Week 8 - AYUPod - Clustering

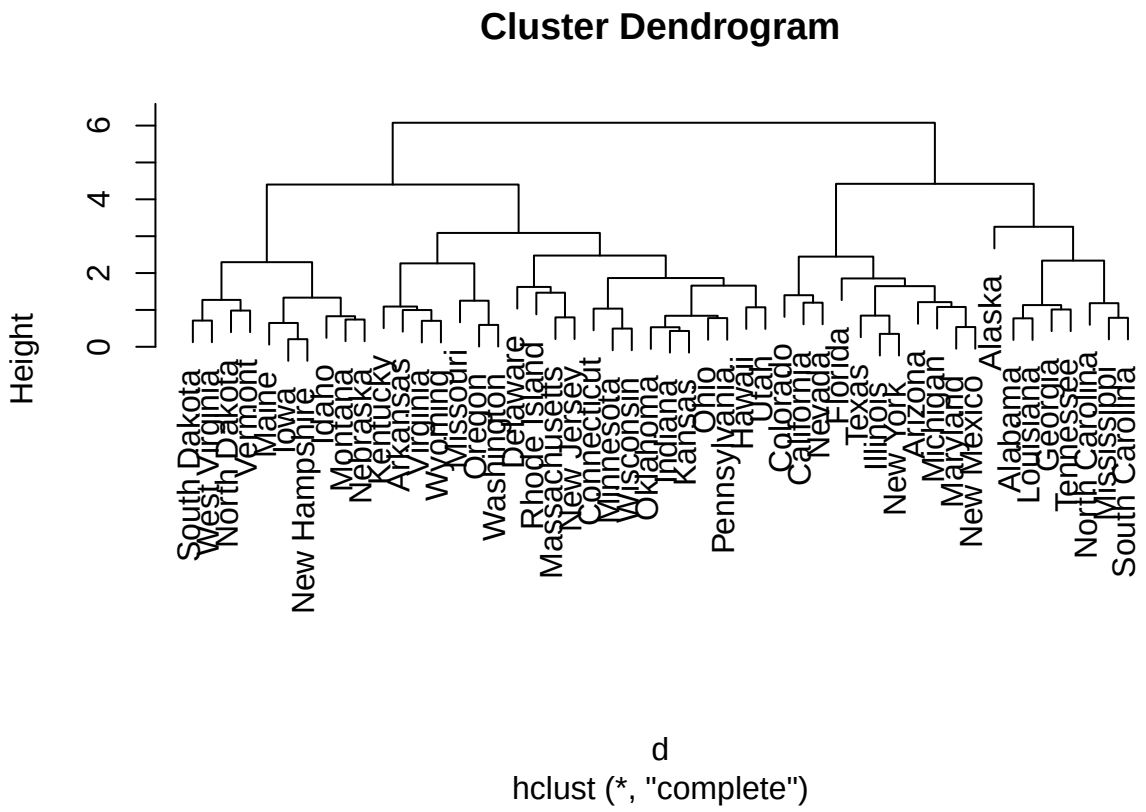
Contents

(Source: kaggle.com)

Hierarchical Clustering

```
library(cluster)
library(factoextra)
library(tidyverse)
df <- USArrests
df <- na.omit(df)
df <- scale(df)
# Dissimilarity matrix
d <- dist(df, method = "euclidean")

# Hierarchical clustering using Complete Linkage
# Method could be single, average...
```

```r
hi_clustering <- hclust(d, method = "complete" )

# Plot the obtained dendrogram
plot(hi_clustering)
```

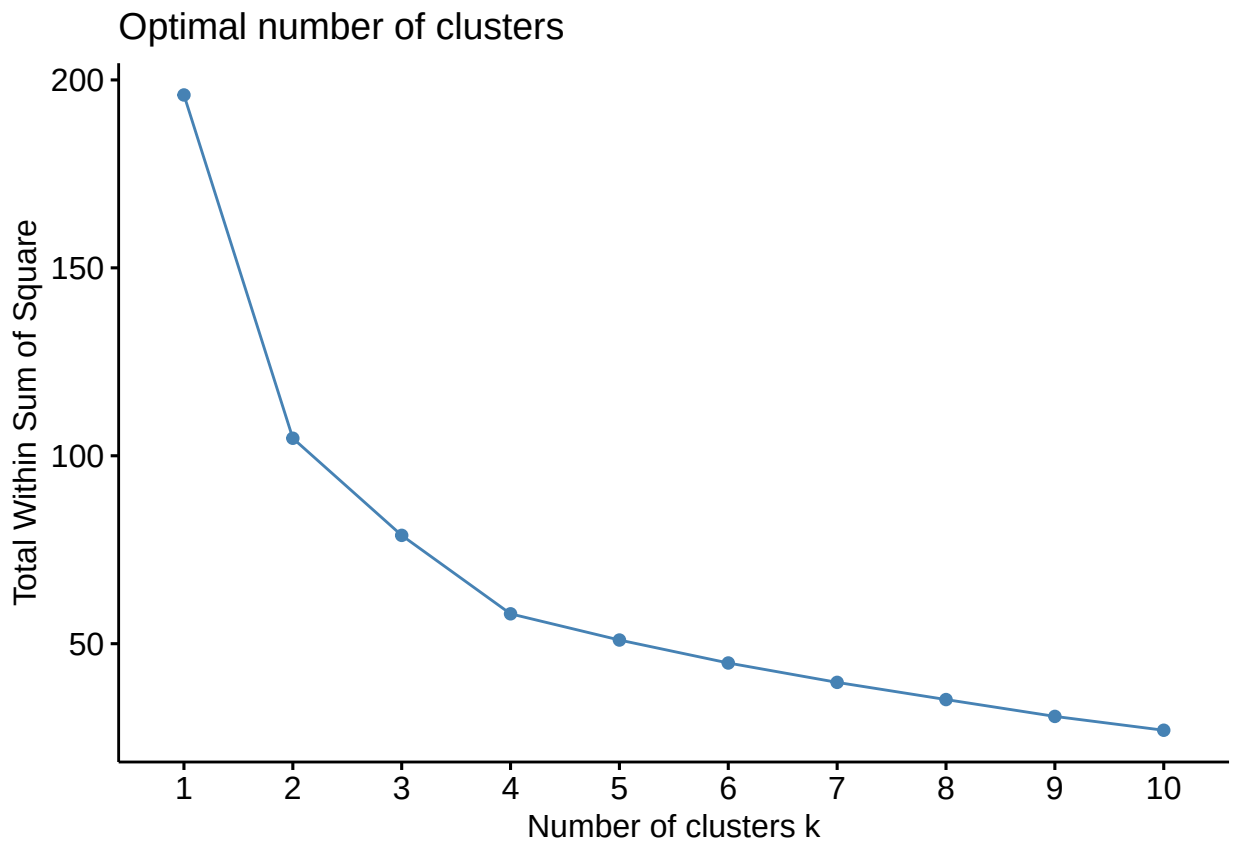


- Decide the number of clusters

We will use the `elbow` method to decide the number of cluster we should partition the data into. We will plot the total sum squares within clusters to determine how `spread out` the clusters are within themselves. If a cluster contains one point then the sum square within this cluster is zero. The more points a cluster has, the more likely it has larger sum squares. Thus, at the first step of hierarchical clustering where each point is a cluster, the total sum squares should be zero. At each step the total sum squares will be reduced.

We look for the `elbow` point of the graph, to identify the number of cluster. We can argue that the `elbow` point of this graph is at the number of cluster being 3. Thus we decide that the number of clusters for the data is 3.

```
fviz_nbclust(df, FUN = hcut, method = "wss")
```

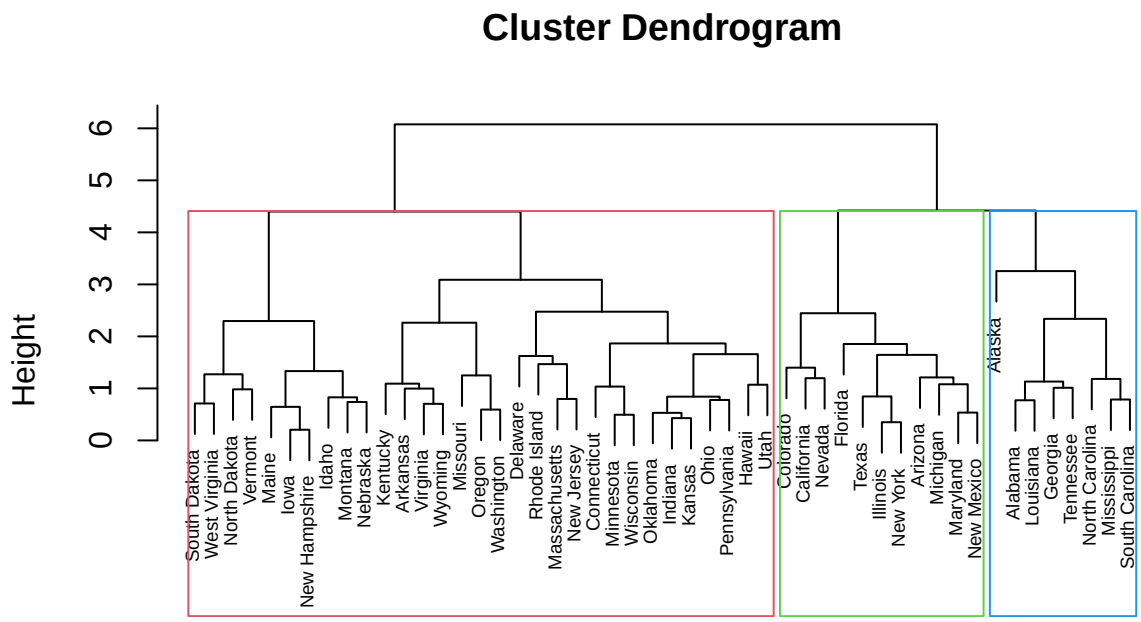


- Assign clusters to the observations

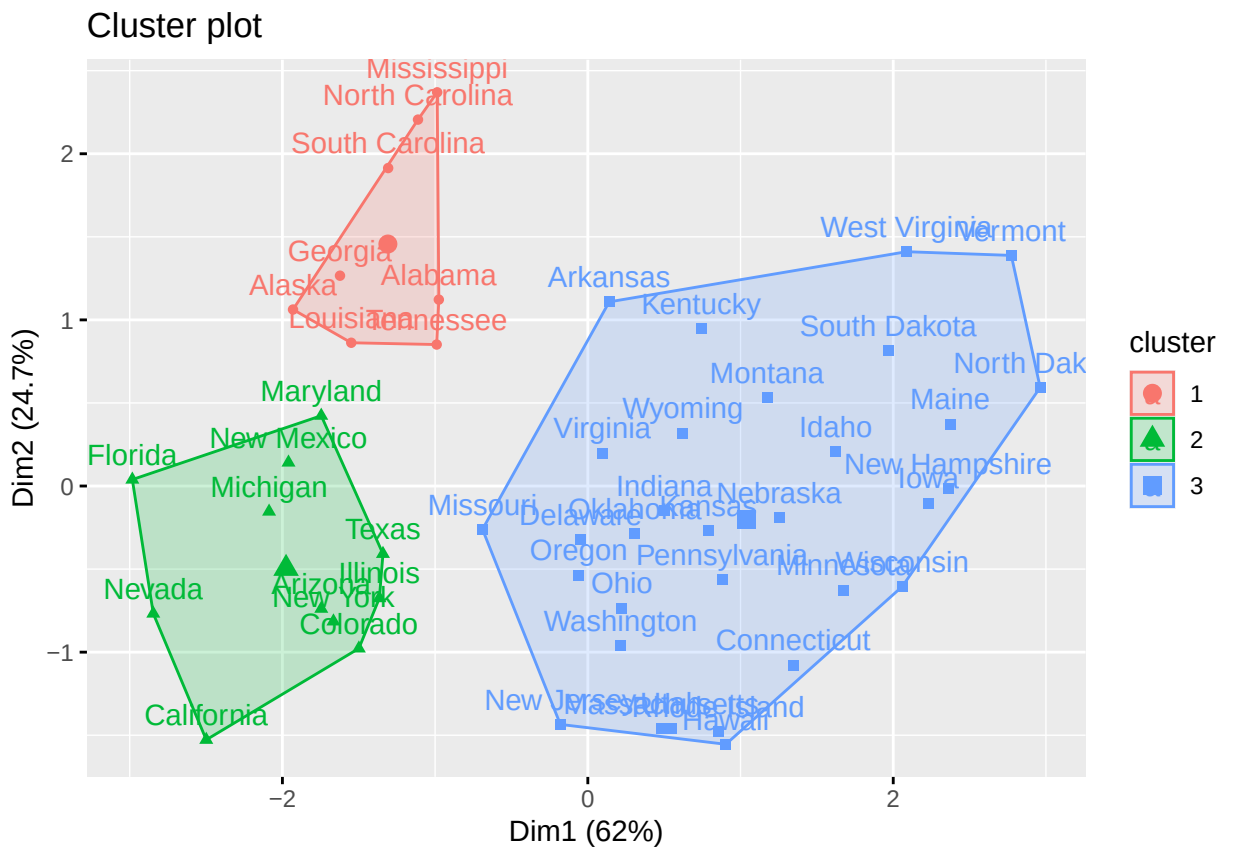
```
# Cut tree into 4 groups
sub_grp <- cutree(hi_clustering, k = 3)
USArrests = USArrests %>%
  mutate(cluster = sub_grp)
```

- Visualize the clusters

```
plot(hi_clustering, cex = 0.6)
rect.hclust(hi_clustering, k = 3, border = 2:5)
```




```
fviz_cluster(list(data = df, cluster = sub_grp))
```



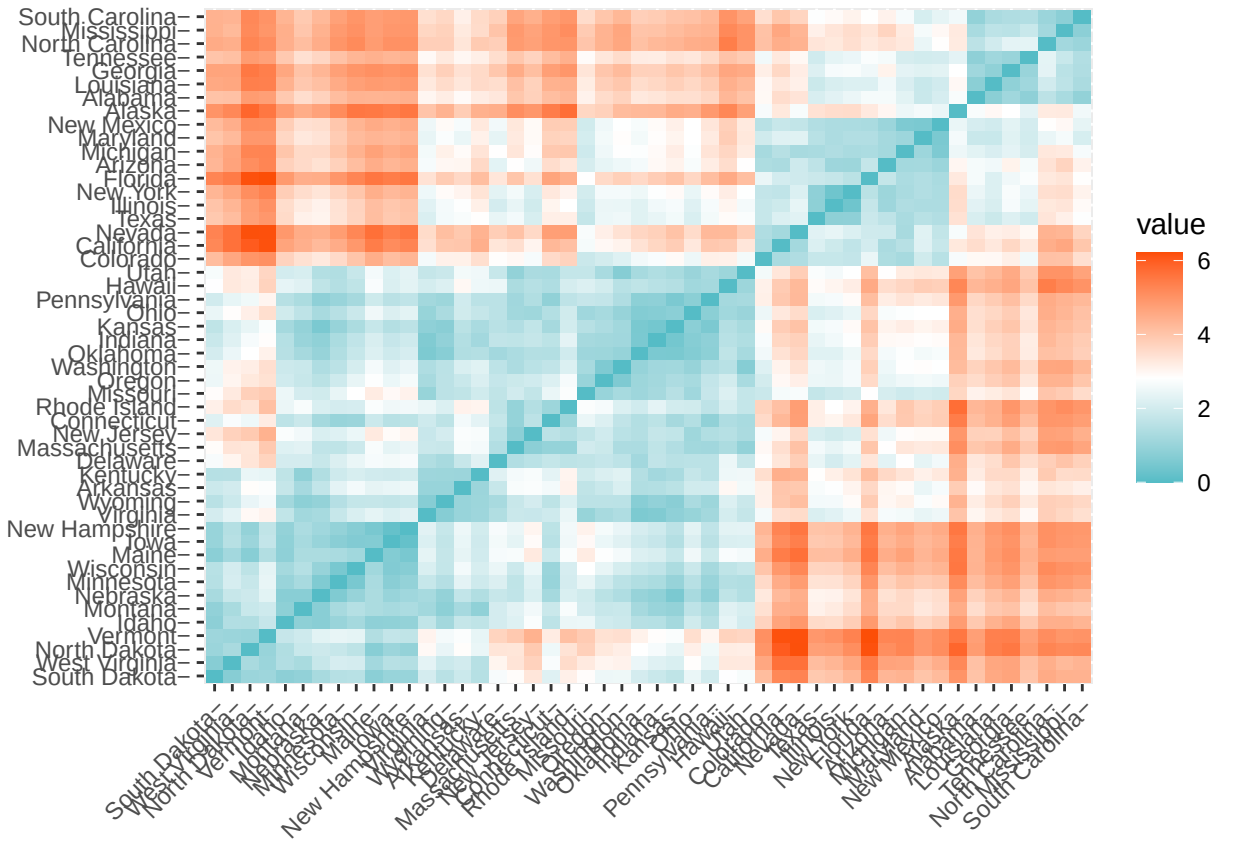
Question

Working with the Maill Customers dataset.

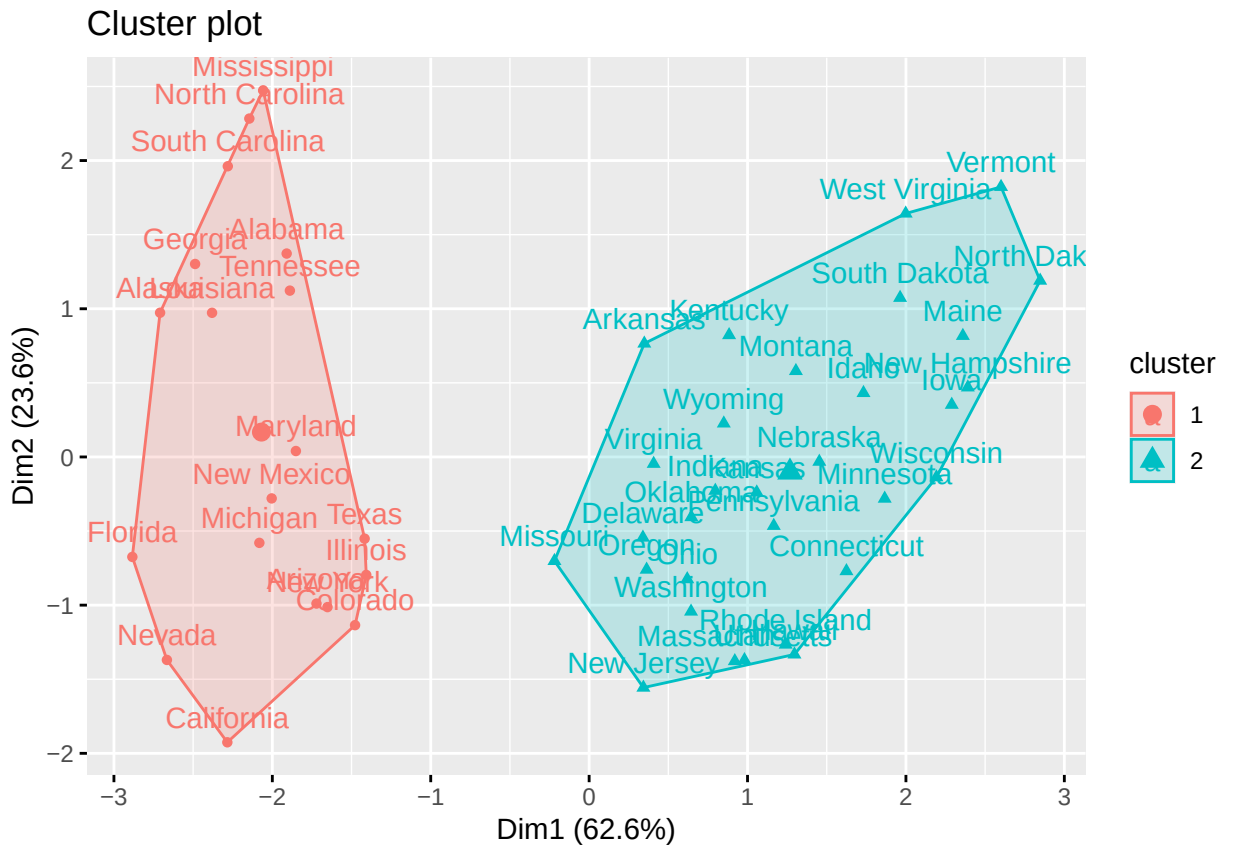
- Plot the total sum squares within clusters and use the `elbow` method to decide the number of clusters.
- Visualize the clusters with the selected number of clusters.

K-means Clustering

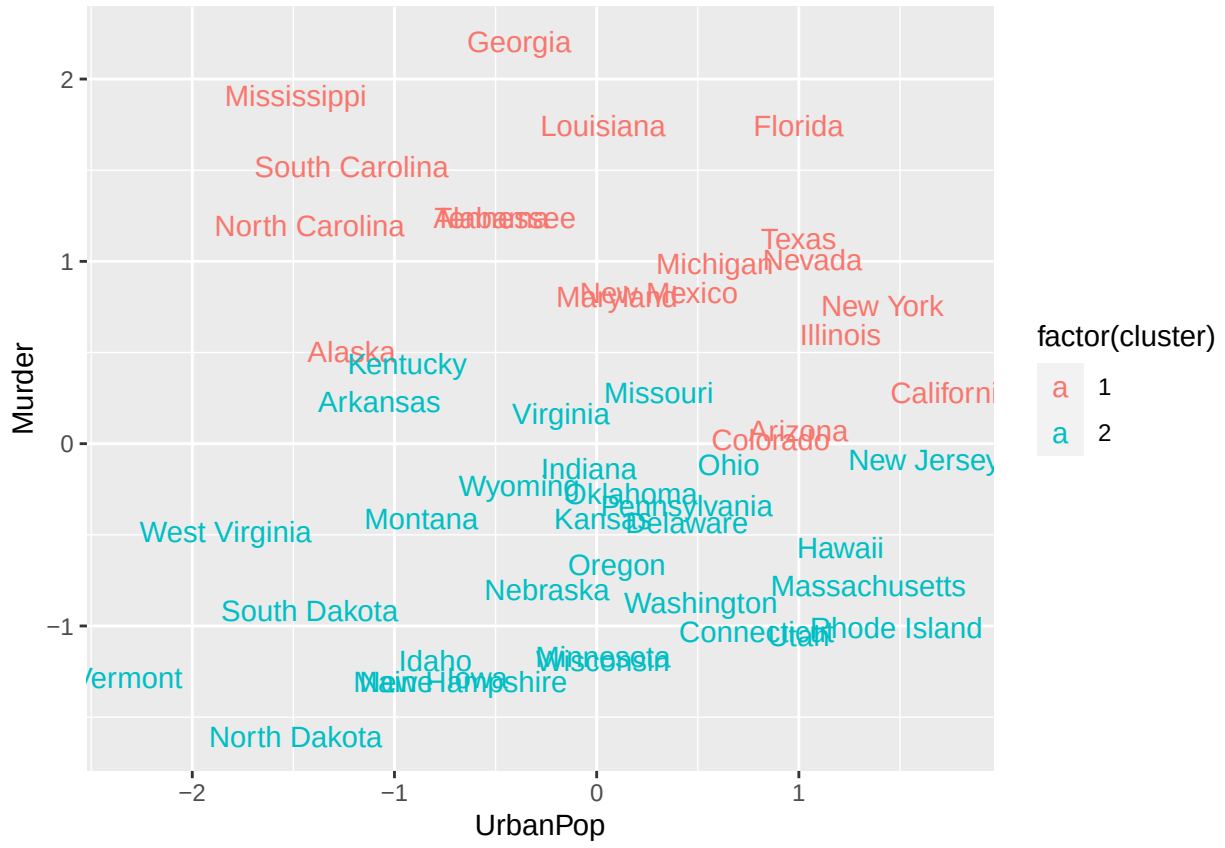
```
library(tidyverse)  # data manipulation
library(cluster)    # clustering algorithms
library(factoextra) # clustering algorithms & visualization
df <- USArrests

df <- na.omit(df)

df <- scale(df)
distance <- get_dist(df)
fviz_dist(distance, gradient = list(low = "#00AFBB", mid = "white", high = "#FC4E07"))
```



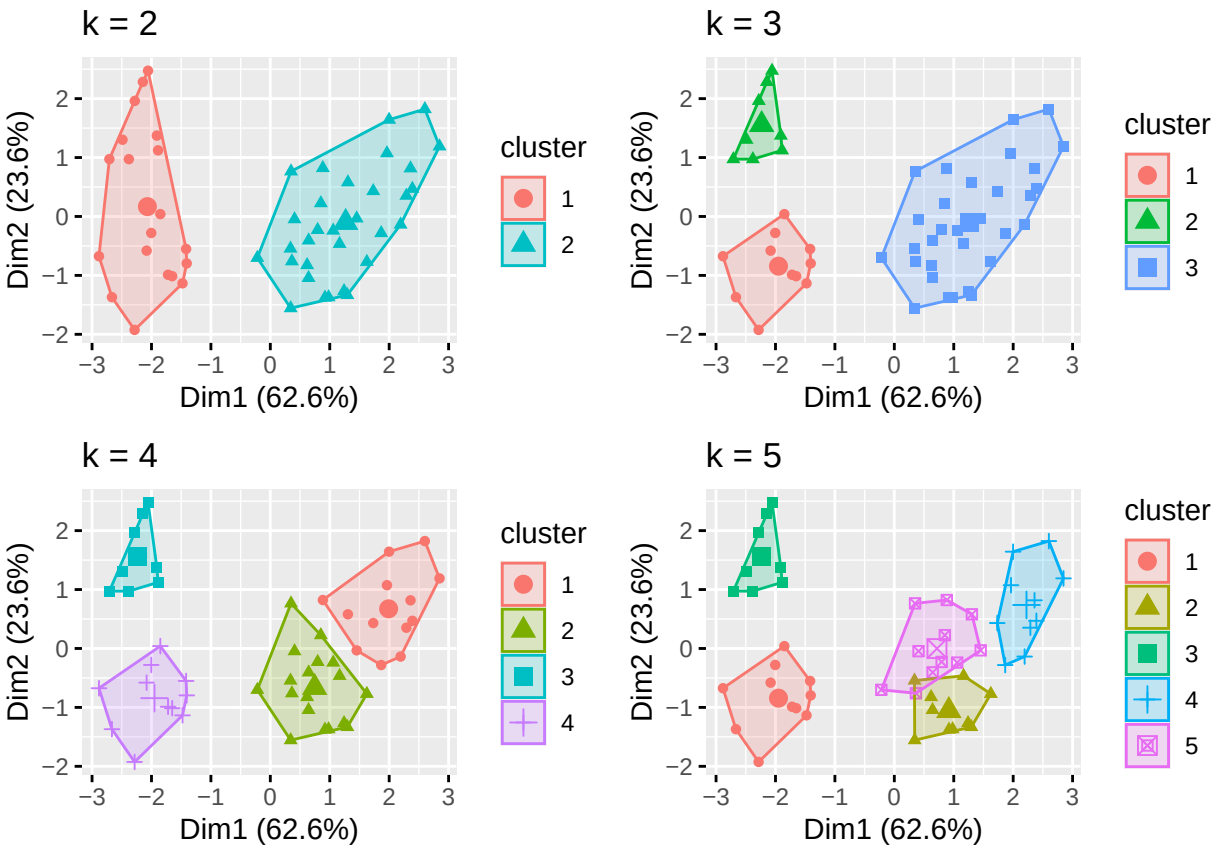

```
k2 <- kmeans(df, centers = 2, nstart = 25)
fviz_cluster(k2, data = df)
```



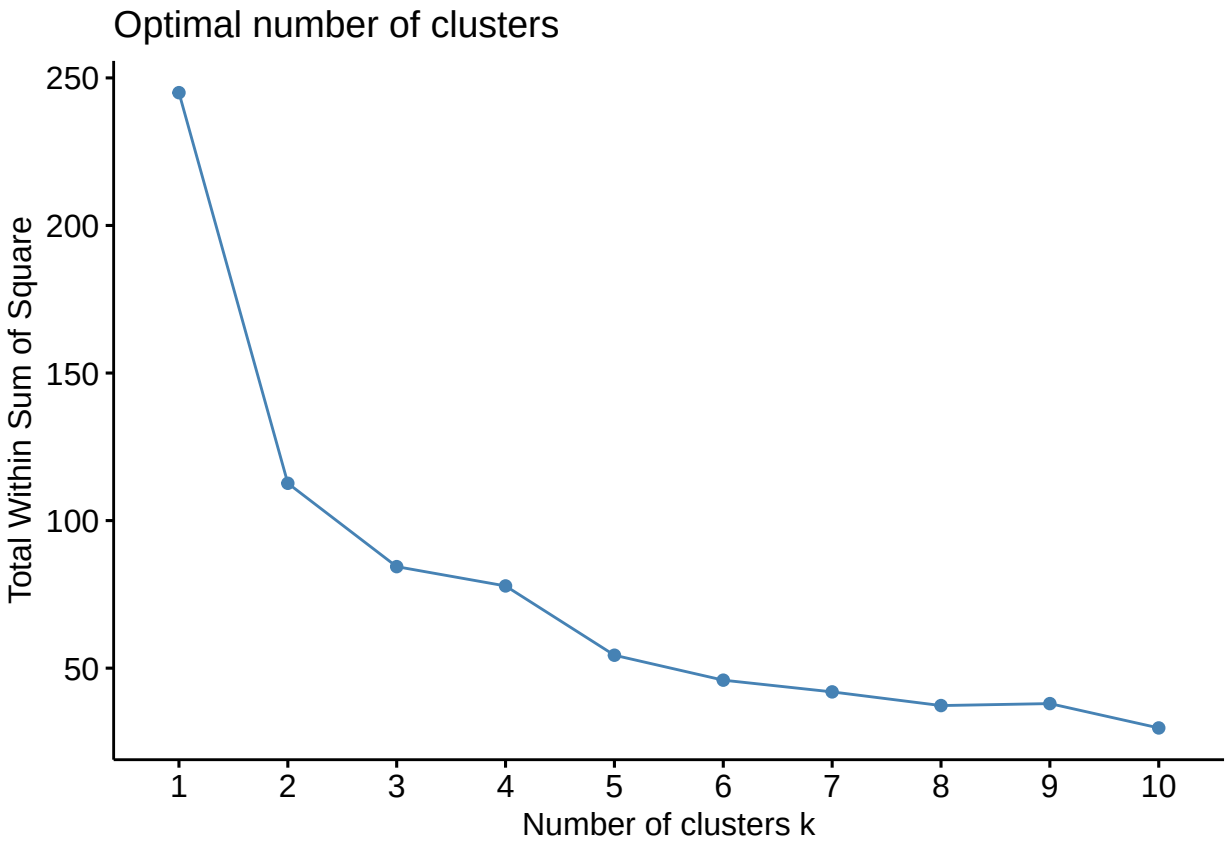

```
df %>%
  as_tibble() %>%
  mutate(cluster = k2$cluster,
         state = row.names(USArrests)) %>%
  ggplot(aes(UrbanPop, Murder, color = factor(cluster), label = state)) +
  geom_text()
```



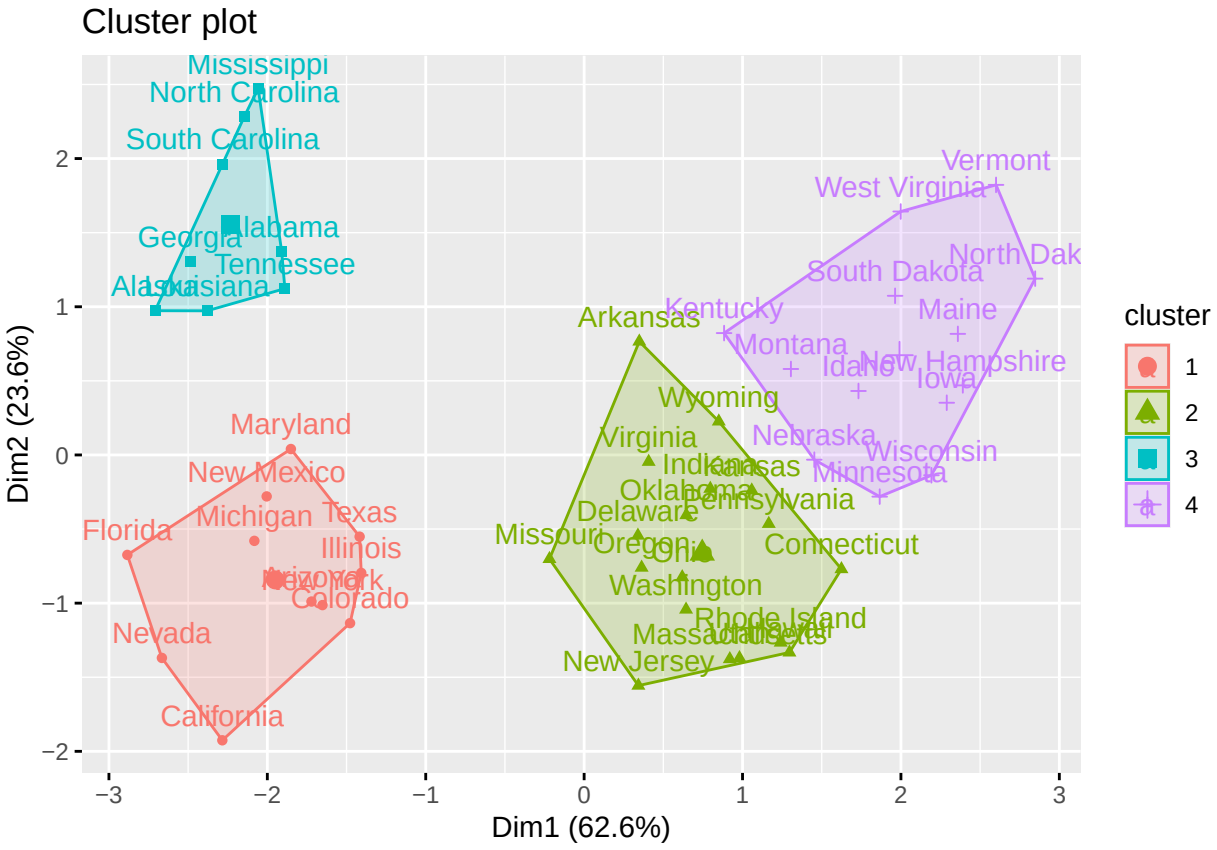

```
k3 <- kmeans(df, centers = 3, nstart = 25)
k4 <- kmeans(df, centers = 4, nstart = 25)
k5 <- kmeans(df, centers = 5, nstart = 25)

# plots to compare
p1 <- fviz_cluster(k2, geom = "point", data = df) + ggtitle("k = 2")
p2 <- fviz_cluster(k3, geom = "point",  data = df) + ggtitle("k = 3")
p3 <- fviz_cluster(k4, geom = "point",  data = df) + ggtitle("k = 4")
p4 <- fviz_cluster(k5, geom = "point",  data = df) + ggtitle("k = 5")

library(gridExtra)
grid.arrange(p1, p2, p3, p4, nrow = 2)
```




```
set.seed(123)

fviz_nbclust(df, kmeans, method = "wss")
```




```
final <- kmeans(df, 4, nstart = 25)

fviz_cluster(final, data = df)
```



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