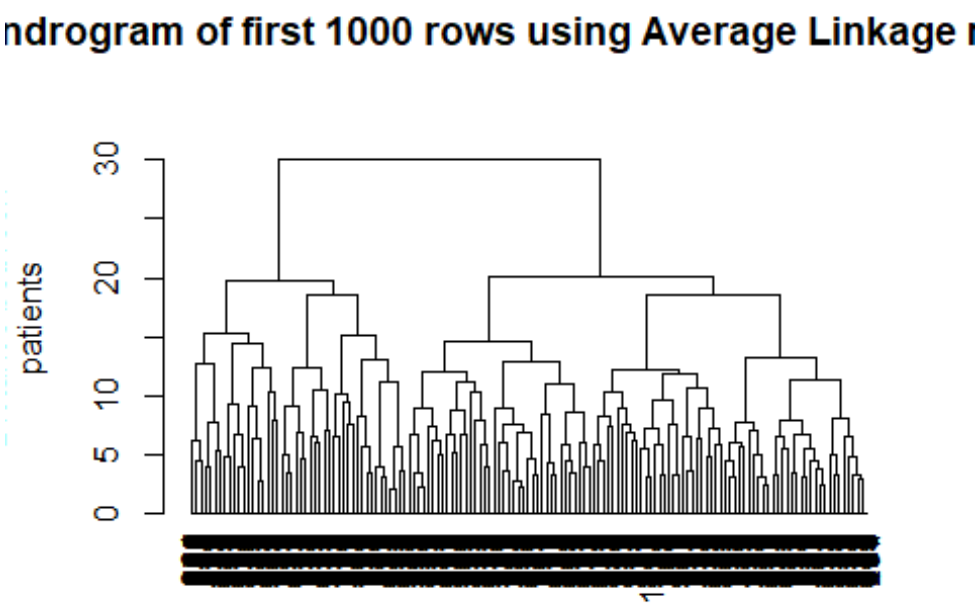
```
## [1] 1000   12
```

```r
Distance <- dist(dataset2, method="euclidean")

#Hirerarchical Methods
#1. Single Linkage Method
# Invoking hclust command (cluster analysis by single linkage method)
clus_sales_prediction.nn <- hclust(Distance, method = "single")
clus_sales_prediction.nn

##
## Call:
## hclust(d = Distance, method = "single")
##
## Cluster method   : single
## Distance         : euclidean
## Number of objects: 1000

#Plotting of dendrogram using Single Linkage method
plot(as.dendrogram(clus_sales_prediction.nn),ylab="Distance between
patients",ylim=c(0,9), main="Dendrogram of first 1000 rows using Single Linka
ge method")
```

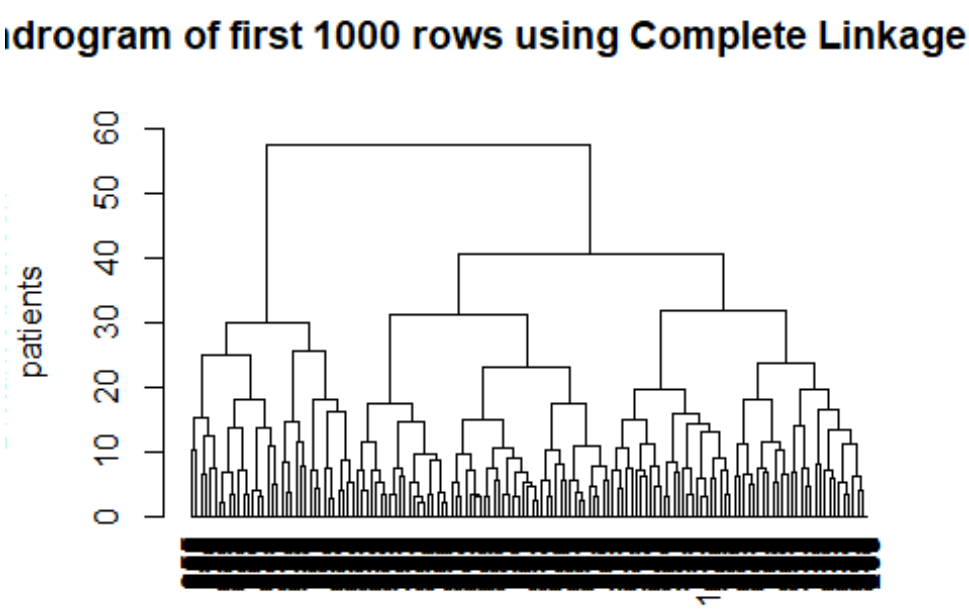



```r
#2. Average Linkage Method
clus_sales_prediction.avl <- hclust(Distance, method = "average")
clus_sales_prediction.avl

##
## Call:
## hclust(d = Distance, method = "average")
```

```
##
## Cluster method   : average
## Distance         : euclidean
## Number of objects: 1000

#Plotting of dendrogram using Average Linkage method
plot(as.dendrogram(clus_sales_prediction.avl),ylab="Distance between
patients",ylim=c(0,33),
 main="Dendrogram of first 1000 rows using Average Linkage method")
```




```
#3. Complete Linkage Method
clus_sales_prediction.fn <- hclust(Distance)
clus_sales_prediction.fn

##
## Call:
## hclust(d = Distance)
##
## Cluster method   : complete
## Distance         : euclidean
## Number of objects: 1000

plot(as.dendrogram(clus_sales_prediction.fn),ylab="Distance between
patients",ylim=c(0,60),
 main="Dendrogram of first 1000 rows using Complete Linkage method")
```




```
#Non-hirerarchical Method
#K-Means
# Centers (k's) are numbers thus, 10 random sets are chosen
(kmeans2.dataset <- kmeans(dataset2,2,nstart = 10))

## K-means clustering with 2 clusters of sizes 608, 392
##
## Cluster means:
##    IsHoliday Type_A Type_B Type_C   Size Temperature Fuel_Price      CPI
## 1 0.03453947      1      0      0 151315    78.00280   3.309079 216.5814
## 2 0.12500000      1      0      0 151315    53.26589   3.080339 215.0713
##   Unemployment     Year    Month      Day
## 1     7.530895 2011.044 6.902961 16.57072
## 2     7.736411 2010.839 5.732143 14.26786
##
## Clustering vector:
##    [1] 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2 1
##   [38] 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1
1 1 1
##   [75] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
2 2 2
##  [112] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 2 2 2
2 2 2
##  [149] 2 2 2 2 2 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2
2 2 2
##  [186] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1
```

```
1 1 1
##  [223] 1 1 1 1 1 1 1 1 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1
1 1 1
##  [260] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 2 2 2 2 2 2 2
2 2 2
##  [297] 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2 2 2 2 2 2
2 2 2
##  [334] 2 2 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
##  [371] 1 1 1 1 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1
1 1 1
##  [408] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 2 2 2 2 2 2 2 2 2 1 2
1 1 1
##  [445] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2 2 2 2 2 2 2 2 2
2 2 2
##  [482] 2 2 2 2 2 2 2 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
##  [519] 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1
1 1 1
##  [556] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1 1 1
1 1 1
##  [593] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
2 2 2
##  [630] 2 2 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1
2 2 2
##  [667] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
##  [704] 1 1 1 1 1 1 1 1 1 2 1 1 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1 1 1 1 1 1 1 1
1 1 1
##  [741] 1 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
1 2 1
##  [778] 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2 2 2 2 2
2 2 2
##  [815] 2 2 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
##  [852] 1 1 1 1 2 1 1 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1
##  [889] 1 1 1 1 1 2 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 1 1 1
1 2 1
##  [926] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2 2 2 2 2 2 2 2 2 2
2 2 2
##  [963] 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 2
## [1000] 1
##
## Within cluster sum of squares by cluster:
## [1] 92813.91 67925.67
##  (between_SS / total_SS =  47.9 %)
##
## Available components:
```

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

```
# Computing the percentage of variation accounted for. Two clusters
perc.var.2 <- round(100*(1 -
kmeans2.dataset$betweenss/kmeans2.dataset$totss),1)
names(perc.var.2) <- "Perc. 2 clus"
perc.var.2
```

```
## Perc. 2 clus
##         52.1
```