

Kira Plastinina Customer Insights Project

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Defining the question

In this weeks problem, I will be working as a data scientist for a client, Kira Plastinina. Kira Plastinina is a Russian brand that is sold throughout retail stores in Russia, Ukraine, Kazakhstan, Belarus, China, Philippines, and Armenia. It's marketing team would like to better understand their customers behaviors and therefore requested me to draw insights on the characteristics of various customer groups.

Defining the metric of success

The metric of success is to obtain several distinct clusters of the Kira Plastina's customers and their characteristics.

Data Sourcing

The dataset was sourced from the company's database of existing customers. The dataset was availed by the brand's sales and marketing team.

The Experimental Design

For me to be able to obtain the required results, the following steps will be undertaken

1. Problem definition
2. Data sourcing
3. Checking the data
4. Performing data cleaning
5. Perform Exploratory data analysis
6. Implementing the solution
7. Challenging the solution
8. Follow up questions

Checking the data

Loading the dataset

```
# the dataset has been downloaded to a local repository and will be loaded as a csv file
data <- read.csv(file.choose())
head(data)
```

```
##      Administrative Administrative_Duration Informational Informational_Duration
## 1           0           0           0           0
## 2           0           0           0           0
## 3           0          -1           0          -1
## 4           0           0           0           0
## 5           0           0           0           0
## 6           0           0           0           0
##      ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1           1           0.000000 0.20000000 0.20000000 0
## 2           2          64.000000 0.00000000 0.10000000 0
## 3           1          -1.000000 0.20000000 0.20000000 0
## 4           2           2.666667 0.05000000 0.14000000 0
## 5          10          627.500000 0.02000000 0.05000000 0
## 6          19          154.216667 0.01578947 0.0245614 0
##      SpecialDay Month OperatingSystems Browser Region TrafficType
## 1           0 Feb           1           1           1           1
## 2           0 Feb           2           2           1           2
## 3           0 Feb           4           1           9           3
## 4           0 Feb           3           2           2           4
## 5           0 Feb           3           3           1           4
## 6           0 Feb           2           2           1           3
##      VisitorType Weekend Revenue
## 1 Returning_Visitor FALSE FALSE
## 2 Returning_Visitor FALSE FALSE
## 3 Returning_Visitor FALSE FALSE
## 4 Returning_Visitor FALSE FALSE
## 5 Returning_Visitor TRUE  FALSE
## 6 Returning_Visitor FALSE FALSE
```

```
# previewing the bottom of the dataset
tail(data)
```

```
##      Administrative Administrative_Duration Informational
## 12325           0           0           1
## 12326           3          145           0
## 12327           0           0           0
## 12328           0           0           0
## 12329           4           75           0
## 12330           0           0           0
##      Informational_Duration ProductRelated ProductRelated_Duration BounceRates
## 12325           0           16          503.000 0.000000000
## 12326           0           53         1783.792 0.007142857
## 12327           0           5          465.750 0.000000000
## 12328           0           6          184.250 0.083333333
## 12329           0          15          346.000 0.000000000
## 12330           0           3          21.250 0.000000000
##      ExitRates PageValues SpecialDay Month OperatingSystems Browser Region
## 12325 0.03764706 0.00000 0 Nov           2           2           1
## 12326 0.02903061 12.24172 0 Dec           4           6           1
## 12327 0.02133333 0.00000 0 Nov           3           2           1
## 12328 0.08666667 0.00000 0 Nov           3           2           1
## 12329 0.02105263 0.00000 0 Nov           2           2           3
## 12330 0.06666667 0.00000 0 Nov           3           2           1
##      TrafficType VisitorType Weekend Revenue
```

```
## 12325      1 Returning_Visitor  FALSE  FALSE
## 12326      1 Returning_Visitor   TRUE  FALSE
## 12327      8 Returning_Visitor   TRUE  FALSE
## 12328     13 Returning_Visitor   TRUE  FALSE
## 12329     11 Returning_Visitor  FALSE  FALSE
## 12330      2      New_Visitor   TRUE  FALSE
```

```
# displaying the structure of the dataset
str(data)
```

```
## 'data.frame':  12330 obs. of  18 variables:
## $ Administrative      : int  0 0 0 0 0 0 0 1 0 0 ...
## $ Administrative_Duration: num  0 0 -1 0 0 0 -1 -1 0 0 ...
## $ Informational       : int  0 0 0 0 0 0 0 0 0 0 ...
## $ Informational_Duration: num  0 0 -1 0 0 0 -1 -1 0 0 ...
## $ ProductRelated      : int  1 2 1 2 10 19 1 1 2 3 ...
## $ ProductRelated_Duration: num  0 64 -1 2.67 627.5 ...
## $ BounceRates          : num  0.2 0 0.2 0.05 0.02 ...
## $ ExitRates            : num  0.2 0.1 0.2 0.14 0.05 ...
## $ PageValues           : num  0 0 0 0 0 0 0 0 0 0 ...
## $ SpecialDay           : num  0 0 0 0 0 0 0.4 0 0.8 0.4 ...
## $ Month                : chr  "Feb" "Feb" "Feb" "Feb" ...
## $ OperatingSystems     : int  1 2 4 3 3 2 2 1 2 2 ...
## $ Browser              : int  1 2 1 2 3 2 4 2 2 4 ...
## $ Region               : int  1 1 9 2 1 1 3 1 2 1 ...
## $ TrafficType          : int  1 2 3 4 4 3 3 5 3 2 ...
## $ VisitorType          : chr  "Returning_Visitor" "Returning_Visitor" "Returning_Visitor" "Return
## $ Weekend              : logi  FALSE FALSE FALSE FALSE TRUE FALSE ...
## $ Revenue              : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
```

```
# displaying the dimension of the dataset
dim(data)
```

```
## [1] 12330    18
```

the data contains 12,330 entries and 18 columns

```
# checking the names of the columns and their datatypes in the dataset
```

```
columns = colnames(data)
for (column in seq(length(colnames(data)))){
  print(columns[column])
  print(class(data[, column]))
  cat('\n')
}
```

```
## [1] "Administrative"
## [1] "integer"
##
## [1] "Administrative_Duration"
## [1] "numeric"
##
```

```
## [1] "Informational"
## [1] "integer"
##
## [1] "Informational_Duration"
## [1] "numeric"
##
## [1] "ProductRelated"
## [1] "integer"
##
## [1] "ProductRelated_Duration"
## [1] "numeric"
##
## [1] "BounceRates"
## [1] "numeric"
##
## [1] "ExitRates"
## [1] "numeric"
##
## [1] "PageValues"
## [1] "numeric"
##
## [1] "SpecialDay"
## [1] "numeric"
##
## [1] "Month"
## [1] "character"
##
## [1] "OperatingSystems"
## [1] "integer"
##
## [1] "Browser"
## [1] "integer"
##
## [1] "Region"
## [1] "integer"
##
## [1] "TrafficType"
## [1] "integer"
##
## [1] "VisitorType"
## [1] "character"
##
## [1] "Weekend"
## [1] "logical"
##
## [1] "Revenue"
## [1] "logical"
```

Checking for missing values

```
# checking if the dataset contains any missing values
any(is.na(data))
```

```
## [1] TRUE
```

```
# checking the columns with missing data  
colSums(is.na(data))
```

```
##      Administrative Administrative_Duration      Informational  
##      14              14              14  
## Informational_Duration      ProductRelated ProductRelated_Duration  
##      14              14              14  
##      BounceRates      ExitRates      PageValues  
##      14              14              0  
##      SpecialDay      Month      OperatingSystems  
##      0              0              0  
##      Browser      Region      TrafficType  
##      0              0              0  
##      VisitorType      Weekend      Revenue  
##      0              0              0
```

```
# since the missing data is not a lot I will skip the missing data  
df <- na.omit(data)  
  
# cheking the dimension of the new dataset  
dim(df)
```

```
## [1] 12316      18
```

checking for duplicates

```
# checking for duplicated data in the dataset  
any(duplicated(df))
```

```
## [1] TRUE
```

```
# identifying the duplicated data  
dup <- df[duplicated(df),]  
dup
```

```
##      Administrative Administrative_Duration      Informational  
## 159              0              0              0  
## 179              0              0              0  
## 419              0              0              0  
## 457              0              0              0  
## 484              0              0              0  
## 513              0              0              0  
## 555              0              0              0  
## 590              0              0              0  
## 660              0              0              0  
## 775              0              0              0  
## 873              0              0              0  
## 890              0              0              0
```

## 923	0	0	0
## 948	0	0	0
## 975	0	0	0
## 1035	0	0	0
## 1120	0	0	0
## 1171	0	0	0
## 1177	0	0	0
## 1214	0	0	0
## 1215	0	0	0
## 1292	0	0	0
## 1326	0	0	0
## 1357	0	0	0
## 1367	0	0	0
## 1382	0	0	0
## 1391	0	0	0
## 1395	0	0	0
## 1437	0	0	0
## 1454	0	0	0
## 1516	0	0	0
## 1574	0	0	0
## 1609	0	0	0
## 1698	0	0	0
## 1776	0	0	0
## 1805	0	0	0
## 1840	0	0	0
## 1867	0	0	0
## 1926	0	0	0
## 1934	0	0	0
## 1950	0	0	0
## 2057	0	0	0
## 2058	0	0	0
## 2236	0	0	0
## 2622	0	0	0
## 2740	0	0	0
## 3232	0	0	0
## 3273	0	0	0
## 3282	0	0	0
## 3578	0	0	0
## 3651	0	0	0
## 3664	0	0	0
## 3722	0	0	0
## 3892	0	0	0
## 4164	0	0	0
## 4183	0	0	0
## 4232	0	0	0
## 4344	0	0	0
## 4375	0	0	0
## 4404	0	0	0
## 4427	0	0	0
## 4464	0	0	0
## 4490	0	0	0
## 4553	0	0	0
## 4818	0	0	0
## 4884	0	0	0

## 4914	0	0	0
## 5039	0	0	0
## 5044	0	0	0
## 5057	0	0	0
## 5119	0	0	0
## 5199	0	0	0
## 5200	0	0	0
## 5255	0	0	0
## 5277	0	0	0
## 5287	0	0	0
## 5356	0	0	0
## 5408	0	0	0
## 6930	0	0	0
## 7152	0	0	0
## 7636	0	0	0
## 8545	0	0	0
## 9307	0	0	0
## 9495	0	0	0
## 9552	0	0	0
## 9569	0	0	0
## 9582	0	0	0
## 9719	0	0	0
## 9770	0	0	0
## 9879	0	0	0
## 9908	0	0	0
## 10147	0	0	0
## 10223	0	0	0
## 10270	0	0	0
## 10573	0	0	0
## 10632	0	0	0
## 10752	0	0	0
## 10796	0	0	0
## 10842	0	0	0
## 10989	0	0	0
## 11044	0	0	0
## 11206	0	0	0
## 11405	0	0	0
## 11524	0	0	0
## 11582	0	0	0
## 11625	0	0	0
## 11659	0	0	0
## 11734	0	0	0
## 11748	0	0	0
## 11802	0	0	0
## 11814	0	0	0
## 11828	0	0	0
## 11935	0	0	0
## 11939	0	0	0
## 12160	0	0	0
## 12181	0	0	0
## 12186	0	0	0
##	Informational_Duration	ProductRelated	ProductRelated_Duration
## 159	0	1	0
## 179	0	1	0
			BounceRates
			0.2
			0.2

## 419	0	1	0	0.2
## 457	0	1	0	0.2
## 484	0	1	0	0.2
## 513	0	1	0	0.2
## 555	0	1	0	0.2
## 590	0	1	0	0.2
## 660	0	2	0	0.2
## 775	0	1	0	0.2
## 873	0	1	0	0.2
## 890	0	1	0	0.2
## 923	0	1	0	0.2
## 948	0	1	0	0.2
## 975	0	1	0	0.2
## 1035	0	1	0	0.2
## 1120	0	1	0	0.2
## 1171	0	1	0	0.2
## 1177	0	1	0	0.2
## 1214	0	1	0	0.2
## 1215	0	1	0	0.2
## 1292	0	2	0	0.2
## 1326	0	1	0	0.2
## 1357	0	2	0	0.2
## 1367	0	1	0	0.2
## 1382	0	1	0	0.2
## 1391	0	1	0	0.2
## 1395	0	1	0	0.2
## 1437	0	1	0	0.2
## 1454	0	1	0	0.2
## 1516	0	1	0	0.2
## 1574	0	1	0	0.2
## 1609	0	1	0	0.2
## 1698	0	1	0	0.2
## 1776	0	1	0	0.2
## 1805	0	1	0	0.2
## 1840	0	1	0	0.2
## 1867	0	1	0	0.2
## 1926	0	1	0	0.2
## 1934	0	1	0	0.2
## 1950	0	1	0	0.2
## 2057	0	1	0	0.2
## 2058	0	1	0	0.2
## 2236	0	1	0	0.2
## 2622	0	1	0	0.2
## 2740	0	1	0	0.2
## 3232	0	1	0	0.2
## 3273	0	1	0	0.2
## 3282	0	1	0	0.2
## 3578	0	1	0	0.2
## 3651	0	1	0	0.2
## 3664	0	1	0	0.2
## 3722	0	1	0	0.2
## 3892	0	1	0	0.2
## 4164	0	1	0	0.2
## 4183	0	1	0	0.2

## 4232	0	1	0	0.2
## 4344	0	1	0	0.2
## 4375	0	1	0	0.2
## 4404	0	1	0	0.2
## 4427	0	1	0	0.2
## 4464	0	1	0	0.2
## 4490	0	1	0	0.2
## 4553	0	2	0	0.2
## 4818	0	1	0	0.2
## 4884	0	1	0	0.2
## 4914	0	1	0	0.2
## 5039	0	1	0	0.2
## 5044	0	1	0	0.2
## 5057	0	1	0	0.2
## 5119	0	1	0	0.2
## 5199	0	1	0	0.2
## 5200	0	2	0	0.2
## 5255	0	1	0	0.2
## 5277	0	1	0	0.2
## 5287	0	1	0	0.2
## 5356	0	1	0	0.2
## 5408	0	1	0	0.2
## 6930	0	1	0	0.2
## 7152	0	1	0	0.2
## 7636	0	1	0	0.2
## 8545	0	1	0	0.2
## 9307	0	1	0	0.2
## 9495	0	1	0	0.2
## 9552	0	1	0	0.2
## 9569	0	1	0	0.2
## 9582	0	1	0	0.2
## 9719	0	1	0	0.2
## 9770	0	1	0	0.2
## 9879	0	1	0	0.2
## 9908	0	1	0	0.2
## 10147	0	1	0	0.2
## 10223	0	2	0	0.2
## 10270	0	1	0	0.2
## 10573	0	1	0	0.2
## 10632	0	1	0	0.2
## 10752	0	1	0	0.2
## 10796	0	1	0	0.2
## 10842	0	1	0	0.2
## 10989	0	1	0	0.2
## 11044	0	1	0	0.2
## 11206	0	1	0	0.2
## 11405	0	1	0	0.2
## 11524	0	1	0	0.2
## 11582	0	1	0	0.2
## 11625	0	1	0	0.2
## 11659	0	1	0	0.2
## 11734	0	1	0	0.2
## 11748	0	1	0	0.2
## 11802	0	1	0	0.2

## 11814		0		1		0		0.2
## 11828		0		1		0		0.2
## 11935		0		1		0		0.2
## 11939		0		1		0		0.2
## 12160		0		1		0		0.2
## 12181		0		1		0		0.2
## 12186		0		1		0		0.2
##	ExitRates	PageValues	SpecialDay	Month	OperatingSystems	Browser	Region	
## 159	0.2	0	0.0	Feb	1	1	1	
## 179	0.2	0	0.0	Feb	3	2	3	
## 419	0.2	0	0.0	Mar	1	1	1	
## 457	0.2	0	0.0	Mar	2	2	4	
## 484	0.2	0	0.0	Mar	3	2	3	
## 513	0.2	0	0.0	Mar	2	2	1	
## 555	0.2	0	0.0	Mar	2	2	1	
## 590	0.2	0	0.0	Mar	2	2	1	
## 660	0.2	0	0.0	Mar	2	5	1	
## 775	0.2	0	0.0	Mar	2	2	4	
## 873	0.2	0	0.0	Mar	3	2	3	
## 890	0.2	0	0.0	Mar	1	1	2	
## 923	0.2	0	0.0	Mar	3	2	2	
## 948	0.2	0	0.0	Mar	2	2	1	
## 975	0.2	0	0.0	Mar	2	2	1	
## 1035	0.2	0	0.0	Mar	2	2	1	
## 1120	0.2	0	0.0	Mar	2	2	1	
## 1171	0.2	0	0.0	Mar	3	2	1	
## 1177	0.2	0	0.0	Mar	2	4	1	
## 1214	0.2	0	0.0	Mar	3	2	3	
## 1215	0.2	0	0.0	Mar	1	1	1	
## 1292	0.2	0	0.0	Mar	2	2	1	
## 1326	0.2	0	0.0	Mar	1	1	3	
## 1357	0.2	0	0.0	Mar	1	1	1	
## 1367	0.2	0	0.0	Mar	1	1	8	
## 1382	0.2	0	0.0	Mar	1	1	4	
## 1391	0.2	0	0.0	Mar	2	2	1	
## 1395	0.2	0	0.0	Mar	2	2	1	
## 1437	0.2	0	0.0	Mar	3	2	3	
## 1454	0.2	0	0.0	Mar	2	2	1	
## 1516	0.2	0	0.0	Mar	1	1	1	
## 1574	0.2	0	0.0	Mar	2	2	1	
## 1609	0.2	0	0.0	Mar	2	2	7	
## 1698	0.2	0	0.0	Mar	2	2	2	
## 1776	0.2	0	0.0	Mar	3	2	1	
## 1805	0.2	0	0.0	Mar	1	1	8	
## 1840	0.2	0	0.0	Mar	2	2	1	
## 1867	0.2	0	0.0	Mar	1	1	1	
## 1926	0.2	0	0.0	Mar	3	2	1	
## 1934	0.2	0	0.0	Mar	2	2	1	
## 1950	0.2	0	0.0	Mar	2	2	1	
## 2057	0.2	0	0.0	Mar	3	2	3	
## 2058	0.2	0	0.0	Mar	2	4	1	
## 2236	0.2	0	0.0	May	1	1	4	
## 2622	0.2	0	0.0	May	1	1	1	
## 2740	0.2	0	0.0	May	2	2	1	

## 3232	0.2	0	0.0	May	2	4	1
## 3273	0.2	0	0.0	May	1	1	3
## 3282	0.2	0	0.0	May	1	1	1
## 3578	0.2	0	0.0	May	2	2	1
## 3651	0.2	0	0.0	May	2	2	4
## 3664	0.2	0	0.0	May	1	1	1
## 3722	0.2	0	0.0	May	1	1	4
## 3892	0.2	0	0.0	May	2	2	7
## 4164	0.2	0	0.0	May	1	1	4
## 4183	0.2	0	0.0	May	1	1	1
## 4232	0.2	0	0.0	May	2	2	2
## 4344	0.2	0	0.0	May	3	2	1
## 4375	0.2	0	0.0	May	2	2	1
## 4404	0.2	0	0.0	May	2	2	1
## 4427	0.2	0	0.0	May	2	2	1
## 4464	0.2	0	0.0	May	1	1	1
## 4490	0.2	0	0.0	May	3	2	9
## 4553	0.2	0	0.0	May	2	2	2
## 4818	0.2	0	0.0	May	2	2	1
## 4884	0.2	0	0.0	May	2	2	1
## 4914	0.2	0	0.8	May	2	2	1
## 5039	0.2	0	0.0	May	3	2	3
## 5044	0.2	0	0.0	May	2	2	1
## 5057	0.2	0	0.0	May	2	2	6
## 5119	0.2	0	0.0	May	1	1	6
## 5199	0.2	0	0.0	May	2	2	1
## 5200	0.2	0	0.0	May	2	2	2
## 5255	0.2	0	0.6	May	2	2	1
## 5277	0.2	0	0.0	May	3	2	3
## 5287	0.2	0	0.0	May	1	1	3
## 5356	0.2	0	0.0	May	1	1	3
## 5408	0.2	0	0.0	May	2	4	1
## 6930	0.2	0	0.0	June	2	2	1
## 7152	0.2	0	0.0	June	2	2	1
## 7636	0.2	0	0.0	June	3	2	3
## 8545	0.2	0	0.0	Nov	3	2	3
## 9307	0.2	0	0.0	Dec	3	2	3
## 9495	0.2	0	0.0	Dec	2	2	1
## 9552	0.2	0	0.0	Nov	3	2	4
## 9569	0.2	0	0.0	Dec	2	2	8
## 9582	0.2	0	0.0	Nov	2	2	1
## 9719	0.2	0	0.0	Nov	3	2	7
## 9770	0.2	0	0.0	Dec	2	2	2
## 9879	0.2	0	0.0	Dec	2	2	6
## 9908	0.2	0	0.0	Dec	2	2	1
## 10147	0.2	0	0.0	Dec	8	13	9
## 10223	0.2	0	0.0	Nov	1	1	1
## 10270	0.2	0	0.0	Nov	1	1	3
## 10573	0.2	0	0.0	Nov	2	2	3
## 10632	0.2	0	0.0	Nov	2	2	1
## 10752	0.2	0	0.0	Dec	1	1	1
## 10796	0.2	0	0.0	Nov	1	1	4
## 10842	0.2	0	0.0	Nov	2	2	3
## 10989	0.2	0	0.0	Nov	2	4	3

##	11044	0.2	0	0.0	Dec	3	2	6
##	11206	0.2	0	0.0	Dec	8	13	9
##	11405	0.2	0	0.0	Nov	3	2	1
##	11524	0.2	0	0.0	Dec	2	2	1
##	11582	0.2	0	0.0	Dec	8	13	9
##	11625	0.2	0	0.0	Nov	3	2	1
##	11659	0.2	0	0.0	Dec	1	1	1
##	11734	0.2	0	0.0	Nov	2	2	1
##	11748	0.2	0	0.0	Nov	1	1	3
##	11802	0.2	0	0.0	Dec	1	1	4
##	11814	0.2	0	0.0	Dec	2	2	1
##	11828	0.2	0	0.0	Dec	2	2	1
##	11935	0.2	0	0.0	Dec	1	1	1
##	11939	0.2	0	0.0	Dec	1	1	4
##	12160	0.2	0	0.0	Dec	1	1	1
##	12181	0.2	0	0.0	Dec	1	13	9
##	12186	0.2	0	0.0	Dec	8	13	9
##	TrafficType VisitorType Weekend Revenue							
##	159	3	Returning_Visitor	FALSE	FALSE			
##	179	3	Returning_Visitor	FALSE	FALSE			
##	419	1	Returning_Visitor	TRUE	FALSE			
##	457	1	Returning_Visitor	FALSE	FALSE			
##	484	1	Returning_Visitor	FALSE	FALSE			
##	513	1	Returning_Visitor	FALSE	FALSE			
##	555	1	Returning_Visitor	FALSE	FALSE			
##	590	1	Returning_Visitor	FALSE	FALSE			
##	660	1	Returning_Visitor	FALSE	FALSE			
##	775	1	Returning_Visitor	FALSE	FALSE			
##	873	1	Returning_Visitor	FALSE	FALSE			
##	890	1	Returning_Visitor	FALSE	FALSE			
##	923	1	Returning_Visitor	FALSE	FALSE			
##	948	1	Returning_Visitor	FALSE	FALSE			
##	975	1	Returning_Visitor	FALSE	FALSE			
##	1035	1	Returning_Visitor	FALSE	FALSE			
##	1120	1	Returning_Visitor	FALSE	FALSE			
##	1171	1	Returning_Visitor	FALSE	FALSE			
##	1177	1	Returning_Visitor	FALSE	FALSE			
##	1214	1	Returning_Visitor	FALSE	FALSE			
##	1215	3	Returning_Visitor	FALSE	FALSE			
##	1292	1	Returning_Visitor	FALSE	FALSE			
##	1326	3	Returning_Visitor	FALSE	FALSE			
##	1357	1	Returning_Visitor	FALSE	FALSE			
##	1367	1	Returning_Visitor	FALSE	FALSE			
##	1382	1	Returning_Visitor	FALSE	FALSE			
##	1391	1	Returning_Visitor	FALSE	FALSE			
##	1395	1	Returning_Visitor	FALSE	FALSE			
##	1437	1	Returning_Visitor	FALSE	FALSE			
##	1454	1	Returning_Visitor	FALSE	FALSE			
##	1516	3	Returning_Visitor	TRUE	FALSE			
##	1574	1	Returning_Visitor	FALSE	FALSE			
##	1609	1	Returning_Visitor	FALSE	FALSE			
##	1698	1	Returning_Visitor	FALSE	FALSE			
##	1776	1	Returning_Visitor	FALSE	FALSE			
##	1805	1	Returning_Visitor	FALSE	FALSE			

## 1840	3	Returning_Visitor	FALSE	FALSE
## 1867	9	Returning_Visitor	TRUE	FALSE
## 1926	1	Returning_Visitor	FALSE	FALSE
## 1934	1	Returning_Visitor	FALSE	FALSE
## 1950	1	Returning_Visitor	FALSE	FALSE
## 2057	1	Returning_Visitor	FALSE	FALSE
## 2058	1	Returning_Visitor	FALSE	FALSE
## 2236	3	Returning_Visitor	FALSE	FALSE
## 2622	3	Returning_Visitor	FALSE	FALSE
## 2740	1	Returning_Visitor	FALSE	FALSE
## 3232	3	Returning_Visitor	FALSE	FALSE
## 3273	3	Returning_Visitor	FALSE	FALSE
## 3282	3	Returning_Visitor	FALSE	FALSE
## 3578	4	Returning_Visitor	FALSE	FALSE
## 3651	1	Returning_Visitor	FALSE	FALSE
## 3664	3	Returning_Visitor	FALSE	FALSE
## 3722	3	Returning_Visitor	FALSE	FALSE
## 3892	4	Returning_Visitor	FALSE	FALSE
## 4164	3	Returning_Visitor	FALSE	FALSE
## 4183	3	Returning_Visitor	FALSE	FALSE
## 4232	1	Returning_Visitor	FALSE	FALSE
## 4344	13	Returning_Visitor	FALSE	FALSE
## 4375	3	Returning_Visitor	FALSE	FALSE
## 4404	3	Returning_Visitor	FALSE	FALSE
## 4427	3	Returning_Visitor	FALSE	FALSE
## 4464	3	Returning_Visitor	FALSE	FALSE
## 4490	3	Returning_Visitor	FALSE	FALSE
## 4553	3	Returning_Visitor	FALSE	FALSE
## 4818	3	Returning_Visitor	FALSE	FALSE
## 4884	3	Returning_Visitor	FALSE	FALSE
## 4914	1	Returning_Visitor	FALSE	FALSE
## 5039	3	Returning_Visitor	FALSE	FALSE
## 5044	3	Returning_Visitor	FALSE	FALSE
## 5057	3	Returning_Visitor	FALSE	FALSE
## 5119	4	Returning_Visitor	TRUE	FALSE
## 5199	13	Returning_Visitor	FALSE	FALSE
## 5200	3	Returning_Visitor	FALSE	FALSE
## 5255	1	Returning_Visitor	FALSE	FALSE
## 5277	13	Returning_Visitor	FALSE	FALSE
## 5287	15	Returning_Visitor	FALSE	FALSE
## 5356	3	Returning_Visitor	FALSE	FALSE
## 5408	6	Returning_Visitor	FALSE	FALSE
## 6930	1	Returning_Visitor	FALSE	FALSE
## 7152	1	Returning_Visitor	FALSE	FALSE
## 7636	13	Returning_Visitor	FALSE	FALSE
## 8545	3	Returning_Visitor	FALSE	FALSE
## 9307	1	Returning_Visitor	TRUE	FALSE
## 9495	3	Returning_Visitor	FALSE	FALSE
## 9552	3	Returning_Visitor	FALSE	FALSE
## 9569	1	Returning_Visitor	FALSE	FALSE
## 9582	1	Returning_Visitor	FALSE	FALSE
## 9719	13	Returning_Visitor	FALSE	FALSE
## 9770	1	Returning_Visitor	FALSE	FALSE
## 9879	13	Returning_Visitor	FALSE	FALSE

```
## 9908      13 Returning_Visitor FALSE FALSE
## 10147     20      Other FALSE FALSE
## 10223      1 Returning_Visitor FALSE FALSE
## 10270      2 Returning_Visitor FALSE FALSE
## 10573      1 Returning_Visitor FALSE FALSE
## 10632      1 Returning_Visitor FALSE FALSE
## 10752      1 Returning_Visitor TRUE FALSE
## 10796      1 Returning_Visitor FALSE FALSE
## 10842      1 Returning_Visitor FALSE FALSE
## 10989      3 Returning_Visitor FALSE FALSE
## 11044      1 Returning_Visitor FALSE FALSE
## 11206     20      Other FALSE FALSE
## 11405     13 Returning_Visitor FALSE FALSE
## 11524     13 Returning_Visitor FALSE FALSE
## 11582     20      Other FALSE FALSE
## 11625      1 Returning_Visitor FALSE FALSE
## 11659      1 Returning_Visitor TRUE FALSE
## 11734      1 Returning_Visitor FALSE FALSE
## 11748      3 Returning_Visitor FALSE FALSE
## 11802      1 Returning_Visitor TRUE FALSE
## 11814      1 Returning_Visitor FALSE FALSE
## 11828      1 Returning_Visitor FALSE FALSE
## 11935      2      New_Visitor FALSE FALSE
## 11939      1 Returning_Visitor TRUE FALSE
## 12160      3 Returning_Visitor FALSE FALSE
## 12181     20 Returning_Visitor FALSE FALSE
## 12186     20      Other FALSE FALSE
```

data showed above as duplicated did not look like duplicated data. They had a lot of similar entries in some columns but did not have entirely similar column entries. Therefore I will not remove the 177 rows as this might cause inconsistencies within the data set and affect final results

checking for outliers

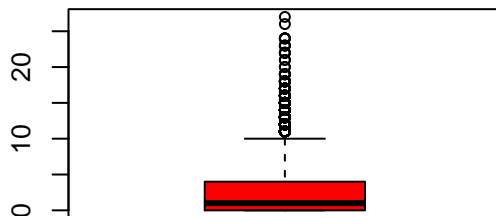
```
# obtaining the numerical columns
numerical = df[,c(1:10)]
head(numerical)
```

```
##      Administrative Administrative_Duration Informational Informational_Duration
## 1              0              0              0              0
## 2              0              0              0              0
## 3              0             -1              0             -1
## 4              0              0              0              0
## 5              0              0              0              0
## 6              0              0              0              0
##      ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1              1          0.000000 0.20000000 0.2000000      0
## 2              2          64.000000 0.00000000 0.1000000      0
## 3              1          -1.000000 0.20000000 0.2000000      0
## 4              2           2.666667 0.05000000 0.1400000      0
## 5             10          627.500000 0.02000000 0.0500000      0
## 6             19          154.216667 0.01578947 0.0245614      0
```

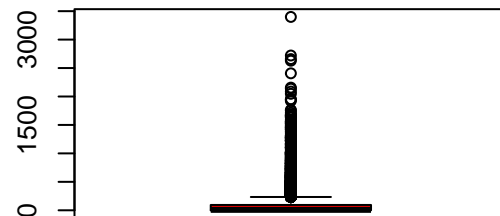
```
## SpecialDay
## 1      0
## 2      0
## 3      0
## 4      0
## 5      0
## 6      0
```

```
# generating boxplots for the numerical columns
par(mfrow=c(2,2), mar=c(5,4,2,2))

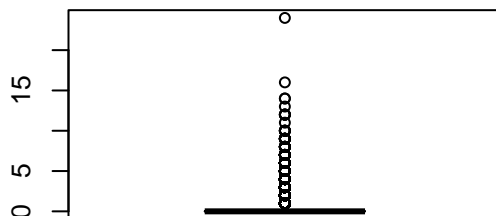
for (i in names(numerical)){
  x <- (numerical)[,i]
  boxplot(x, xlab= i, col="red")
  boxplot.stats(x)$out
}
```



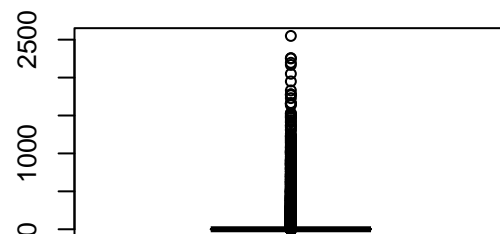
Administrative



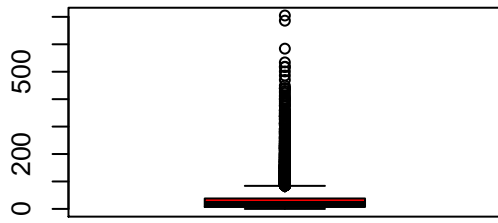
Administrative_Duration



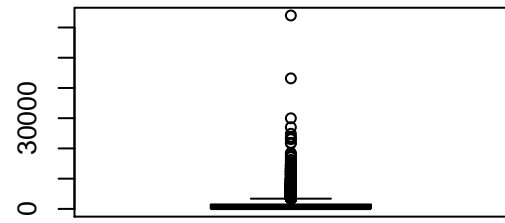
Informational



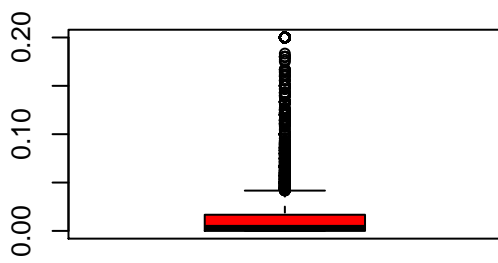
Informational_Duration



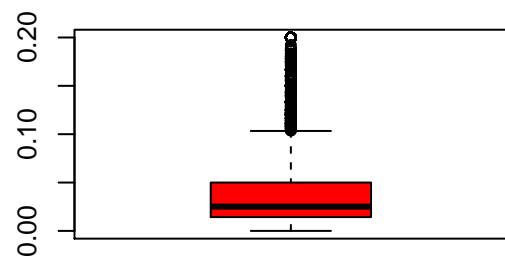
ProductRelated



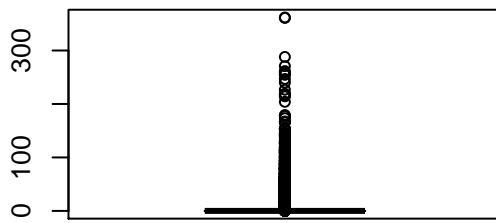
ProductRelated_Duration



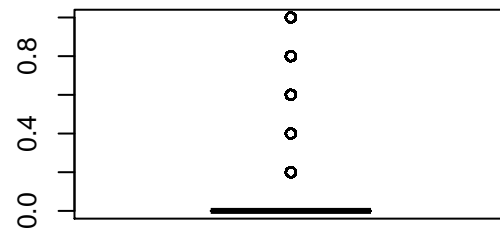
BounceRates



ExitRates



PageValues



SpecialDay

```
# dealing with the outliers
```

```
# checking the summary of the dataset
```

```
summary(df)
```

```
## Administrative    Administrative_Duration Informational
## Min.   : 0.000    Min.   : -1.00      Min.   : 0.000
## 1st Qu.: 0.000    1st Qu.:  0.00      1st Qu.: 0.000
## Median : 1.000    Median :  8.00      Median : 0.000
## Mean   : 2.318    Mean   : 80.91      Mean   : 0.504
## 3rd Qu.: 4.000    3rd Qu.: 93.50      3rd Qu.: 0.000
## Max.   :27.000    Max.   :3398.75     Max.   :24.000
## Informational_Duration ProductRelated    ProductRelated_Duration
## Min.   : -1.00      Min.   : 0.00      Min.   : -1.0
## 1st Qu.:  0.00      1st Qu.: 7.00      1st Qu.: 185.0
## Median :  0.00      Median : 18.00     Median : 599.8
## Mean   : 34.51      Mean   : 31.76     Mean   : 1196.0
## 3rd Qu.:  0.00      3rd Qu.: 38.00     3rd Qu.: 1466.5
## Max.   :2549.38     Max.   :705.00     Max.   :63973.5
## BounceRates        ExitRates        PageValues        SpecialDay
## Min.   :0.000000    Min.   :0.000000    Min.   : 0.000    Min.   :0.0000
## 1st Qu.:0.000000    1st Qu.:0.01429    1st Qu.: 0.000    1st Qu.:0.0000
## Median :0.003119    Median :0.02512    Median : 0.000    Median :0.0000
## Mean   :0.022152    Mean   :0.04300    Mean   : 5.896    Mean   :0.0615
## 3rd Qu.:0.016684    3rd Qu.:0.05000    3rd Qu.: 0.000    3rd Qu.:0.0000
```

```
## Max. :0.200000 Max. :0.20000 Max. :361.764 Max. :1.0000
## Month OperatingSystems Browser Region
## Length:12316 Min. :1.000 Min. : 1.000 Min. :1.000
## Class :character 1st Qu.:2.000 1st Qu.: 2.000 1st Qu.:1.000
## Mode :character Median :2.000 Median : 2.000 Median :3.000
## Mean :2.124 Mean : 2.358 Mean :3.148
## 3rd Qu.:3.000 3rd Qu.: 2.000 3rd Qu.:4.000
## Max. :8.000 Max. :13.000 Max. :9.000
## TrafficType VisitorType Weekend Revenue
## Min. : 1.00 Length:12316 Mode :logical Mode :logical
## 1st Qu.: 2.00 Class :character FALSE:9451 FALSE:10408
## Median : 2.00 Mode :character TRUE :2865 TRUE :1908
## Mean : 4.07
## 3rd Qu.: 4.00
## Max. :20.00
```

Univariate Exploratory Data Analysis

Measures of central tendencies

```
# obtaining the mean of the numerical columns
```

```
for (i in names(numerical)){
  x <- numerical[,i]
  mean <- mean(x)
  print(paste("The mean ", i , "is" , mean))
  cat('\n')
}
```

```
## [1] "The mean Administrative is 2.31779798635921"
##
## [1] "The mean Administrative_Duration is 80.9061763519009"
##
## [1] "The mean Informational is 0.503978564468983"
##
## [1] "The mean Informational_Duration is 34.5063873375142"
##
## [1] "The mean ProductRelated is 31.7638843780448"
##
## [1] "The mean ProductRelated_Duration is 1196.03705685414"
##
## [1] "The mean BounceRates is 0.0221524619360182"
##
## [1] "The mean ExitRates is 0.0430025384157194"
##
## [1] "The mean PageValues is 5.89595237471679"
##
## [1] "The mean SpecialDay is 0.0614972393634297"
```

```
# obtaining the median of the numerical columns
```

```

for (i in names(numerical)){
  x <- numerical[,i]
  mean <- median(x)
  print(paste("The mean ", i , "is" , mean))
  cat('\n')
}

```

```

## [1] "The mean Administrative is 1"
##
## [1] "The mean Administrative_Duration is 8"
##
## [1] "The mean Informational is 0"
##
## [1] "The mean Informational_Duration is 0"
##
## [1] "The mean ProductRelated is 18"
##
## [1] "The mean ProductRelated_Duration is 599.76619045"
##
## [1] "The mean BounceRates is 0.003119412"
##
## [1] "The mean ExitRates is 0.025124489"
##
## [1] "The mean PageValues is 0"
##
## [1] "The mean SpecialDay is 0"

```

displaying the mode of the numerical columns

```

getmode <- function(a){
  uniqv <- unique(a)
  uniqv[which.max(tabulate(match(a,uniqv)))]
}

```

looping through the columns to get the mode

```

for (i in names(numerical)){
  x <- numerical[,i]
  mode <- getmode(x)
  print(paste("column", i , ":" , mode))
  cat('\n')
}

```

```

## [1] "column Administrative : 0"
##
## [1] "column Administrative_Duration : 0"
##
## [1] "column Informational : 0"
##
## [1] "column Informational_Duration : 0"
##
## [1] "column ProductRelated : 1"
##

```

```
## [1] "column ProductRelated_Duration : 0"
##
## [1] "column BounceRates : 0"
##
## [1] "column ExitRates : 0.2"
##
## [1] "column PageValues : 0"
##
## [1] "column SpecialDay : 0"
```

Measures of dispersion

obtaining the five number summary of the numerical columns

```
for (i in names(numerical)){
  x <- numerical[,i]
  quantile <- quantile(x)
  print(paste(i))
  cat('\n')
  print(quantile)
  cat('\n')
}
```

```
## [1] "Administrative"
##
##   0%  25%  50%  75% 100%
##   0   0   1   4  27
##
## [1] "Administrative_Duration"
##
##      0%      25%      50%      75%      100%
## -1.00    0.00    8.00   93.50 3398.75
##
## [1] "Informational"
##
##   0%  25%  50%  75% 100%
##   0   0   0   0  24
##
## [1] "Informational_Duration"
##
##      0%      25%      50%      75%      100%
## -1.000    0.000    0.000    0.000 2549.375
##
## [1] "ProductRelated"
##
##   0%  25%  50%  75% 100%
##   0   7  18  38 705
##
## [1] "ProductRelated_Duration"
##
##      0%      25%      50%      75%      100%
## -1.0000  185.0000  599.7662 1466.4799 63973.5222
```

```
##
## [1] "BounceRates"
##
##      0%      25%      50%      75%      100%
## 0.000000000 0.000000000 0.003119412 0.016683674 0.200000000
##
## [1] "ExitRates"
##
##      0%      25%      50%      75%      100%
## 0.000000000 0.01428571 0.02512449 0.05000000 0.20000000
##
## [1] "PageValues"
##
##      0%      25%      50%      75%      100%
## 0.0000 0.0000 0.0000 0.0000 361.7637
##
## [1] "SpecialDay"
##
## 0% 25% 50% 75% 100%
## 0 0 0 0 1
```

```
# showing the variances and standard deviation of the numerical columns
for (i in names(numerical)){
  x <- numerical[,i]
  Sdev <- sd(x)
  var <- var(x)
  print(paste(i))
  cat('\n')
  print(paste("Variance :", round(var, digits = 2), "Standard deviation :", round(Sdev, digits = 2)))
  cat('\n')
}
```

```
## [1] "Administrative"
##
## [1] "Variance : 11.04 Standard deviation : 3.32"
##
## [1] "Administrative_Duration"
##
## [1] "Variance : 31279.61 Standard deviation : 176.86"
##
## [1] "Informational"
##
## [1] "Variance : 1.61 Standard deviation : 1.27"
##
## [1] "Informational_Duration"
##
## [1] "Variance : 19831.82 Standard deviation : 140.83"
##
## [1] "ProductRelated"
##
## [1] "Variance : 1979.39 Standard deviation : 44.49"
##
## [1] "ProductRelated_Duration"
##
```

```
## [1] "Variance : 3664822.11 Standard deviation : 1914.37"
##
## [1] "BounceRates"
##
## [1] "Variance : 0 Standard deviation : 0.05"
##
## [1] "ExitRates"
##
## [1] "Variance : 0 Standard deviation : 0.05"
##
## [1] "PageValues"
##
## [1] "Variance : 345.14 Standard deviation : 18.58"
##
## [1] "SpecialDay"
##
## [1] "Variance : 0.04 Standard deviation : 0.2"
```

Bivariate analysis

Multivariate analysis

Implimenting the solution

K-Means Clustering

This method involves partitioning the data set into clusters or k groups.

```
# Since clustering is unsupervised learning I will remove the class attribute which is revenue
df_new <- df[,c(1:9)]
df_class <- df[,c(10)]
```

```
# looking at the predictor data
head(df_new)
```

```
##      Administrative Administrative_Duration Informational Informational_Duration
## 1                0                      0                0                      0
## 2                0                      0                0                      0
## 3                0                     -1                0                     -1
## 4                0                      0                0                      0
## 5                0                      0                0                      0
## 6                0                      0                0                      0
##      ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1                1          0.000000 0.20000000 0.2000000 0
## 2                2          64.000000 0.00000000 0.1000000 0
## 3                1          -1.000000 0.20000000 0.2000000 0
## 4                2           2.666667 0.05000000 0.1400000 0
## 5               10          627.500000 0.02000000 0.0500000 0
## 6               19          154.216667 0.01578947 0.0245614 0
```

```
# normalizing the dataset
head(df)
```

```
##      Administrative Administrative_Duration Informational Informational_Duration
## 1              0              0              0              0
## 2              0              0              0              0
## 3              0             -1              0             -1
## 4              0              0              0              0
## 5              0              0              0              0
## 6              0              0              0              0
##      ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1              1          0.000000 0.20000000 0.2000000      0
## 2              2          64.000000 0.00000000 0.1000000      0
## 3              1          -1.000000 0.20000000 0.2000000      0
## 4              2           2.666667 0.05000000 0.1400000      0
## 5             10          627.500000 0.02000000 0.0500000      0
## 6             19          154.216667 0.01578947 0.0245614      0
##      SpecialDay Month OperatingSystems Browser Region TrafficType
## 1              0   Feb              1      1      1          1
## 2              0   Feb              2      2      1          2
## 3              0   Feb              4      1      9          3
## 4              0   Feb              3      2      2          4
## 5              0   Feb              3      3      1          4
## 6              0   Feb              2      2      1          3
##      VisitorType Weekend Revenue
## 1 Returning_Visitor  FALSE  FALSE
## 2 Returning_Visitor  FALSE  FALSE
## 3 Returning_Visitor  FALSE  FALSE
## 4 Returning_Visitor  FALSE  FALSE
## 5 Returning_Visitor   TRUE  FALSE
## 6 Returning_Visitor  FALSE  FALSE
```

```
# printing unique values for the categorical columns
for (i in names(df[,c(11:18)])){
  print(unique(df[i]))
}
```

```
##      Month
## 1      Feb
## 185     Mar
## 2092    May
## 5456    Oct
## 5457    June
## 5461    Jul
## 5463    Aug
## 5464    Nov
## 5469    Sep
## 7983    Dec
##      OperatingSystems
## 1              1
## 2              2
## 3              4
## 4              3
```

##	261	7
##	2415	6
##	3365	8
##	6317	5
##	Browser	
##	1	1
##	2	2
##	5	3
##	7	4
##	14	5
##	29	6
##	69	7
##	245	10
##	267	8
##	285	9
##	3051	12
##	5680	13
##	6317	11
##	Region	
##	1	1
##	3	9
##	4	2
##	7	3
##	12	4
##	21	5
##	31	6
##	36	7
##	38	8
##	TrafficType	
##	1	1
##	2	2
##	3	3
##	4	4
##	8	5
##	32	6
##	99	7
##	185	8
##	202	9
##	205	10
##	213	11
##	220	12
##	311	13
##	463	14
##	688	15
##	2124	18
##	2425	19
##	2576	16
##	2641	17
##	2768	20
##	VisitorType	
##	1	Returning_Visitor
##	94	New_Visitor
##	5680	Other
##	Weekend	


```
## 1 FALSE
## 5 TRUE
## Revenue
## 1 FALSE
## 66 TRUE
```

One hot encoding the categorical columns

```
library(caret)
```

```
## Loading required package: lattice
```

```
## Loading required package: ggplot2
```

```
dummy <- dummyVars("~.", data=df, fullRank=T)
df_enc <- data.frame(predict(dummy, newdata=df))
str(df_enc)
```

```
## 'data.frame': 12316 obs. of 27 variables:
## $ Administrative : num 0 0 0 0 0 0 0 1 0 0 ...
## $ Administrative_Duration : num 0 0 -1 0 0 0 -1 -1 0 0 ...
## $ Informational : num 0 0 0 0 0 0 0 0 0 0 ...
## $ Informational_Duration : num 0 0 -1 0 0 0 -1 -1 0 0 ...
## $ ProductRelated : num 1 2 1 2 10 19 1 1 2 3 ...
## $ ProductRelated_Duration : num 0 64 -1 2.67 627.5 ...
## $ BounceRates : num 0.2 0 0.2 0.05 0.02 ...
## $ ExitRates : num 0.2 0.1 0.2 0.14 0.05 ...
## $ PageValues : num 0 0 0 0 0 0 0 0 0 0 ...
## $ SpecialDay : num 0 0 0 0 0 0 0.4 0 0.8 0.4 ...
## $ MonthDec : num 0 0 0 0 0 0 0 0 0 0 ...
## $ MonthFeb : num 1 1 1 1 1 1 1 1 1 1 ...
## $ MonthJul : num 0 0 0 0 0 0 0 0 0 0 ...
## $ MonthJune : num 0 0 0 0 0 0 0 0 0 0 ...
## $ MonthMar : num 0 0 0 0 0 0 0 0 0 0 ...
## $ MonthMay : num 0 0 0 0 0 0 0 0 0 0 ...
## $ MonthNov : num 0 0 0 0 0 0 0 0 0 0 ...
## $ MonthOct : num 0 0 0 0 0 0 0 0 0 0 ...
## $ MonthSep : num 0 0 0 0 0 0 0 0 0 0 ...
## $ OperatingSystems : num 1 2 4 3 3 2 2 1 2 2 ...
## $ Browser : num 1 2 1 2 3 2 4 2 2 4 ...
## $ Region : num 1 1 9 2 1 1 3 1 2 1 ...
## $ TrafficType : num 1 2 3 4 4 3 3 5 3 2 ...
## $ VisitorTypeOther : num 0 0 0 0 0 0 0 0 0 0 ...
## $ VisitorTypeReturning_Visitor: num 1 1 1 1 1 1 1 1 1 1 ...
## $ WeekendTRUE : num 0 0 0 0 1 0 0 1 0 0 ...
## $ RevenueTRUE : num 0 0 0 0 0 0 0 0 0 0 ...
```

```
# scaling the numerical columns
df_scale <- scale(df_enc[,1:10])
head(df_scale)
```

```
##      Administrative Administrative_Duration Informational Informational_Duration
## 1      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 2      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 3      -0.6975533          -0.4631119      -0.3966145          -0.2521304
## 4      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 5      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 6      -0.6975533          -0.4574578      -0.3966145          -0.2450294
##      ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1      -0.6914734          -0.6247671      3.67247746      3.2352400 -0.3173633
## 2      -0.6689966          -0.5913358      -0.45743910      1.1745443 -0.3173633
## 3      -0.6914734          -0.6252895      3.67247746      3.2352400 -0.3173633
## 4      -0.6689966          -0.6233742      0.57504004      1.9988226 -0.3173633
## 5      -0.4891823          -0.2969835      -0.04444744      0.1441964 -0.3173633
## 6      -0.2868911          -0.5442099      -0.13139305      -0.3800157 -0.3173633
##      SpecialDay
## 1      -0.309001
## 2      -0.309001
## 3      -0.309001
## 4      -0.309001
## 5      -0.309001
## 6      -0.309001
```

joining the two dataset

```
final <- cbind(df_scale, df_enc[,11:27])
head(final)
```

```
##      Administrative Administrative_Duration Informational Informational_Duration
## 1      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 2      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 3      -0.6975533          -0.4631119      -0.3966145          -0.2521304
## 4      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 5      -0.6975533          -0.4574578      -0.3966145          -0.2450294
## 6      -0.6975533          -0.4574578      -0.3966145          -0.2450294
##      ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1      -0.6914734          -0.6247671      3.67247746      3.2352400 -0.3173633
## 2      -0.6689966          -0.5913358      -0.45743910      1.1745443 -0.3173633
## 3      -0.6914734          -0.6252895      3.67247746      3.2352400 -0.3173633
## 4      -0.6689966          -0.6233742      0.57504004      1.9988226 -0.3173633
## 5      -0.4891823          -0.2969835      -0.04444744      0.1441964 -0.3173633
## 6      -0.2868911          -0.5442099      -0.13139305      -0.3800157 -0.3173633
##      SpecialDay MonthDec MonthFeb MonthJul MonthJune MonthMar MonthMay MonthNov
## 1      -0.309001          0          1          0          0          0          0          0
## 2      -0.309001          0          1          0          0          0          0          0
## 3      -0.309001          0          1          0          0          0          0          0
## 4      -0.309001          0          1          0          0          0          0          0
## 5      -0.309001          0          1          0          0          0          0          0
## 6      -0.309001          0          1          0          0          0          0          0
##      MonthOct MonthSep OperatingSystems Browser Region TrafficType
## 1          0          0                  1          1          1          1
## 2          0          0                  2          2          1          2
## 3          0          0                  4          1          9          3
## 4          0          0                  3          2          2          4
## 5          0          0                  3          3          1          4
## 6          0          0                  2          2          1          3
```

```
## VisitorTypeOther VisitorTypeReturning_Visitor WeekendTRUE RevenueTRUE
## 1 0 1 0 0
## 2 0 1 0 0
## 3 0 1 0 0
## 4 0 1 0 0
## 5 0 1 1 0
## 6 0 1 0 0
```

```
# removing the class attribute
final_att <- final[,c(1:26)]
final_class <- final$RevenueTRUE
head(final_att)
```

```
## Administrative Administrative_Duration Informational Informational_Duration
## 1 -0.6975533 -0.4574578 -0.3966145 -0.2450294
## 2 -0.6975533 -0.4574578 -0.3966145 -0.2450294
## 3 -0.6975533 -0.4631119 -0.3966145 -0.2521304
## 4 -0.6975533 -0.4574578 -0.3966145 -0.2450294
## 5 -0.6975533 -0.4574578 -0.3966145 -0.2450294
## 6 -0.6975533 -0.4574578 -0.3966145 -0.2450294
## ProductRelated ProductRelated_Duration BounceRates ExitRates PageValues
## 1 -0.6914734 -0.6247671 3.67247746 3.2352400 -0.3173633
## 2 -0.6689966 -0.5913358 -0.45743910 1.1745443 -0.3173633
## 3 -0.6914734 -0.6252895 3.67247746 3.2352400 -0.3173633
## 4 -0.6689966 -0.6233742 0.57504004 1.9988226 -0.3173633
## 5 -0.4891823 -0.2969835 -0.04444744 0.1441964 -0.3173633
## 6 -0.2868911 -0.5442099 -0.13139305 -0.3800157 -0.3173633
## SpecialDay MonthDec MonthFeb MonthJul MonthJune MonthMar MonthMay MonthNov
## 1 -0.309001 0 1 0 0 0 0 0
## 2 -0.309001 0 1 0 0 0 0 0
## 3 -0.309001 0 1 0 0 0 0 0
## 4 -0.309001 0 1 0 0 0 0 0
## 5 -0.309001 0 1 0 0 0 0 0
## 6 -0.309001 0 1 0 0 0 0 0
## MonthOct MonthSep OperatingSystems Browser Region TrafficType
## 1 0 0 1 1 1 1
## 2 0 0 2 2 1 2
## 3 0 0 4 1 9 3
## 4 0 0 3 2 2 4
## 5 0 0 3 3 1 4
## 6 0 0 2 2 1 3
## VisitorTypeOther VisitorTypeReturning_Visitor WeekendTRUE
## 1 0 1 0
## 2 0 1 0
## 3 0 1 0
## 4 0 1 0
## 5 0 1 1
## 6 0 1 0
```

```
# applying the k-means clustering
result <- kmeans(final_att, 3)
result
```

```
## K-means clustering with 3 clusters of sizes 2368, 2046, 7902
```

```

##
## Cluster means:
##   Administrative Administrative_Duration Informational Informational_Duration
## 1    0.003870524          -0.009896510   -0.03038239          -0.03211290
## 2   -0.070489805          -0.025492868   -0.06044189          -0.03859204
## 3    0.017091463           0.009566356    0.02475444           0.01961562
##   ProductRelated ProductRelated_Duration BounceRates   ExitRates   PageValues
## 1   -0.03925729          -0.03033240 -0.06526861 -0.07652119  0.012332495
## 2   -0.05068711          -0.03103094  0.17292882  0.17184939  0.001077899
## 3    0.02488827           0.01712432 -0.02521593 -0.02156437 -0.003974782
##   SpecialDay MonthDec  MonthFeb  MonthJul  MonthJune  MonthMar  MonthMay
## 1 -0.031033606 0.1448480 0.01182432 0.04180743 0.02407095 0.1562500 0.2816723
## 2  0.006818982 0.1652004 0.00000000 0.02248289 0.02150538 0.1436950 0.2277615
## 3  0.007534288 0.1323716 0.01974184 0.03631992 0.02366489 0.1556568 0.2822070
##   MonthNov  MonthOct  MonthSep OperatingSystems Browser  Region
## 1 0.2060811 0.04983108 0.04434122          2.071368 2.368666 6.966639
## 2 0.3548387 0.03323558 0.01515152          2.407625 2.566471 3.155914
## 3 0.2257656 0.04593774 0.03948368          2.066565 2.300177 2.001645
##   TrafficType VisitorTypeOther VisitorTypeReturning_Visitor WeekendTRUE
## 1    2.550676          0.002956081          0.8319257  0.2352196
## 2   12.108016          0.028347996          0.8470186  0.2448680
## 3    2.444824          0.002531005          0.8648443  0.2286763
##
## Clustering vector:
##    1    2    3    4    5    6    7    8    9   10   11   12   13
##    3    3    1    3    3    3    3    3    3    3    3    3    3
##   14   15   16   17   18   19   20   21   22   23   24   25   26
##    3    3    1    3    3    3    3    1    3    3    3    3    1
##   27   28   29   30   31   32   33   34   35   36   37   38   39
##    3    3    3    3    1    1    3    3    3    1    3    1    3
##   40   41   42   43   44   45   46   47   48   49   50   51   52
##    3    1    3    3    3    3    3    3    3    3    3    3    3
##   53   54   55   56   57   58   59   60   61   62   63   64   65
##    3    3    3    3    3    3    1    3    3    3    3    1    3
##   66   67   68   69   70   71   72   73   74   75   76   77   78
##    3    3    1    3    3    3    1    3    3    3    3    3    3
##   79   80   81   82   83   84   85   86   87   88   89   90   91
##    3    3    3    3    3    3    3    3    3    3    3    3    3
##   92   93   94   95   96   97   98   99  100  101  102  103  104
##    3    3    3    3    3    3    3    3    3    3    1    3    3
##  105  106  107  108  109  110  111  112  113  114  115  116  117
##    3    1    3    3    3    3    3    3    3    3    3    3    3
##  118  119  120  121  122  123  124  125  126  127  128  129  130
##    3    3    1    3    3    3    3    3    3    3    1    1    3
##  131  132  133  134  135  136  137  138  139  140  141  142  143
##    3    3    3    3    3    3    1    3    3    3    1    1    3
##  144  145  146  147  148  149  150  151  152  153  154  155  156
##    3    3    3    3    3    3    3    3    3    1    3    3    3
##  157  158  159  160  161  162  163  164  165  166  167  168  169
##    3    3    3    3    3    3    3    3    3    3    3    3    1
##  170  171  172  173  174  175  176  177  178  179  180  181  182
##    1    3    3    3    3    1    3    1    3    3    1    1    3
##  183  184  185  186  187  188  189  190  191  192  193  194  195
##    3    3    2    3    3    1    1    3    3    3    3    3    1

```

##	196	197	198	199	200	201	202	203	204	205	206	207	208
##	3	3	3	1	3	1	2	3	2	2	1	3	1
##	209	210	211	212	213	214	215	216	217	218	219	220	221
##	1	3	3	3	2	1	3	3	1	3	3	2	1
##	222	223	224	225	226	227	228	229	230	231	232	233	234
##	3	3	2	3	2	3	3	3	3	2	3	3	3
##	235	236	237	238	239	240	241	242	243	244	245	246	247
##	3	3	2	3	3	3	3	3	1	3	3	3	1
##	248	249	250	251	252	253	254	255	256	257	258	259	260
##	3	3	3	1	3	3	3	1	3	3	1	3	2
##	261	262	263	264	265	266	267	268	269	270	271	272	273
##	1	1	3	3	1	3	1	2	3	3	3	3	2
##	274	275	276	277	278	279	280	281	282	283	284	285	286
##	3	2	1	3	1	3	3	3	2	3	3	1	3
##	287	288	289	290	291	292	293	294	295	296	297	298	299
##	3	3	1	2	1	3	3	3	3	3	3	3	1
##	300	301	302	303	304	305	306	307	308	309	310	311	312
##	3	2	3	3	1	3	3	3	3	2	2	2	3
##	313	314	315	316	317	318	319	320	321	322	323	324	325
##	3	3	1	3	3	2	3	3	1	3	1	3	1
##	326	327	328	329	330	331	332	333	334	335	336	337	338
##	3	3	3	2	1	3	3	3	3	3	3	3	3
##	339	340	341	342	343	344	345	346	347	348	349	350	351
##	3	3	3	3	3	1	1	2	3	3	3	3	3
##	352	353	354	355	356	357	358	359	360	361	362	363	364
##	1	3	1	3	3	3	3	3	3	3	3	3	3
##	365	366	367	368	369	370	371	372	373	374	375	376	377
##	3	1	3	1	3	3	3	1	2	3	3	3	1
##	378	379	380	381	382	383	384	385	386	387	388	389	390
##	3	2	3	1	3	1	3	3	3	3	1	3	3
##	391	392	393	394	395	396	397	398	399	400	401	402	403
##	3	1	3	3	3	3	2	3	3	1	3	3	3
##	404	405	406	407	408	409	410	411	412	413	414	415	416
##	1	3	1	3	3	2	1	1	1	2	2	1	2
##	417	418	419	420	421	422	423	424	425	426	427	428	429
##	3	3	3	1	3	3	3	1	3	3	3	3	3
##	430	431	432	433	434	435	436	437	438	439	440	441	442
##	2	3	3	3	3	2	3	3	3	3	1	3	3
##	443	444	445	446	447	448	449	450	451	452	453	454	455
##	3	2	2	2	3	1	3	3	3	3	1	3	3
##	456	457	458	459	460	461	462	463	464	465	466	467	468
##	2	3	3	1	3	2	3	2	3	3	3	3	1
##	469	470	471	472	473	474	475	476	477	478	479	480	481
##	3	3	1	3	1	3	3	3	3	3	3	3	3
##	482	483	484	485	486	487	488	489	490	491	492	493	494
##	3	1	3	1	3	3	1	1	2	3	2	3	1
##	495	496	497	498	499	500	501	502	503	504	505	506	507
##	3	3	2	3	1	3	3	3	3	3	2	1	2
##	508	509	510	511	512	513	514	515	516	517	518	519	520
##	3	3	3	1	3	3	3	1	3	3	3	2	3
##	521	522	523	524	525	526	527	528	529	530	531	532	533
##	2	3	3	3	3	2	1	1	3	3	3	3	1
##	534	535	536	537	538	539	540	541	542	543	544	545	546
##	3	1	3	3	2	2	3	3	1	1	3	3	1

##	547	548	549	550	551	552	553	554	555	556	557	558	559
##	3	2	3	3	3	3	3	3	3	3	1	3	3
##	560	561	562	563	564	565	566	567	568	569	570	571	572
##	3	1	2	1	2	3	3	3	3	2	3	2	3
##	573	574	575	576	577	578	579	580	581	582	583	584	585
##	3	3	3	3	3	1	1	3	1	3	2	3	3
##	586	587	588	589	590	591	592	593	594	595	596	597	598
##	2	2	2	3	3	1	3	3	1	3	1	3	1
##	599	600	601	602	603	604	605	606	607	608	609	610	611
##	3	3	1	3	3	3	1	3	3	2	3	2	3
##	612	613	614	615	616	617	618	619	620	621	622	623	624
##	3	3	3	3	2	3	3	3	3	3	3	1	3
##	625	626	627	628	629	630	631	632	633	634	635	636	637
##	1	3	1	3	3	1	3	3	1	3	1	1	3
##	638	639	640	641	642	643	644	645	646	647	648	649	650
##	3	3	1	3	3	1	3	1	3	2	3	3	3
##	651	652	653	654	655	656	657	658	659	660	661	662	663
##	2	3	3	3	3	3	3	1	1	3	3	3	2
##	664	665	666	667	668	669	670	671	672	673	674	675	676
##	1	3	1	3	2	1	3	1	3	3	3	1	3
##	677	678	679	680	681	682	683	684	685	686	687	688	689
##	3	2	3	1	3	1	3	3	1	3	3	2	2
##	690	691	692	693	694	695	696	697	698	699	700	701	702
##	3	3	3	2	3	3	3	3	2	3	2	2	1
##	703	704	705	706	707	708	709	710	711	712	713	714	715
##	2	3	3	3	1	3	3	2	3	2	3	3	2
##	716	717	718	719	720	721	722	723	724	725	726	727	728
##	3	3	3	3	1	3	3	3	1	3	1	2	3
##	729	730	731	732	733	734	735	736	737	738	739	740	741
##	1	3	2	1	3	3	3	2	3	3	2	2	3
##	742	743	744	745	746	747	748	749	750	751	752	753	754
##	3	2	3	1	3	3	3	2	3	1	3	3	3
##	755	756	757	758	759	760	761	762	763	764	765	766	767
##	3	3	3	1	3	3	3	3	3	3	3	3	3
##	768	769	770	771	772	773	774	775	776	777	778	779	780
##	3	3	3	3	3	3	3	3	3	3	2	3	3
##	781	782	783	784	785	786	787	788	789	790	791	792	793
##	1	2	3	2	3	3	3	3	3	3	3	3	2
##	794	795	796	797	798	799	800	801	802	803	804	805	806
##	1	3	3	2	1	2	2	2	2	2	3	3	1
##	807	808	809	810	811	812	813	814	815	816	817	818	819
##	3	3	3	3	3	3	1	3	3	1	1	2	3
##	820	821	822	823	824	825	826	827	828	829	830	831	832
##	3	1	3	3	3	3	3	3	3	3	3	3	3
##	833	834	835	836	837	838	839	840	841	842	843	844	845
##	3	3	2	2	3	3	1	2	2	1	3	3	3
##	846	847	848	849	850	851	852	853	854	855	856	857	858
##	2	3	2	3	3	1	3	3	3	3	3	3	3
##	859	860	861	862	863	864	865	866	867	868	869	870	871
##	2	2	3	3	2	2	3	3	1	2	1	3	3
##	872	873	874	875	876	877	878	879	880	881	882	883	884
##	2	3	3	3	3	2	3	2	3	3	3	3	3
##	885	886	887	888	889	890	891	892	893	894	895	896	897
##	1	1	3	3	3	3	3	1	3	1	3	3	1

##	898	899	900	901	902	903	904	905	906	907	908	909	910
##	2	3	1	3	3	3	3	2	3	3	2	1	2
##	911	912	913	914	915	916	917	918	919	920	921	922	923
##	1	1	3	3	3	1	3	3	3	3	3	2	3
##	924	925	926	927	928	929	930	931	932	933	934	935	936
##	3	3	1	3	1	3	2	2	3	3	2	3	3
##	937	938	939	940	941	942	943	944	945	946	947	948	949
##	3	2	1	2	3	3	1	1	3	2	3	3	3
##	950	951	952	953	954	955	956	957	958	959	960	961	962
##	2	3	3	3	2	2	1	3	3	3	2	1	3
##	963	964	965	966	967	968	969	970	971	972	973	974	975
##	3	3	3	3	1	3	3	3	2	3	1	1	3
##	976	977	978	979	980	981	982	983	984	985	986	987	988
##	3	1	3	3	2	3	3	3	3	3	3	3	3
##	989	990	991	992	993	994	995	996	997	998	999	1000	1001
##	1	3	3	3	3	2	3	3	3	3	3	3	1
##	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014
##	2	3	2	2	3	3	3	3	3	3	3	1	2
##	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027
##	2	2	3	1	1	2	3	2	3	3	3	2	3
##	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040
##	3	1	2	2	3	3	2	3	3	3	2	2	1
##	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053
##	3	3	3	3	3	3	3	1	1	3	1	2	3
##	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1067
##	3	3	2	3	3	2	3	3	3	1	3	3	1
##	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080
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##	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280
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##	4071	4072	4073	4074	4075	4076	4077	4078	4079	4080	4081	4082	4083
##	3	1	2	2	3	3	1	3	3	3	2	3	1
##	4084	4085	4086	4087	4088	4089	4090	4091	4092	4093	4094	4095	4096
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##	4422	4423	4424	4425	4426	4427	4428	4429	4430	4431	4432	4433	4434
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##	4435	4436	4437	4438	4439	4440	4441	4442	4443	4444	4445	4446	4447
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##	4773	4774	4775	4776	4777	4778	4779	4780	4781	4782	4783	4784	4785
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##	7035	7036	7037	7038	7039	7040	7041	7042	7043	7044	7045	7046	7047
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##	7230	7231	7232	7233	7234	7235	7236	7237	7238	7239	7240	7241	7242
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##	7542	7543	7544	7545	7546	7547	7548	7549	7550	7551	7552	7553	7554
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##	8517	8518	8519	8520	8521	8522	8523	8524	8525	8526	8527	8528	8529
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##	8530	8531	8532	8533	8534	8535	8536	8537	8538	8539	8540	8541	8542
##	1	2	2	3	3	3	2	3	3	2	3	3	3
##	8543	8544	8545	8546	8547	8548	8549	8550	8551	8552	8553	8554	8555
##	1	3	3	3	3	3	3	1	3	2	3	2	2
##	8556	8557	8558	8559	8560	8561	8562	8563	8564	8565	8566	8567	8568
##	3	3	2	3	3	3	3	1	3	3	2	2	3
##	8569	8570	8571	8572	8573	8574	8575	8576	8577	8578	8579	8580	8581
##	3	3	1	3	3	3	3	3	2	3	3	3	3
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##	3	3	3	3	3	2	1	3	1	3	3	3	3
##	8595	8596	8597	8598	8599	8600	8601	8602	8603	8604	8605	8606	8607
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##	8621	8622	8623	8624	8625	8626	8627	8628	8629	8630	8631	8632	8633
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##	8634	8635	8636	8637	8638	8639	8640	8641	8642	8643	8644	8645	8646
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##	8647	8648	8649	8650	8651	8652	8653	8654	8655	8656	8657	8658	8659
##	3	2	3	3	2	2	2	2	2	3	2	1	2
##	8660	8661	8662	8663	8664	8665	8666	8667	8668	8669	8670	8671	8672
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##	8673	8674	8675	8676	8677	8678	8679	8680	8681	8682	8683	8684	8685
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##	8686	8687	8688	8689	8690	8691	8692	8693	8694	8695	8696	8697	8698
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##	8764	8765	8766	8767	8768	8769	8770	8771	8772	8773	8774	8775	8776
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##	1	3	3	3	3	3	1	2	3	3	2	3	3
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##	2	3	2	3	3	3	2	2	3	3	1	3	3
##	8946	8947	8948	8949	8950	8951	8952	8953	8954	8955	8956	8957	8958
##	1	3	3	3	3	3	1	3	1	3	1	2	1
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##	3	3	3	1	3	2	1	1	2	3	3	3	3
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##	2	3	2	1	3	3	3	3	3	2	3	2	2

##	8985	8986	8987	8988	8989	8990	8991	8992	8993	8994	8995	8996	8997
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##	8998	8999	9000	9001	9002	9003	9004	9005	9006	9007	9008	9009	9010
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##	2	1	3	2	2	3	2	3	3	3	1	2	3
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##	1	3	2	2	1	2	2	3	1	1	1	2	3
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##	10038	10039	10040	10041	10042	10043	10044	10045	10046	10047	10048	10049	10050
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##	10064	10065	10066	10067	10068	10069	10070	10071	10072	10073	10074	10075	10076
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##	11468	11469	11470	11471	11472	11473	11474	11475	11476	11477	11478	11479	11480
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##	11481	11482	11483	11484	11485	11486	11487	11488	11489	11490	11491	11492	11493
##	2	3	3	2	3	2	1	1	2	2	1	3	3
##	11494	11495	11496	11497	11498	11499	11500	11501	11502	11503	11504	11505	11506
##	2	3	3	3	1	3	3	1	3	1	3	3	3
##	11507	11508	11509	11510	11511	11512	11513	11514	11515	11516	11517	11518	11519
##	2	2	2	3	1	3	3	3	3	3	1	3	1
##	11520	11521	11522	11523	11524	11525	11526	11527	11528	11529	11530	11531	11532
##	3	3	2	3	2	3	2	3	3	2	3	1	1
##	11533	11534	11535	11536	11537	11538	11539	11540	11541	11542	11543	11544	11545
##	3	1	2	3	3	3	3	2	3	1	2	3	3
##	11546	11547	11548	11549	11550	11551	11552	11553	11554	11555	11556	11557	11558
##	2	2	3	3	3	2	3	1	2	3	3	3	3
##	11559	11560	11561	11562	11563	11564	11565	11566	11567	11568	11569	11570	11571
##	3	2	2	3	3	1	3	2	3	3	2	1	2
##	11572	11573	11574	11575	11576	11577	11578	11579	11580	11581	11582	11583	11584
##	1	2	3	3	3	3	3	3	3	2	2	3	1
##	11585	11586	11587	11588	11589	11590	11591	11592	11593	11594	11595	11596	11597
##	3	2	3	3	3	2	3	3	3	2	3	3	3
##	11598	11599	11600	11601	11602	11603	11604	11605	11606	11607	11608	11609	11610
##	2	3	2	3	2	2	3	3	3	3	3	2	3
##	11611	11612	11613	11614	11615	11616	11617	11618	11619	11620	11621	11622	11623
##	1	1	2	3	2	2	2	3	1	3	3	3	3
##	11624	11625	11626	11627	11628	11629	11630	11631	11632	11633	11634	11635	11636
##	2	3	2	3	3	3	2	2	3	2	3	3	3
##	11637	11638	11639	11640	11641	11642	11643	11644	11645	11646	11647	11648	11649
##	3	2	2	3	1	2	3	2	1	3	3	3	3
##	11650	11651	11652	11653	11654	11655	11656	11657	11658	11659	11660	11661	11662
##	1	1	3	1	3	3	2	3	3	3	3	3	3
##	11663	11664	11665	11666	11667	11668	11669	11670	11671	11672	11673	11674	11675
##	3	3	2	3	3	3	3	2	2	1	2	2	3
##	11676	11677	11678	11679	11680	11681	11682	11683	11684	11685	11686	11687	11688
##	2	2	3	3	1	3	1	2	3	3	2	3	3
##	11689	11690	11691	11692	11693	11694	11695	11696	11697	11698	11699	11700	11701
##	2	3	3	2	3	1	3	3	3	3	1	3	2
##	11702	11703	11704	11705	11706	11707	11708	11709	11710	11711	11712	11713	11714
##	3	3	1	3	3	3	3	3	3	3	3	3	3
##	11715	11716	11717	11718	11719	11720	11721	11722	11723	11724	11725	11726	11727
##	2	3	3	1	1	2	3	3	3	3	1	3	1
##	11728	11729	11730	11731	11732	11733	11734	11735	11736	11737	11738	11739	11740
##	3	3	3	3	3	3	3	2	3	3	1	2	3
##	11741	11742	11743	11744	11745	11746	11747	11748	11749	11750	11751	11752	11753
##	3	3	2	3	3	3	3	3	3	3	3	3	3
##	11754	11755	11756	11757	11758	11759	11760	11761	11762	11763	11764	11765	11766
##	3	3	3	2	2	3	2	2	3	1	2	3	2
##	11767	11768	11769	11770	11771	11772	11773	11774	11775	11776	11777	11778	11779
##	2	2	1	3	3	2	3	3	3	2	3	1	1
##	11780	11781	11782	11783	11784	11785	11786	11787	11788	11789	11790	11791	11792
##	3	3	3	3	3	1	3	1	3	3	2	3	3

##	11793	11794	11795	11796	11797	11798	11799	11800	11801	11802	11803	11804	11805
##	3	2	3	2	3	3	3	3	3	3	3	1	3
##	11806	11807	11808	11809	11810	11811	11812	11813	11814	11815	11816	11817	11818
##	3	1	3	2	2	3	3	1	3	2	3	2	2
##	11819	11820	11821	11822	11823	11824	11825	11826	11827	11828	11829	11830	11831
##	2	1	2	1	2	3	3	1	3	3	3	3	3
##	11832	11833	11834	11835	11836	11837	11838	11839	11840	11841	11842	11843	11844
##	2	3	1	2	3	3	3	3	2	3	3	3	3
##	11845	11846	11847	11848	11849	11850	11851	11852	11853	11854	11855	11856	11857
##	3	2	2	3	3	3	2	3	1	3	3	3	1
##	11858	11859	11860	11861	11862	11863	11864	11865	11866	11867	11868	11869	11870
##	2	3	3	3	3	3	3	1	1	1	2	3	3
##	11871	11872	11873	11874	11875	11876	11877	11878	11879	11880	11881	11882	11883
##	3	2	1	3	3	3	1	3	1	1	1	3	3
##	11884	11885	11886	11887	11888	11889	11890	11891	11892	11893	11894	11895	11896
##	3	2	1	3	3	3	2	3	3	1	3	1	3
##	11897	11898	11899	11900	11901	11902	11903	11904	11905	11906	11907	11908	11909
##	2	3	3	3	2	3	3	3	2	2	3	3	2
##	11910	11911	11912	11913	11914	11915	11916	11917	11918	11919	11920	11921	11922
##	2	1	3	1	1	3	3	3	2	1	3	3	1
##	11923	11924	11925	11926	11927	11928	11929	11930	11931	11932	11933	11934	11935
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##	11936	11937	11938	11939	11940	11941	11942	11943	11944	11945	11946	11947	11948
##	3	3	3	3	2	3	3	3	2	3	3	1	3
##	11949	11950	11951	11952	11953	11954	11955	11956	11957	11958	11959	11960	11961
##	1	3	2	2	2	3	3	3	1	2	3	3	3
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##	3	2	2	3	3	2	3	2	2	3	3	3	3
##	11975	11976	11977	11978	11979	11980	11981	11982	11983	11984	11985	11986	11987
##	3	3	3	3	3	2	3	2	3	3	3	2	2
##	11988	11989	11990	11991	11992	11993	11994	11995	11996	11997	11998	11999	12000
##	3	1	3	3	3	2	3	3	3	3	3	2	2
##	12001	12002	12003	12004	12005	12006	12007	12008	12009	12010	12011	12012	12013
##	2	3	3	2	3	1	1	3	3	3	1	3	1
##	12014	12015	12016	12017	12018	12019	12020	12021	12022	12023	12024	12025	12026
##	3	3	3	3	3	3	3	3	2	1	3	2	2
##	12027	12028	12029	12030	12031	12032	12033	12034	12035	12036	12037	12038	12039
##	1	1	3	3	1	1	3	3	3	3	3	3	3
##	12040	12041	12042	12043	12044	12045	12046	12047	12048	12049	12050	12051	12052
##	2	2	1	3	3	3	2	2	1	1	3	3	1
##	12053	12054	12055	12056	12057	12058	12059	12060	12061	12062	12063	12064	12065
##	1	3	3	3	2	2	1	3	1	3	1	3	3
##	12066	12067	12068	12069	12070	12071	12072	12073	12074	12075	12076	12077	12078
##	3	3	3	3	3	3	1	3	1	3	2	2	3
##	12079	12080	12081	12082	12083	12084	12085	12086	12087	12088	12089	12090	12091
##	3	3	2	2	3	3	3	3	1	3	2	3	3
##	12092	12093	12094	12095	12096	12097	12098	12099	12100	12101	12102	12103	12104
##	3	1	3	3	3	1	2	3	2	3	1	1	3
##	12105	12106	12107	12108	12109	12110	12111	12112	12113	12114	12115	12116	12117
##	3	2	3	1	2	2	3	2	2	3	3	3	3
##	12118	12119	12120	12121	12122	12123	12124	12125	12126	12127	12128	12129	12130
##	2	3	3	3	3	3	3	3	3	3	3	3	3
##	12131	12132	12133	12134	12135	12136	12137	12138	12139	12140	12141	12142	12143
##	3	3	3	3	3	2	2	3	2	3	1	3	3

```
## 12144 12145 12146 12147 12148 12149 12150 12151 12152 12153 12154 12155 12156
##      3      3      3      1      3      3      3      3      2      3      2      2      3
## 12157 12158 12159 12160 12161 12162 12163 12164 12165 12166 12167 12168 12169
##      2      2      1      3      1      3      1      3      3      3      2      3      2
## 12170 12171 12172 12173 12174 12175 12176 12177 12178 12179 12180 12181 12182
##      3      3      2      2      3      1      1      3      2      2      3      2      3
## 12183 12184 12185 12186 12187 12188 12189 12190 12191 12192 12193 12194 12195
##      3      3      3      2      3      3      2      1      3      2      3      2      1
## 12196 12197 12198 12199 12200 12201 12202 12203 12204 12205 12206 12207 12208
##      3      3      2      2      3      1      3      3      2      3      3      1      1
## 12209 12210 12211 12212 12213 12214 12215 12216 12217 12218 12219 12220 12221
##      3      2      1      3      3      2      3      3      1      3      2      3      3
## 12222 12223 12224 12225 12226 12227 12228 12229 12230 12231 12232 12233 12234
##      2      3      3      2      3      3      1      3      3      3      1      1      3
## 12235 12236 12237 12238 12239 12240 12241 12242 12243 12244 12245 12246 12247
##      2      3      3      3      2      3      1      1      3      2      3      3      3
## 12248 12249 12250 12251 12252 12253 12254 12255 12256 12257 12258 12259 12260
##      2      3      1      3      1      1      2      2      3      3      2      3      3
## 12261 12262 12263 12264 12265 12266 12267 12268 12269 12270 12271 12272 12273
##      3      1      1      3      3      1      3      3      1      3      3      3      3
## 12274 12275 12276 12277 12278 12279 12280 12281 12282 12283 12284 12285 12286
##      3      2      1      3      3      3      2      1      1      3      1      3      3
## 12287 12288 12289 12290 12291 12292 12293 12294 12295 12296 12297 12298 12299
##      1      1      2      3      3      3      2      3      1      2      3      3      3
## 12300 12301 12302 12303 12304 12305 12306 12307 12308 12309 12310 12311 12312
##      3      3      3      3      2      3      3      1      3      3      3      1      3
## 12313 12314 12315 12316 12317 12318 12319 12320 12321 12322 12323 12324 12325
##      3      3      3      2      3      3      2      3      3      3      3      2      3
## 12326 12327 12328 12329 12330
##      3      2      2      2      3
##
```

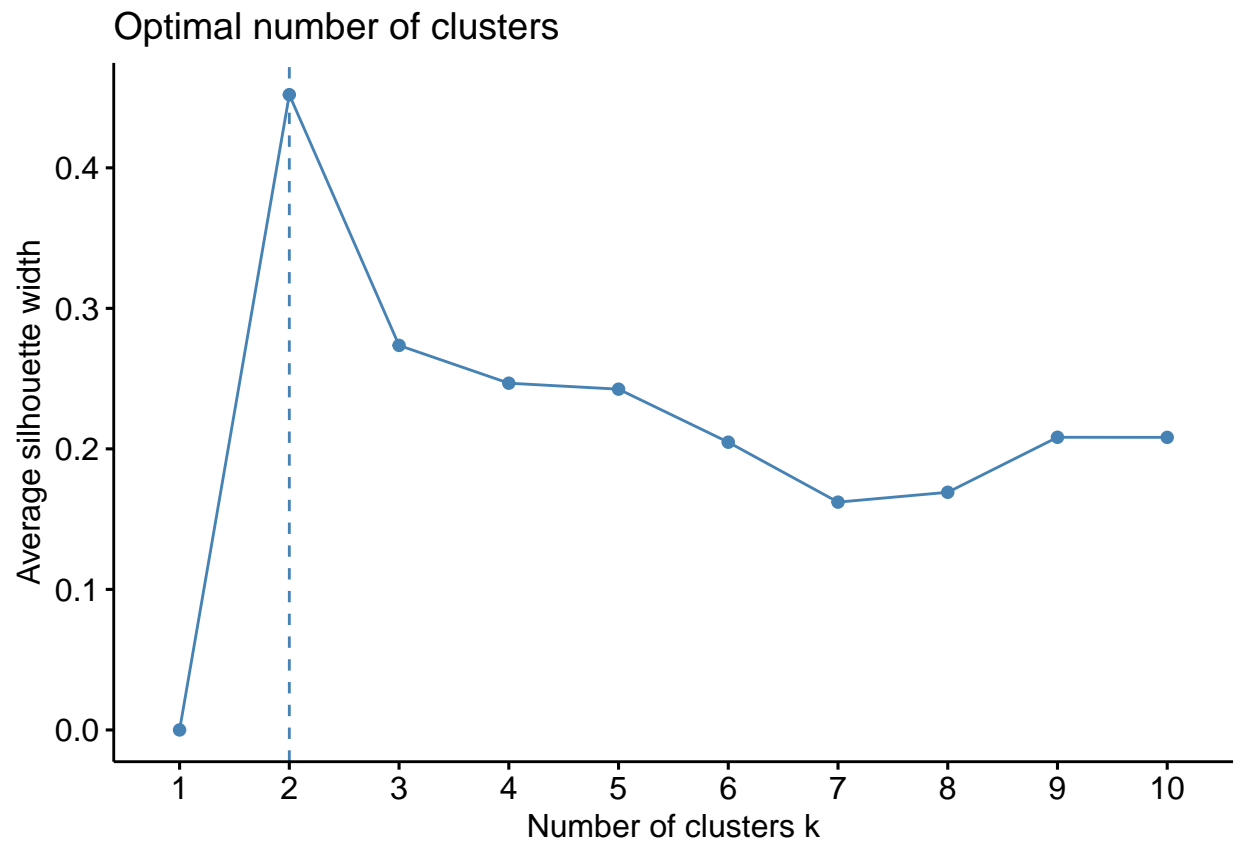
```
## Within cluster sum of squares by cluster:
## [1] 39478.79 73339.78 136874.88
## (between_SS / total_SS = 45.0 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"
```

```
# visualizing the clusters
# installing the package
# install.packages("factoextra")
png("C:\\plot1.png", width = 480, height = 480, units = "px", bg = "white")
library(factoextra)
```

```
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

```
fviz_cluster(result, data = final_att)
```

```
# obtaining the optimal number of clusters
fviz_nbclust(x = final_att, FUNcluster = kmeans, method = 'silhouette')
```



Hierachical clustering