ip_week13-superviced

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AD CLICK ANALYSIS

Defining the Question

1. Specifying the Question

Which individuals are most likely to click on an online cryptography course advertisement?

2. Metric for success

Come up with an analysis that will make our customer identify individuals who are likely to click on her cryptography course.

3. Understanding the Context

A Kenyan entrepreneur has created an online cryptography course and would want to advertise it on her blog. She currently targets audiences originating from various countries. In the past, she ran ads to advertise a related course on the same blog and collected data in the process. She would now like to employ your services as a Data Science Consultant to help her identify which individuals are most likely to click on her ads.

4. Experimental Design taken

1. Data Exploration
2. Data Cleaning
3. Univariate Analysis
4. Bivariate Analysis
5. Conclusion
6. Recommendation
7. Modelling

5. Data relevance

The data collected is from advertising related course so it is relevant.

1. Data Exploration

Loading the data

Loading the necessary packages

```
library("data.table")
advert <- read.csv("advertising.csv")

##Previewing the first 6 rows of dataset

head(advert)
```

```
##   Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage
## 1                    68.95  35    61833.90               256.09
## 2                    80.23  31    68441.85               193.77
## 3                    69.47  26    59785.94               236.50
## 4                    74.15  29    54806.18               245.89
## 5                    68.37  35    73889.99               225.58
## 6                    59.99  23    59761.56               226.74
##                           Ad.Topic.Line           City Male    Country
## 1    Cloned 5thgeneration orchestration    Wrightburgh    0    Tunisia
## 2    Monitored national standardization      West Jodi    1      Nauru
## 3      Organic bottom-line service-desk       Davidton    0 San Marino
## 4 Triple-buffered reciprocal time-frame West Terrifurt    1      Italy
## 5         Robust logistical utilization   South Manuel    0    Iceland
## 6       Sharable client-driven software      Jamieberg    1     Norway
##             Timestamp Clicked.on.Ad
## 1 2016-03-27 00:53:11             0
## 2 2016-04-04 01:39:02             0
## 3 2016-03-13 20:35:42             0
## 4 2016-01-10 02:31:19             0
## 5 2016-06-03 03:36:18             0
## 6 2016-05-19 14:30:17             0
```

```
##Previewing the last 6 rows of dataset

tail(advert)
```

```
##      Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage
## 995                     43.70  28    63126.96               173.01
## 996                     72.97  30    71384.57               208.58
## 997                     51.30  45    67782.17               134.42
## 998                     51.63  51    42415.72               120.37
## 999                     55.55  19    41920.79               187.95
## 1000                    45.01  26    29875.80               178.35
##                            Ad.Topic.Line          City Male
```

```
## 995         Front-line bifurcated ability  Nicholasland    0
## 996         Fundamental modular algorithm     Duffystad    1
## 997       Grass-roots cohesive monitoring   New Darlene    1
## 998          Expanded intangible solution South Jessica    1
## 999  Proactive bandwidth-monitored policy   West Steven    0
## 1000      Virtual 5thgeneration emulation   Ronniemouth    0
##                      Country           Timestamp Clicked.on.Ad
## 995                  Mayotte 2016-04-04 03:57:48             1
## 996                  Lebanon 2016-02-11 21:49:00             1
## 997  Bosnia and Herzegovina 2016-04-22 02:07:01             1
## 998                 Mongolia 2016-02-01 17:24:57             1
## 999                Guatemala 2016-03-24 02:35:54             0
## 1000                  Brazil 2016-06-03 21:43:21             1
```

```
##Basic structure of the data
str(advert)
```

```
## 'data.frame':    1000 obs. of  10 variables:
##  $ Daily.Time.Spent.on.Site: num  69 80.2 69.5 74.2 68.4 ...
##  $ Age                     : int  35 31 26 29 35 23 33 48 30 20 ...
##  $ Area.Income             : num  61834 68442 59786 54806 73890 ...
##  $ Daily.Internet.Usage    : num  256 194 236 246 226 ...
##  $ Ad.Topic.Line           : chr  "Cloned 5thgeneration orchestration" "Monitored national standardi
##  $ City                    : chr  "Wrightburgh" "West Jodi" "Davidton" "West Terrifurt" ...
##  $ Male                    : int  0 1 0 1 0 1 0 1 1 1 ...
##  $ Country                 : chr  "Tunisia" "Nauru" "San Marino" "Italy" ...
##  $ Timestamp               : chr  "2016-03-27 00:53:11" "2016-04-04 01:39:02" "2016-03-13 20:35:42"
##  $ Clicked.on.Ad           : int  0 0 0 0 0 0 0 1 0 0 ...
```

2. Data Cleaning

Tidying the dataset the dataset

```
# Identifying duplicates
advert[duplicated(advert), ]
```

```
##  [1] Daily.Time.Spent.on.Site Age                      Area.Income
##  [4] Daily.Internet.Usage     Ad.Topic.Line            City
##  [7] Male                     Country                  Timestamp
## [10] Clicked.on.Ad
## <0 rows> (or 0-length row.names)
```

```
##There are no duplicates in this dataset.

## Identifying missing data
length(which(!is.na(advert)))
```

```
## [1] 10000
```

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

```
## Daily.Time.Spent.on.Site                      Age             Area.Income
##                        0                        0                        0
##     Daily.Internet.Usage           Ad.Topic.Line                     City
##                        0                        0                        0
##                     Male                  Country                Timestamp
##                        0                        0                        0
##            Clicked.on.Ad
##                        0
```

```
##There is no missing data
```

Checking for outliers

```
boxplot.stats(advert$`Daily Time Spent on Site`)$out
```

```
## NULL
```

```
boxplot.stats(advert$Age)$out
```

```
## integer(0)
```

```
boxplot.stats(advert$`Area Income`)$out
```

```
## NULL
```

```
boxplot.stats(advert$`Daily Internet Usage`)$out
```

```
## NULL
```

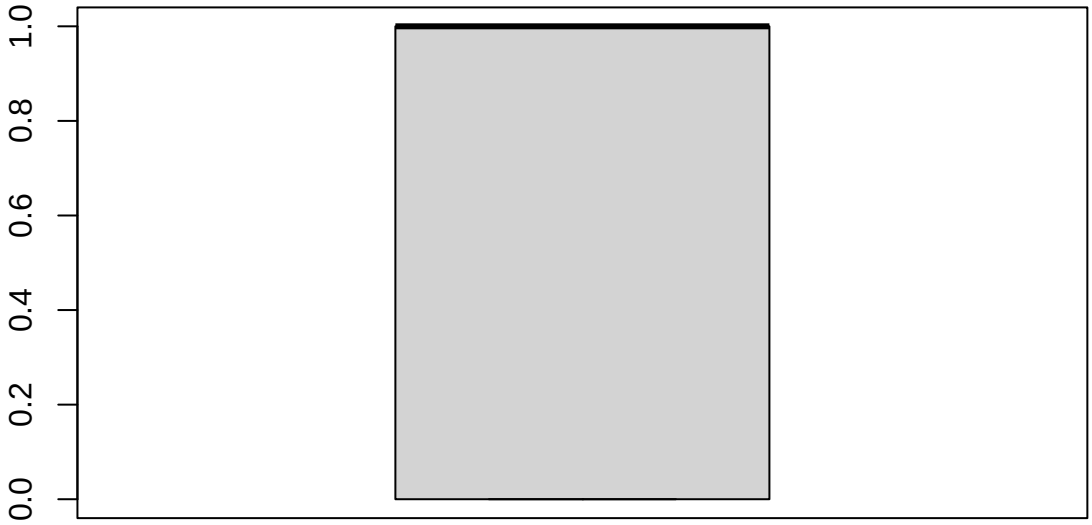
```
boxplot.stats(advert$`Clicked on Ad`)$out
```

```
## NULL
```

```
numeric_cols <- unlist(lapply(advert, is.numeric))
numeric_cols
```

```
## Daily.Time.Spent.on.Site                      Age             Area.Income
##                     TRUE                     TRUE                     TRUE
##     Daily.Internet.Usage           Ad.Topic.Line                     City
##                     TRUE                    FALSE                    FALSE
##                     Male                  Country                Timestamp
##                     TRUE                    FALSE                    FALSE
##            Clicked.on.Ad
##                     TRUE
```

```
boxplot(numeric_cols)
```



we do not have outliers.

checking for anomalies

Anomalies are inconsistencies in the data

```
###Checking the number of unique values in each column
lengths(lapply(advert, unique))
```

```
## Daily.Time.Spent.on.Site                   Age           Area.Income
##                      900                    43                  1000
##     Daily.Internet.Usage         Ad.Topic.Line                  City
##                      966                  1000                   969
##                     Male               Country             Timestamp
##                        2                   237                  1000
##           Clicked.on.Ad
##                        2
```

```
str(advert)
```

```
## 'data.frame':    1000 obs. of  10 variables:
##  $ Daily.Time.Spent.on.Site: num  69 80.2 69.5 74.2 68.4 ...
```

```
##  $ Age                     : int  35 31 26 29 35 23 33 48 30 20 ...
##  $ Area.Income             : num  61834 68442 59786 54806 73890 ...
##  $ Daily.Internet.Usage    : num  256 194 236 246 226 ...
##  $ Ad.Topic.Line           : chr  "Cloned 5thgeneration orchestration" "Monitored national standardi
##  $ City                    : chr  "Wrightburgh" "West Jodi" "Davidton" "West Terrifurt" ...
##  $ Male                    : int  0 1 0 1 0 1 0 1 1 1 ...
##  $ Country                 : chr  "Tunisia" "Nauru" "San Marino" "Italy" ...
##  $ Timestamp               : chr  "2016-03-27 00:53:11" "2016-04-04 01:39:02" "2016-03-13 20:35:42"
##  $ Clicked.on.Ad           : int  0 0 0 0 0 0 0 1 0 0 ...
```

3. Univariate Analysis

checking the means of all our numerical values

```
# Summary of the dataset
summary(advert)
```

```
##  Daily.Time.Spent.on.Site      Age          Area.Income    Daily.Internet.Usage
##  Min.   :32.60            Min.   :19.00   Min.   :13996   Min.   :104.8
##  1st Qu.:51.36            1st Qu.:29.00   1st Qu.:47032   1st Qu.:138.8
##  Median :68.22            Median :35.00   Median :57012   Median :183.1
##  Mean   :65.00            Mean   :36.01   Mean   :55000   Mean   :180.0
##  3rd Qu.:78.55            3rd Qu.:42.00   3rd Qu.:65471   3rd Qu.:218.8
##  Max.   :91.43            Max.   :61.00   Max.   :79485   Max.   :270.0
##  Ad.Topic.Line          City                Male         Country
##  Length:1000        Length:1000        Min.   :0.000   Length:1000
##  Class :character   Class :character   1st Qu.:0.000   Class :character
##  Mode  :character   Mode  :character   Median :0.000   Mode  :character
##                                        Mean   :0.481
##                                        3rd Qu.:1.000
##                                        Max.   :1.000
##   Timestamp         Clicked.on.Ad
##  Length:1000        Min.   :0.0
##  Class :character   1st Qu.:0.0
##  Mode  :character   Median :0.5
##                     Mean   :0.5
##                     3rd Qu.:1.0
##                     Max.   :1.0
```

```
# Getting the time period of the data
range(advert$Timestamp)
```

```
## [1] "2016-01-01 02:52:10" "2016-07-24 00:22:16"
```

Getting variance and std.deviation of Daily time spent on site

```
advert.daily.variance <- var(advert$Daily.Time.Spent.on.Site)
advert.daily.variance
```

```
## [1] 251.3371
```

```
#checking the datatypes on the columns
sapply(advert, class)
```

```
## Daily.Time.Spent.on.Site                      Age             Area.Income
##                "numeric"                "integer"                "numeric"
##     Daily.Internet.Usage            Ad.Topic.Line                     City
##                "numeric"              "character"              "character"
##                     Male                  Country                Timestamp
##                "integer"              "character"              "character"
##            Clicked.on.Ad
##                "integer"
```

```
# Getting variance and std.deviation of Area Income

var(advert$Area.Income)
```

```
## [1] 179952406
```

```
##the timestamp has  a wrong data type so we will need to convert it to datetime
advert$Timestamp <- as.POSIXct(advert$Timestamp, "%Y-%m-%d %H:%M:%S",tz = "GMT")

### Checking if change has been effected
sapply(advert, class)
```

```
## $Daily.Time.Spent.on.Site
## [1] "numeric"
##
## $Age
## [1] "integer"
##
## $Area.Income
## [1] "numeric"
##
## $Daily.Internet.Usage
## [1] "numeric"
##
## $Ad.Topic.Line
## [1] "character"
##
## $City
## [1] "character"
##
## $Male
## [1] "integer"
##
## $Country
## [1] "character"
##
## $Timestamp
## [1] "POSIXct" "POSIXt"
```

```
##
## $Clicked.on.Ad
## [1] "integer"
```

```
summary(advert)
```

```
##  Daily.Time.Spent.on.Site      Age          Area.Income    Daily.Internet.Usage
##  Min.   :32.60            Min.   :19.00   Min.   :13996   Min.   :104.8
##  1st Qu.:51.36            1st Qu.:29.00   1st Qu.:47032   1st Qu.:138.8
##  Median :68.22            Median :35.00   Median :57012   Median :183.1
##  Mean   :65.00            Mean   :36.01   Mean   :55000   Mean   :180.0
##  3rd Qu.:78.55            3rd Qu.:42.00   3rd Qu.:65471   3rd Qu.:218.8
##  Max.   :91.43            Max.   :61.00   Max.   :79485   Max.   :270.0
##  Ad.Topic.Line          City                Male         Country
##  Length:1000        Length:1000        Min.   :0.000   Length:1000
##  Class :character   Class :character   1st Qu.:0.000   Class :character
##  Mode  :character   Mode  :character   Median :0.000   Mode  :character
##                                        Mean   :0.481
##                                        3rd Qu.:1.000
##                                        Max.   :1.000
##    Timestamp                     Clicked.on.Ad
##  Min.   :2016-01-01 02:52:10   Min.   :0.0
##  1st Qu.:2016-02-18 02:55:42   1st Qu.:0.0
##  Median :2016-04-07 17:27:29   Median :0.5
##  Mean   :2016-04-10 10:34:06   Mean   :0.5
##  3rd Qu.:2016-05-31 03:18:14   3rd Qu.:1.0
##  Max.   :2016-07-24 00:22:16   Max.   :1.0
```

Getting variance and std.deviation of Daily time spent on site

```
var(advert$Daily.Time.Spent.on.Site)
```

```
## [1] 251.3371
```

```
sd(advert$Daily.Time.Spent.on.Site)
```

```
## [1] 15.85361
```

```
# Getting variance and std.deviation of Area Income

var(advert$Area.Income)
```

```
## [1] 179952406
```

```
sd(advert$Area.Income)
```

```
## [1] 13414.63
```

```r
# Getting variance and std.deviation of Daily Internet Usage
sd(advert$Daily.Internet.Usage)
```

```
## [1] 43.90234
```

```r
var(advert$Daily.Internet.Usage)
```

```
## [1] 1927.415
```

```r
# Function to get mode
mode <- function(v){
  uniq <- unique(as.integer(v))
  uniq[which.max(tabulate(match(as.integer(v), uniq)))]
}
```

```r
# Mode of daily time spent on site
daily.site <- mode(advert$Daily.Time.Spent.on.Site)
daily.site
```

```
## [1] 78
```

Alot of people spend 78 minutes browsing on the site.

```r
# Getting the mode of the age
age.mode <- mode(advert$Age)
age.mode
```

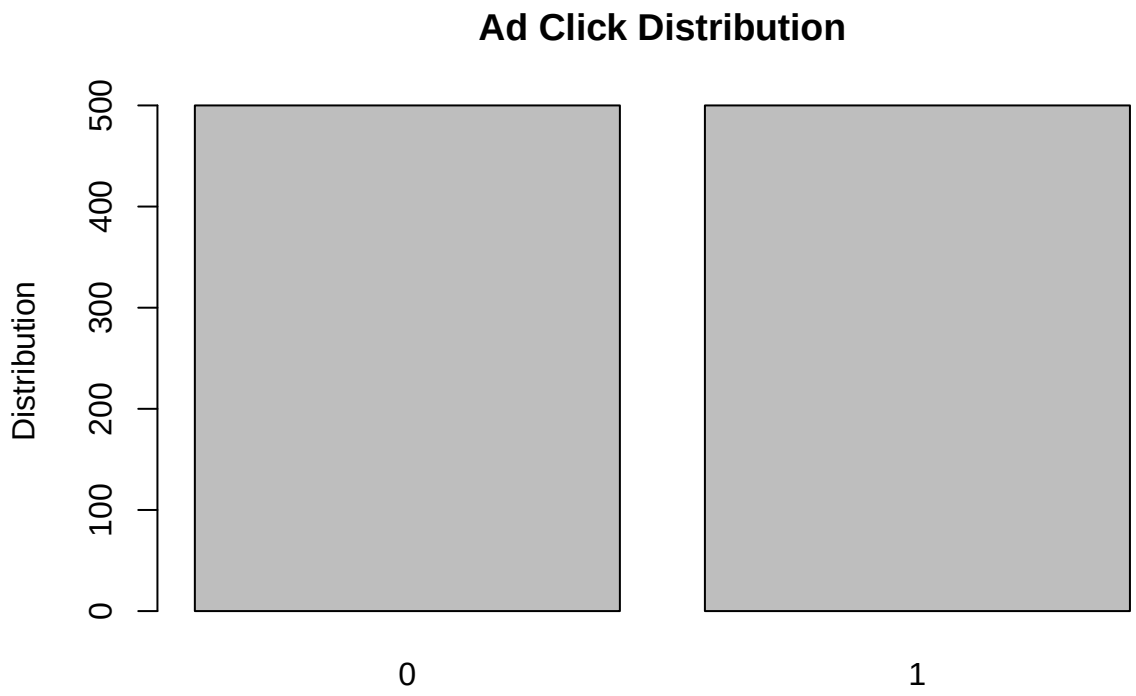
```
## [1] 31
```

Most people on the site are age 31

```r
# Distribution of the genders
gender <- advert$Male
gen <- table(gender)
barplot(gen, main = "Gender Distribution", ylab = "Distribution")
```

Females browsing on the site are more than males by a small percantage.

```
# Distribution of whether one clicked or did not click on an ad
click <- advert$Clicked.on.Ad
clicked <- table(click)
barplot(clicked, main = "Ad Click Distribution", ylab = "Distribution")
```



There is a 50% chance that someone will click on the add while browsing the internet.

```
area_income_mode<- mode((advert$Area.Income))
area_income_mode
```

```
## [1] 51636
```

```
internetusage_mode<- mode(advert$Daily.Internet.Usage)
internetusage_mode
```

```
## [1] 231
```

range

```
range(advert$Age)
```

```
## [1] 19 61
```

people browsing the internet are between ages 19 an 61.

```r
# ad clicked per country
country_ad <- table(advert$Country, advert$Clicked.on.Ad)
names(dimnames(country_ad)) <- c("Country", "Clicked on Ad")
country_ad
```

```
##                                                    Clicked on Ad
## Country                                             0 1
##   Afghanistan                                       3 5
##   Albania                                           3 4
##   Algeria                                           3 3
##   American Samoa                                    2 3
##   Andorra                                           0 2
##   Angola                                            3 1
##   Anguilla                                          3 3
##   Antarctica (the territory South of 60 deg S)      1 2
##   Antigua and Barbuda                               1 4
##   Argentina                                         1 1
##   Armenia                                           2 1
##   Aruba                                             1 0
##   Australia                                         1 7
##   Austria                                           4 1
##   Azerbaijan                                        2 1
##   Bahamas                                           3 4
##   Bahrain                                           3 2
##   Bangladesh                                        2 2
##   Barbados                                          3 2
##   Belarus                                           3 3
##   Belgium                                           3 2
##   Belize                                            2 3
##   Benin                                             1 1
##   Bermuda                                           1 0
##   Bhutan                                            1 1
##   Bolivia                                           6 0
##   Bosnia and Herzegovina                            4 3
##   Bouvet Island (Bouvetoya)                         3 2
##   Brazil                                            2 3
##   British Indian Ocean Territory (Chagos Archipelago) 0 1
##   British Virgin Islands                            2 1
##   Brunei Darussalam                                 3 2
##   Bulgaria                                          2 4
##   Burkina Faso                                      3 1
##   Burundi                                           5 2
##   Cambodia                                          5 2
##   Cameroon                                          5 0
##   Canada                                            2 3
##   Cape Verde                                        1 0
##   Cayman Islands                                    2 3
##   Central African Republic                          1 1
##   Chad                                              2 2
##   Chile                                             1 3
##   China                                             2 4
##   Christmas Island                                  2 4
##   Colombia                                          1 1
```

```
##   Comoros                                  1 1
##   Congo                                    1 3
##   Cook Islands                             2 1
##   Costa Rica                               4 2
##   Cote d'Ivoire                            1 3
##   Croatia                                  6 0
##   Cuba                                     1 4
##   Cyprus                                   4 4
##   Czech Republic                           5 4
##   Denmark                                  1 2
##   Djibouti                                 1 1
##   Dominica                                 3 2
##   Dominican Republic                       2 2
##   Ecuador                                  3 2
##   Egypt                                    2 3
##   El Salvador                              2 4
##   Equatorial Guinea                        1 3
##   Eritrea                                  4 3
##   Estonia                                  2 1
##   Ethiopia                                 0 7
##   Falkland Islands (Malvinas)              2 2
##   Faroe Islands                            1 2
##   Fiji                                     4 3
##   Finland                                  4 1
##   France                                   4 5
##   French Guiana                            1 3
##   French Polynesia                         4 1
##   French Southern Territories              4 1
##   Gabon                                    6 0
##   Gambia                                   1 1
##   Georgia                                  2 2
##   Germany                                  0 1
##   Ghana                                    2 2
##   Gibraltar                                3 0
##   Greece                                   5 3
##   Greenland                                4 1
##   Grenada                                  2 2
##   Guadeloupe                               1 1
##   Guam                                     2 2
##   Guatemala                                1 3
##   Guernsey                                 1 2
##   Guinea                                   1 2
##   Guinea-Bissau                            1 1
##   Guyana                                   2 3
##   Haiti                                    1 1
##   Heard Island and McDonald Islands        1 2
##   Holy See (Vatican City State)            2 1
##   Honduras                                 3 2
##   Hong Kong                                2 4
##   Hungary                                  1 5
##   Iceland                                  2 1
##   India                                    2 0
##   Indonesia                                2 4
##   Iran                                     2 3
```

```
##   Ireland                                  2 1
##   Isle of Man                              2 1
##   Israel                                   2 2
##   Italy                                    4 1
##   Jamaica                                  3 2
##   Japan                                    2 2
##   Jersey                                   2 4
##   Jordan                                   1 0
##   Kazakhstan                               2 2
##   Kenya                                    0 4
##   Kiribati                                 0 1
##   Korea                                    2 3
##   Kuwait                                   1 1
##   Kyrgyz Republic                          5 1
##   Lao People's Democratic Republic         2 2
##   Latvia                                   0 4
##   Lebanon                                  2 4
##   Lesotho                                  1 0
##   Liberia                                  2 6
##   Libyan Arab Jamahiriya                   2 2
##   Liechtenstein                            0 6
##   Lithuania                                0 3
##   Luxembourg                               4 3
##   Macao                                    0 3
##   Macedonia                                1 1
##   Madagascar                               4 2
##   Malawi                                   2 2
##   Malaysia                                 3 0
##   Maldives                                 2 2
##   Mali                                     3 1
##   Malta                                    3 3
##   Marshall Islands                         0 1
##   Martinique                               1 3
##   Mauritania                               1 1
##   Mauritius                                3 1
##   Mayotte                                  1 5
##   Mexico                                   2 4
##   Micronesia                               4 4
##   Moldova                                  4 2
##   Monaco                                   2 1
##   Mongolia                                 2 4
##   Montenegro                               0 2
##   Montserrat                               0 1
##   Morocco                                  2 1
##   Mozambique                               1 0
##   Myanmar                                  4 1
##   Namibia                                  1 1
##   Nauru                                    2 1
##   Nepal                                    3 0
##   Netherlands                              1 3
##   Netherlands Antilles                     4 2
##   New Caledonia                            0 2
##   New Zealand                              2 2
##   Nicaragua                                3 0
```

```
##   Niger                                          1 2
##   Niue                                           3 0
##   Norfolk Island                                 3 2
##   Northern Mariana Islands                       1 2
##   Norway                                         1 1
##   Pakistan                                       4 1
##   Palau                                          2 2
##   Palestinian Territory                          1 2
##   Panama                                         2 0
##   Papua New Guinea                               2 3
##   Paraguay                                       2 1
##   Peru                                           3 5
##   Philippines                                    3 3
##   Pitcairn Islands                               1 1
##   Poland                                         3 3
##   Portugal                                       2 1
##   Puerto Rico                                    3 3
##   Qatar                                          4 2
##   Reunion                                        2 0
##   Romania                                        0 1
##   Russian Federation                             2 1
##   Rwanda                                         3 2
##   Saint Barthelemy                               0 2
##   Saint Helena                                   3 2
##   Saint Kitts and Nevis                          0 1
##   Saint Lucia                                    1 1
##   Saint Martin                                   2 2
##   Saint Pierre and Miquelon                      2 3
##   Saint Vincent and the Grenadines               3 3
##   Samoa                                          2 4
##   San Marino                                     2 1
##   Sao Tome and Principe                          0 2
##   Saudi Arabia                                   1 3
##   Senegal                                        3 5
##   Serbia                                         2 3
##   Seychelles                                     2 1
##   Sierra Leone                                   0 2
##   Singapore                                      5 1
##   Slovakia (Slovak Republic)                     2 0
##   Slovenia                                       0 1
##   Somalia                                        3 2
##   South Africa                                   2 6
##   South Georgia and the South Sandwich Islands   1 1
##   Spain                                          0 3
##   Sri Lanka                                      4 0
##   Sudan                                          2 0
##   Suriname                                       1 1
##   Svalbard & Jan Mayen Islands                   2 4
##   Swaziland                                      2 0
##   Sweden                                         3 1
##   Switzerland                                    1 3
##   Syrian Arab Republic                           2 1
##   Taiwan                                         3 4
##   Tajikistan                                     1 2
```

```
##   Tanzania                                    2 1
##   Thailand                                    2 2
##   Timor-Leste                                 4 1
##   Togo                                        2 1
##   Tokelau                                     1 3
##   Tonga                                       3 2
##   Trinidad and Tobago                         1 2
##   Tunisia                                     3 1
##   Turkey                                      1 7
##   Turkmenistan                                4 2
##   Turks and Caicos Islands                    2 3
##   Tuvalu                                      1 3
##   Uganda                                      0 4
##   Ukraine                                     4 1
##   United Arab Emirates                        3 3
##   United Kingdom                              1 2
##   United States Minor Outlying Islands        2 2
##   United States of America                    2 3
##   United States Virgin Islands                2 2
##   Uruguay                                     4 1
##   Uzbekistan                                  1 1
##   Vanuatu                                     5 1
##   Venezuela                                   4 3
##   Vietnam                                     1 2
##   Wallis and Futuna                           3 1
##   Western Sahara                              3 4
##   Yemen                                       1 2
##   Zambia                                      1 3
##   Zimbabwe                                    2 4
```

People from Australia, Ethopia, turkey and Liechtenstein had highest click on the ad, Liechtenstein and ethopia had all people click on the ad.

4. Bivariate Analysis

```
# Assigning the age column to the variable age
# ---
#
age <- advert$Age
```

```
# Assigning the Clicked.on.Ad column to the variable adclicked
# ---
#
timespent<- advert$ Daily.Time.Spent.on.Site
```

Using the cov() function to determine the covariance

```
#
cov(age, timespent)
```

```
## [1] -46.17415
```

The covariance is a strong negative relatnship between Age and tme spent on sight.

```
# Using the cor() function to determine the correlation
# ---
#
cor(age, timespent)
```

```
## [1] -0.3315133
```

There is no relationship between age and time spent on site

```
# Getting correlation of the continuous variables
cor(advert[,unlist(lapply(advert, is.numeric))])
```

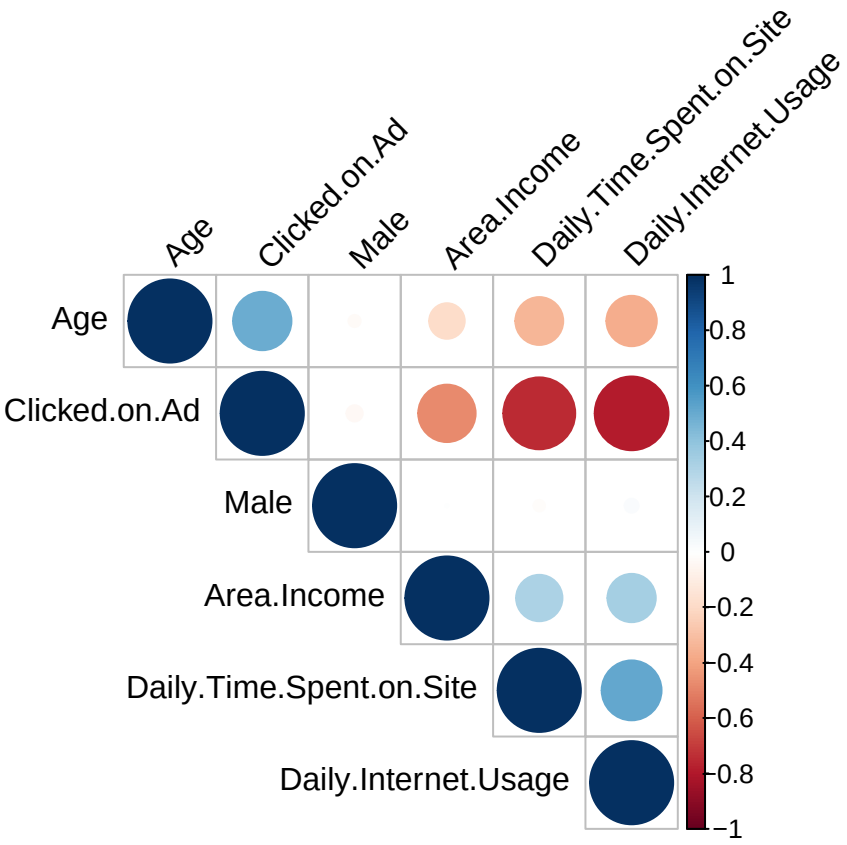
```
##                           Daily.Time.Spent.on.Site         Age  Area.Income
## Daily.Time.Spent.on.Site               1.00000000 -0.33151334  0.310954413
## Age                                   -0.33151334  1.00000000 -0.182604955
## Area.Income                            0.31095441 -0.18260496  1.000000000
## Daily.Internet.Usage                   0.51865848 -0.36720856  0.337495533
## Male                                  -0.01895085 -0.02104406  0.001322359
## Clicked.on.Ad                         -0.74811656  0.49253127 -0.476254628
##                           Daily.Internet.Usage         Male Clicked.on.Ad
## Daily.Time.Spent.on.Site           0.51865848 -0.018950855   -0.74811656
## Age                               -0.36720856 -0.021044064    0.49253127
## Area.Income                        0.33749553  0.001322359   -0.47625463
## Daily.Internet.Usage               1.00000000  0.028012326   -0.78653918
## Male                               0.02801233  1.000000000   -0.03802747
## Clicked.on.Ad                     -0.78653918 -0.038027466    1.00000000
```

Correlation plot package

```
#install.packages("corrplot")
library('corrplot')
```

```
## corrplot 0.90 loaded
```

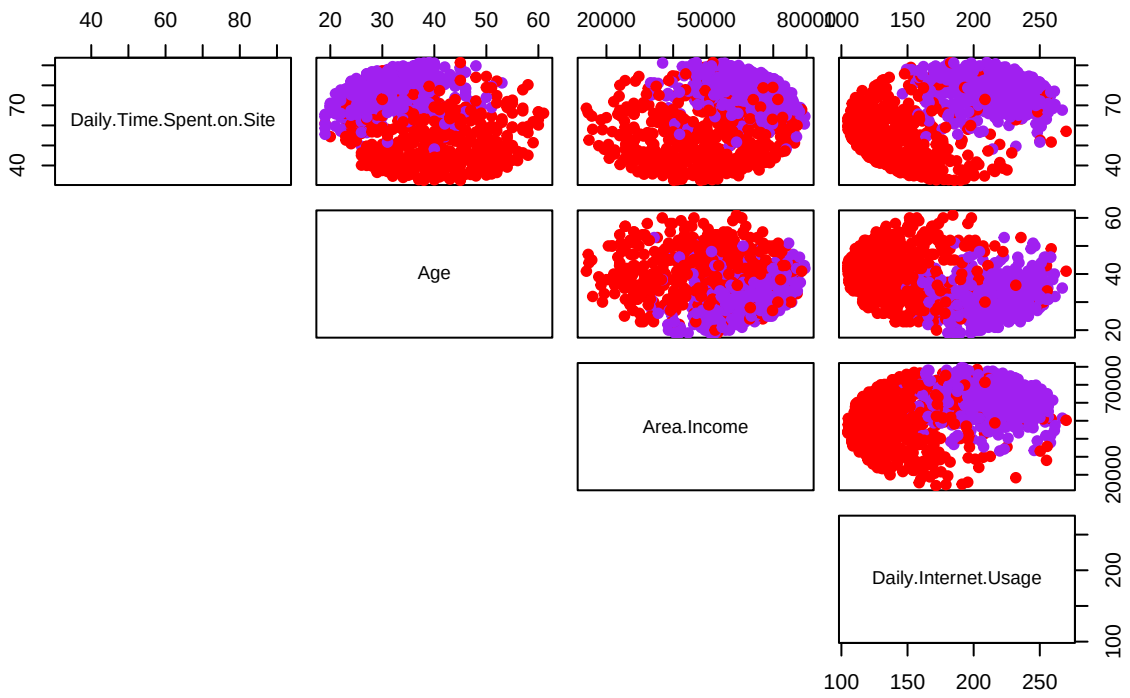
```
#Plotting a correlation matrix plot
corrplot(cor(advert[,unlist(lapply(advert, is.numeric))]), type = "upper", order = "hclust", tl.col = "
```




```
#install.packages("tidyverse")

# Grouping the data by whether one clicked an ad or not
group <- NA
group[advert$Clicked.on.Ad == 1] <- 1
group[advert$Clicked.on.Ad == 0] <- 2

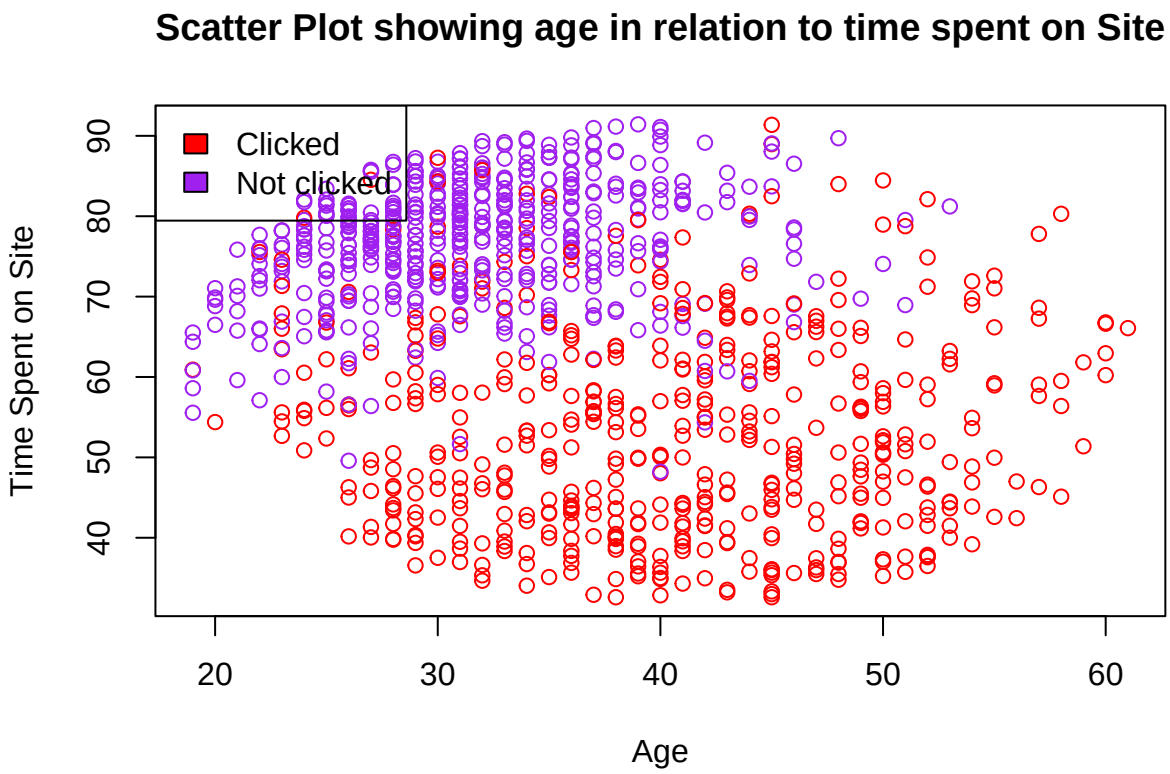
# Plotting a pair plot
pairs(advert[,1:4], pch = 19, lower.panel = NULL,
      main="Pair Plots showing the relationships between variables",
      col = c("red", "purple")[group])
```




```
# Grouping by gender
group1 <- NA
group1[advert$Male == 1] <- 1
group1[advert$Male == 0] <- 2

# Setting the x and y variables
x <- advert$Age
y <- advert$Daily.Time.Spent.on.Site

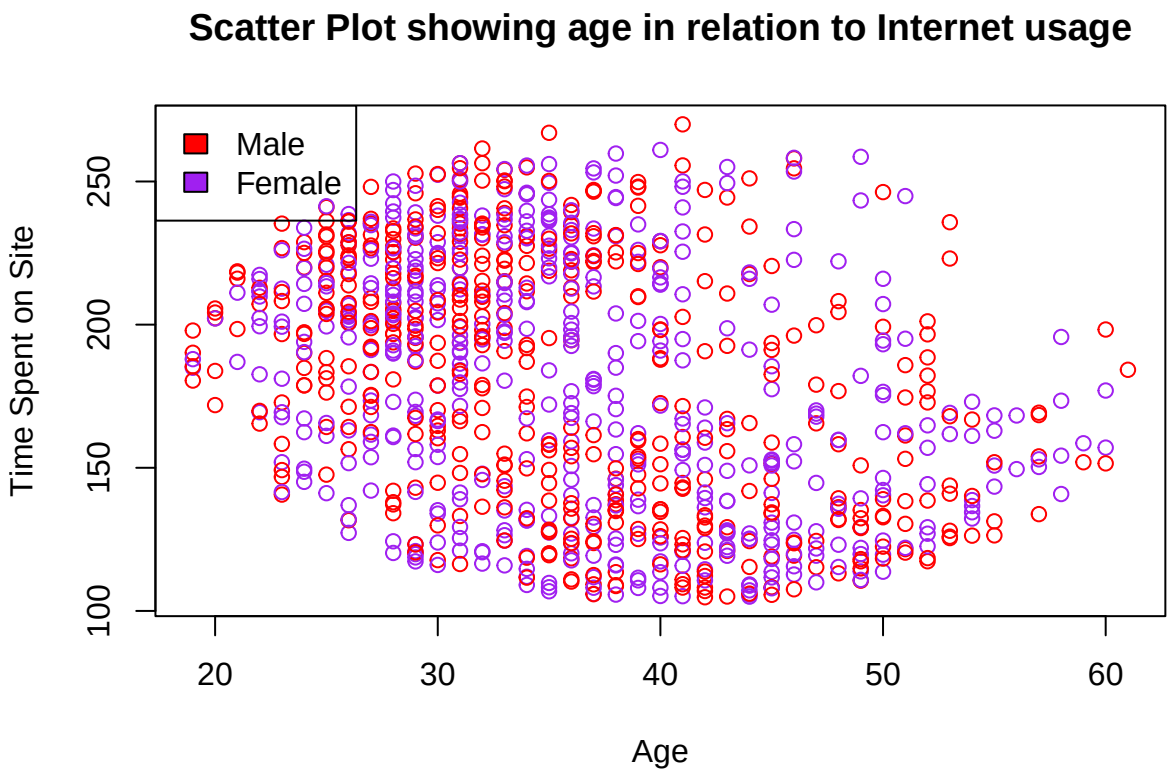
# Scatter plot
plot(x, y, xlab = "Age", ylab = "Time Spent on Site", col = c("red", "purple")[group],
     main="Scatter Plot showing age in relation to time spent on Site")
legend("topleft",c("Clicked","Not clicked"), fill=c("red","purple"))
```



Those who are younger than 40 years were more likely to click on an ad. The less the time spent on a site, the more likely one would not click on an ad.

```
# Setting a new variable
n <- advert$Daily.Internet.Usage

# Scatter plot
plot(x, n, xlab = "Age", ylab = "Time Spent on Site", col = c("red", "purple")[group1],
     main="Scatter Plot showing age in relation to Internet usage")
legend("topleft",c("Male","Female"), fill=c("red","purple"))
```



Both genders are equally distributed in terms of time spent on site.

Getting individuals Who are likely to click on the advertisement.

```
#install.packages("dplyr")
library(dplyr)
```

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

## The following objects are masked from 'package:data.table':
##
##     between, first, last

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

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

```
head(advert)
```

```
##   Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage
## 1                    68.95  35    61833.90               256.09
## 2                    80.23  31    68441.85               193.77
## 3                    69.47  26    59785.94               236.50
## 4                    74.15  29    54806.18               245.89
## 5                    68.37  35    73889.99               225.58
## 6                    59.99  23    59761.56               226.74
##                          Ad.Topic.Line           City Male    Country
## 1    Cloned 5thgeneration orchestration    Wrightburgh    0    Tunisia
## 2    Monitored national standardization      West Jodi    1      Nauru
## 3      Organic bottom-line service-desk       Davidton    0 San Marino
## 4 Triple-buffered reciprocal time-frame West Terrifurt    1      Italy
## 5         Robust logistical utilization   South Manuel    0    Iceland
## 6       Sharable client-driven software      Jamieberg    1     Norway
##             Timestamp Clicked.on.Ad
## 1 2016-03-27 00:53:11             0
## 2 2016-04-04 01:39:02             0
## 3 2016-03-13 20:35:42             0
## 4 2016-01-10 02:31:19             0
## 5 2016-06-03 03:36:18             0
## 6 2016-05-19 14:30:17             0
```

```
filter(advert, Age >= 35 & Daily.Time.Spent.on.Site < 60)
```

```
##     Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage
## 1                      47.64  49    45632.51               122.02
## 2                      55.39  37    23936.86               129.41
## 3                      54.70  36    31087.54               118.39
## 4                      41.49  52    32635.70               164.83
## 5                      41.39  41    68962.32               167.22
## 6                      51.95  52    58295.82               129.23
## 7                      59.05  57    25583.29               169.23
## 8                      57.64  57    45580.92               133.81
## 9                      50.43  46    57425.87               119.32
## 10                     38.93  39    27508.41               162.08
## 11                     37.68  52    53575.48               172.83
## 12                     44.33  37    52723.34               123.72
## 13                     48.01  46    54286.10               119.93
## 14                     33.33  45    53350.11               193.58
## 15                     50.33  50    62657.53               133.20
## 16                     44.98  49    52336.64               129.31
## 17                     41.82  41    24852.90               156.36
## 18                     45.96  45    66281.46               141.22
## 19                     55.35  39    75509.61               153.17
## 20                     33.21  43    42650.32               167.07
## 21                     38.46  42    58183.04               145.98
## 22                     49.81  35    57009.76               120.06
## 23                     56.14  38    32689.04               113.53
## 24                     55.13  45    55605.92               111.71
## 25                     56.64  38    61652.53               115.91
## 26                     57.76  41    47861.93               105.15
```

```
## 27                56.89  37    37334.78              109.29
## 28                50.08  40    64147.86              125.85
## 29                45.72  36    22473.08              154.02
## 30                39.94  41    64927.19              156.30
## 31                35.61  46    51868.85              158.22
## 32                41.49  53    31947.65              169.18
## 33                42.39  42    66541.05              150.99
## 34                46.13  46    37838.72              123.64
## 35                37.75  36    35466.80              225.24
## 36                46.98  50    21644.91              175.37
## 37                41.67  36    53817.02              132.55
## 38                51.24  36    76368.31              176.73
## 39                43.49  47    50335.46              127.83
## 40                49.89  39    17709.98              160.03
## 41                38.37  36    41229.16              140.46
## 42                38.52  38    42581.23              137.28
## 43                55.60  44    65953.76              124.38
## 44                37.47  44    45716.48              141.89
## 45                56.04  49    65120.86              128.95
## 46                49.78  46    71718.51              152.24
## 47                37.00  48    36782.38              158.22
## 48                44.64  36    55787.58              127.01
## 49                41.28  50    50960.08              140.39
## 50                59.59  42    43662.10              104.78
## 51                43.77  52    49030.03              138.55
## 52                39.85  38    31343.39              145.96
## 53                46.88  54    43444.86              136.64
## 54                46.31  57    44248.52              153.98
## 55                39.86  36    32593.59              145.85
## 56                43.67  53    46004.31              143.79
## 57                44.78  45    63363.04              137.24
## 58                35.65  40    31265.75              172.58
## 59                59.51  58    39132.64              140.83
## 60                40.15  38    38745.29              134.88
## 61                41.89  38    68519.96              163.38
## 62                34.87  40    59621.02              200.23
## 63                43.60  38    20856.54              170.49
## 64                49.95  39    68737.75              136.59
## 65                34.86  38    49942.66              154.75
## 66                37.32  50    56735.14              199.25
## 67                40.42  45    40183.75              133.90
## 68                53.68  47    56180.93              115.26
## 69                39.96  45    59610.81              146.13
## 70                57.05  41    50278.89              269.96
## 71                42.44  56    43450.11              168.27
## 72                56.70  48    62784.85              123.13
## 73                40.06  38    56782.18              138.68
## 74                59.21  35    73347.67              144.62
## 75                43.02  44    50199.77              125.22
## 76                44.49  53    63100.13              168.00
## 77                46.37  52    32847.53              144.27
## 78                40.67  35    48913.07              133.18
## 79                47.51  51    53700.57              130.41
## 80                45.05  42    66348.95              141.36
```

```
## 81                55.20  39    76560.59              159.46
## 82                52.62  50    73863.25              176.52
## 83                39.25  39    62378.05              152.36
## 84                33.52  43    42191.61              165.56
## 85                54.92  54    23975.35              161.16
## 86                36.87  36    29398.61              195.91
## 87                34.78  48    42861.42              208.21
## 88                56.30  49    67430.96              135.24
## 89                38.94  41    57587.00              142.67
## 90                36.31  47    57983.30              168.92
## 91                37.87  52    56394.82              188.56
## 92                37.45  47    31281.01              167.86
## 93                49.84  39    45800.48              111.59
## 94                51.38  59    42362.49              158.56
## 95                58.60  50    45400.50              113.70
## 96                36.08  45    41417.27              151.47
## 97                41.73  47    60812.77              144.71
## 98                43.63  41    51662.24              123.25
## 99                44.46  42    30487.48              132.66
## 100               42.05  51    28357.27              174.55
## 101               35.98  47    55993.68              165.52
## 102               39.34  43    31215.88              148.93
## 103               57.24  52    46473.14              117.35
## 104               56.34  50    68713.70              139.02
## 105               51.68  49    51067.54              258.62
## 106               35.34  45    46693.76              152.86
## 107               56.99  40    37713.23              108.15
## 108               41.18  43    41866.55              129.25
## 109               34.30  41    53167.68              160.74
## 110               53.38  35    60803.37              120.06
## 111               43.59  36    58849.77              132.31
## 112               54.43  37    75180.20              154.74
## 113               56.66  42    72684.44              139.42
## 114               57.64  36    37212.54              110.25
## 115               36.44  39    52400.88              147.64
## 116               53.14  38    49111.47              109.00
## 117               32.84  40    41232.89              171.72
## 118               51.87  50    51869.87              119.65
## 119               43.01  35    48347.64              127.37
## 120               48.03  40    25598.75              134.60
## 121               32.99  45    49282.87              177.46
## 122               36.49  52    42136.33              196.61
## 123               43.84  36    70592.81              167.42
## 124               44.96  50    52802.00              132.71
## 125               39.56  41    59243.46              143.13
## 126               46.20  37    51315.38              119.30
## 127               35.49  48    43974.49              159.77
## 128               50.19  40    33987.27              117.30
## 129               41.70  39    42898.21              126.95
## 130               58.35  37    70232.95              132.63
## 131               51.56  46    63102.19              124.85
## 132               58.21  37    47575.44              105.94
## 133               49.99  41    61068.26              121.07
## 134               59.13  44    49525.37              106.04
```

```
## 135                42.94  37    56681.65              130.40
## 136                59.22  55    39131.53              126.39
## 137                35.00  40    46033.73              151.25
## 138                46.61  42    65856.74              136.18
## 139                43.65  39    63649.04              138.87
## 140                46.61  52    27241.11              156.99
## 141                53.44  42    42907.89              108.17
## 142                42.60  55    55121.65              168.29
## 143                56.39  58    32252.38              154.23
## 144                44.73  35    55316.97              127.56
## 145                56.20  49    53549.94              114.85
## 146                38.35  41    34886.01              144.69
## 147                59.52  44    67511.86              251.08
## 148                47.90  42    48467.68              114.53
## 149                50.32  40    27964.60              125.65
## 150                46.66  45    49101.67              118.16
## 151                48.86  54    53188.69              134.46
## 152                37.05  39    49742.83              142.81
## 153                43.83  45    35684.82              129.01
## 154                57.20  42    57739.03              110.66
## 155                49.84  38    67781.31              135.24
## 156                43.97  36    68863.95              156.97
## 157                38.63  48    57777.11              222.11
## 158                52.13  50    40926.93              118.27
## 159                50.18  35    63006.14              127.82
## 160                32.91  37    51691.55              181.02
## 161                40.01  53    51463.17              161.77
## 162                52.70  41    41059.64              109.34
## 163                35.55  39    51593.46              151.18
## 164                41.16  49    59448.44              150.83
## 165                53.54  39    47314.45              108.03
## 166                40.19  37    55358.88              136.99
## 167                58.95  55    56242.70              131.29
## 168                35.76  51    45522.44              195.07
## 169                59.36  49    46931.03              110.84
## 170                44.33  41    43386.07              120.63
## 171                52.84  43    28495.21              122.31
## 172                42.04  49    67323.00              182.11
## 173                48.26  50    43573.66              122.45
## 174                49.96  55    60968.62              151.94
## 175                47.23  38    70582.55              149.80
## 176                43.57  36    50971.73              125.20
## 177                39.19  54    52581.16              173.05
## 178                46.89  48    72553.94              176.78
## 179                45.44  43    48453.55              119.27
## 180                49.42  53    45465.25              128.00
## 181                49.19  38    61004.51              123.08
## 182                39.96  35    53898.89              138.52
## 183                43.07  36    60583.02              137.63
## 184                39.47  43    65576.05              163.48
## 185                48.22  40    73882.91              214.33
## 186                44.11  41    43111.41              121.24
## 187                47.23  43    73538.09              210.87
## 188                43.63  38    61757.12              135.25
```

```
## 189                57.99  50    62466.10              124.58
## 190                45.11  58    39799.73              195.69
## 191                54.35  42    76984.21              164.02
## 192                56.93  37    57887.64              111.80
## 193                48.86  35    62463.70              128.37
## 194                53.63  54    50333.72              126.29
## 195                52.84  51    38641.20              121.57
## 196                55.04  42    43881.73              106.96
## 197                32.60  45    48206.04              185.47
## 198                43.88  54    31523.09              166.85
## 199                52.67  44    14775.50              191.26
## 200                35.21  39    52340.10              154.00
## 201                36.37  40    47338.94              144.53
## 202                35.49  47    36884.23              170.04
## 203                49.35  49    44304.13              119.86
## 204                50.63  50    25767.16              142.23
## 205                41.84  49    37605.11              139.32
## 206                53.92  41    25739.09              125.46
## 207                55.32  43    67682.32              127.65
## 208                53.22  44    44307.18              108.85
## 209                43.16  35    25371.52              156.11
## 210                36.91  48    54645.20              159.69
## 211                57.51  38    47682.28              105.71
## 212                43.49  45    47968.32              124.67
## 213                48.46  49    61230.03              132.38
## 214                41.46  42    52177.40              128.98
## 215                49.21  46    49206.40              115.60
## 216                55.77  49    55942.04              117.33
## 217                44.13  40    33601.84              128.48
## 218                57.82  46    48867.36              107.56
## 219                44.16  42    61690.93              133.42
## 220                55.74  37    26130.93              124.34
## 221                59.05  52    50086.17              118.45
## 222                35.11  35    47638.30              158.03
## 223                37.65  51    50457.01              161.29
## 224                41.53  42    67575.12              158.81
## 225                46.84  45    34903.67              123.22
## 226                44.40  53    43073.78              140.95
## 227                52.17  44    57594.70              115.37
## 228                54.08  36    53012.94              111.02
## 229                37.74  40    65773.49              190.95
## 230                55.46  37    42078.89              108.10
## 231                35.66  45    46197.59              151.72
## 232                50.78  51    49957.00              122.04
## 233                40.47  38    24078.93              203.90
## 234                45.62  43    53647.81              121.28
## 235                37.01  50    48826.14              216.01
## 236                56.91  50    21773.22              146.44
## 237                42.84  52    27073.27              182.20
## 238                34.96  42    36913.51              160.49
## 239                41.86  39    53041.77              128.62
## 240                54.96  42    59419.78              113.75
## 241                55.71  37    57806.03              112.52
## 242                45.48  49    53336.76              129.16
```

```
## 243                  47.00  56    50491.45              149.53
## 244                  59.64  51    71455.62              153.12
## 245                  35.98  45    43241.88              150.79
## 246                  50.60  48    65956.71              135.67
## 247                  32.60  38    40159.20              190.05
## 248                  44.72  46    40468.53              123.86
## 249                  54.55  44    41547.62              109.04
## 250                  35.66  36    59240.24              172.57
## 251                  35.25  50    47051.02              194.44
## 252                  37.58  52    51600.47              176.70
## 253                  45.08  38    35349.26              125.27
## 254                  45.17  48    34418.09              132.07
## 255                  50.48  50    20592.99              162.43
## 256                  41.88  40    44217.68              126.11
## 257                  39.87  48    47929.83              139.34
## 258                  54.37  38    72196.29              140.77
## 259                  35.79  44    33813.08              165.62
## 260                  38.96  38    36497.22              140.67
## 261                  51.30  45    67782.17              134.42
## 262                  51.63  51    42415.72              120.37
##                                                Ad.Topic.Line                City
## 1                          Centralized neutral neural-net      West Brandonton
## 2                       Customizable multi-tasking website       West Dylanberg
## 3          Grass-roots solution-oriented conglomeration          Jessicastad
## 4                 Mandatory disintermediate utilization          South John
## 5                          Exclusive neutral parallelism        Harperborough
## 6                        Monitored systematic hierarchy      South Cathyfurt
## 7                           Digitized global capability   North Richardburgh
## 8                     Synchronized dedicated service-desk          New Thomas
## 9                Persevering needs-based open architecture         Charlesport
## 10                        Intuitive exuding service-desk        Millerchester
## 11                     Organic leadingedge secured line   Lake Cassandraport
## 12               Visionary maximized process improvement         Hamiltonfort
## 13                        Centralized 24/7 installation     West Christopher
## 14                     Pre-emptive value-added workforce   East Samanthashire
## 15                           Sharable analyzing alliance      South Lauraton
## 16                                Organized global model     Port Sarahshire
## 17                    Phased transitional instruction set        Brendachester
## 18                    Streamlined cohesive conglomeration           Robertfurt
## 19               De-engineered object-oriented protocol          East Tammie
## 20          Polarized clear-thinking budgetary management          Wilcoxport
## 21              Customizable 6thgeneration knowledge user    East Michaelmouth
## 22                             Seamless real-time array         Ramirezhaven
## 23                          Devolved tangible approach          Lake Edward
## 24                       Customizable executive software      Lake Conniefurt
## 25                     Down-sized uniform info-mediaries Lake Christopherfurt
## 26                    Triple-buffered scalable groupware          Lake Dustin
## 27                           Open-source coherent policy          Nelsonfurt
## 28                       Ergonomic full-range time-frame           Whiteport
## 29                        Versatile homogeneous capacity         Williammouth
## 30                     Function-based optimizing protocol      Williamsborough
## 31                             Up-sized secondary software        North Michael
## 32                        Persevering reciprocal firmware       Hernandezville
## 33                     De-engineered mobile infrastructure              Erinton
```

```
## 34                          Horizontal hybrid challenge          New Rachel
## 35                        Polarized dynamic throughput         South Daniel
## 36                   Down-sized well-modulated archive    East Michelleberg
## 37                  Realigned zero tolerance emulation           Port Eric
## 38                   Versatile transitional monitoring         Timothyfurt
## 39                  User-centric intangible task-force          Guzmanland
## 40                  Enhanced system-worthy application         East Michele
## 41                  Multi-layered user-facing paradigm            East John
## 42                       Customer-focused 24/7 concept          Lesliebury
## 43              Fully-configurable neutral open system       New Debbiestad
## 44                    Realigned content-based leverage        Port Lawrence
## 45                     Decentralized real-time circuit         West Ricardo
## 46          Enterprise-wide client-driven contingency          Heatherberg
## 47        Function-based context-sensitive secured line         Jonathantown
## 48                     Up-sized incremental encryption           Codyburgh
## 49                       Universal 24/7 implementation      East Rachelview
## 50                  Re-engineered demand-driven capacity         Samanthaland
## 51                          Synergized hybrid time-frame         Kyleborough
## 52                  Profit-focused dedicated utilization         East Stephen
## 53                          Virtual scalable secured line    Port Melissaberg
## 54                    Front-line fault-tolerant intranet          Bernardton
## 55                  Total 5thgeneration standardization          Josephstad
## 56               Cloned analyzing artificial intelligence    South Tiffanyton
## 57                  Extended context-sensitive monitoring          West Casey
## 58                       Seamless intangible secured line      North Johntown
## 59                        Assimilated fault-tolerant hub            Penatown
## 60                  Exclusive disintermediate task-force          Joechester
## 61                          Compatible systemic function       Hartmanchester
## 62       Configurable logistical Graphical User Interface        Davilachester
## 63                  Virtual bandwidth-monitored initiative   North Ricardotown
## 64                       Cloned object-oriented benchmark          Millerbury
## 65              Pre-emptive cohesive budgetary management          West Justin
## 66                          Versatile dedicated software            New Nancy
## 67                        Stand-alone reciprocal synergy           Lisamouth
## 68                            Operative stable moderator          New Michael
## 69                        Enhanced homogeneous moderator         East Barbara
## 70                           Seamless full-range website        Port Erinberg
## 71          Profit-focused attitude-oriented task-force         Petersonfurt
## 72                   Progressive non-volatile neural-net         Port Crystal
## 73       Organized contextually-based customer loyalty            Olsonstad
## 74                     Managed disintermediate matrices      Lake Beckyburgh
## 75                  Configurable bottom-line application     West Lindseybury
## 76                    Business-focused real-time toolset      Jacksonburgh
## 77      De-engineered solution-oriented open architecture        Alexanderfurt
## 78                   Stand-alone encompassing throughput          West Amanda
## 79                  Managed well-modulated collaboration            Bethburgh
## 80                  Digitized contextually-based product          South Kyle
## 81                     Exclusive zero tolerance alliance          Jordantown
## 82                  Enterprise-wide foreground emulation            Port Juan
## 83              Customer-focused incremental system engine         Michellefort
## 84                   Vision-oriented optimizing middleware         Jessicahaven
## 85                            Extended interactive model          Roberttown
## 86                Self-enabling incremental collaboration          New Rebecca
## 87                      Exclusive even-keeled moratorium         Jeffreyburgh
```

```
## 88            Fully-configurable high-level implementation        South Meghan
## 89               Optional mission-critical functionalities          Lewismouth
## 90            Reverse-engineered well-modulated capability  East Yvonnechester
## 91                              Phased analyzing emulation      Robertsonburgh
## 92                           Horizontal high-level concept   South Johnnymouth
## 93                              Reduced multimedia project          Hannaport
## 94                     Object-based modular functionalities        East Anthony
## 95                           Organic asynchronous hierarchy          Rogerburgh
## 96                    Automated client-driven orchestration          Davidside
## 97                     Proactive client-server productivity     Andersonchester
## 98                           Exclusive zero tolerance frame         Jordanshire
## 99                           Intuitive zero-defect framework      Christinehaven
## 100                                 Configurable 24/7 hub    West Eduardotown
## 101               Focused 3rdgeneration pricing structure          West Jane
## 102                               Proactive radical support        Alvaradoport
## 103                          Profound optimizing utilization      Richardsonland
## 104              Multi-channeled mission-critical success   Port Michealburgh
## 105                      Seamless cohesive conglomeration          Katieport
## 106                     De-engineered actuating hierarchy  East Brittanyville
## 107                               Sharable optimal capacity           Brownton
## 108          Enterprise-wide incremental Internet solution     New Denisebury
## 109                 Re-contextualized reciprocal interface    West Melaniefurt
## 110                                   Total local synergy       Alexanderview
## 111         Re-engineered context-sensitive knowledge user          Lake Susan
## 112          Balanced contextually-based pricing structure       Williamsmouth
## 113                          Upgradable asymmetric emulation          Lake Jesus
## 114                              Robust web-enabled attitude      North Maryland
## 115                 Configurable disintermediate throughput     Port Patrickton
## 116                          Automated web-enabled migration          West Julia
## 117                 Triple-buffered 3rdgeneration migration      New Keithburgh
## 118                           Team-oriented dynamic forecast           Kevinberg
## 119                                Organized 24/7 middleware          Butlerfort
## 120                                   Networked stable array        East Lindsey
## 121                               Phased full-range hardware         Masseyshire
## 122              Object-based system-worthy superstructure            Ryanhaven
## 123                          Public-key real-time definition        Port Jessica
## 124               Focused fresh-thinking Graphic Interface         South Peter
## 125                            Ameliorated exuding solution       Port Mitchell
## 126                          Distributed maximized ability          Welchshire
## 127                  Fully-configurable holistic throughput         Timothyport
## 128               Progressive uniform budgetary management  Lake Stephenborough
## 129                           Innovative regional structure           Jensenton
## 130                          Universal asymmetric workforce          Rivasland
## 131                  Business-focused client-driven forecast        Helenborough
## 132                            Open-source global strategy          Pattymouth
## 133                     Profound bottom-line standardization  New Charleschester
## 134                       Upgradable heuristic system engine          South Lisa
## 135                        Synergistic dynamic orchestration        Rebeccamouth
## 136                           Polarized 5thgeneration matrix        North Andrew
## 137 Fully-configurable context-sensitive Graphic Interface         South Walter
## 138                      Progressive intermediate throughput       Catherinefort
## 139                      Business-focused background synergy    North Aaronburgh
## 140                            Ergonomic methodical encoding          Danielview
## 141                    Up-sized next generation architecture        Lake Jennifer
```

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## 142                      Switchable analyzing encryption           Lake Ian
## 143                         Programmable uniform website        West Shannon
## 144                          Object-based neutral policy      North Lauraland
## 145                          Adaptive uniform capability      East Georgeside
## 146                        Synergistic reciprocal attitude           Loriville
## 147                       Managed 5thgeneration time-frame          Amandaland
## 148                  Cross-group human-resource time-frame       East Jessefort
## 149                         Realigned intangible benchmark           Rochabury
## 150                  Grass-roots mission-critical emulation          Wrightview
## 151                         Proactive encompassing paradigm          Perryburgh
## 152                     Automated object-oriented firmware          Tracyhaven
## 153                      Total human-resource flexibility           Greerport
## 154                         Innovative maximized groupware     East Heatherside
## 155                           Phased hybrid superstructure        Jenniferhaven
## 156                    User-friendly grid-enabled analyzer           Boyerberg
## 157          Cross-platform logistical pricing structure         Chapmanmouth
## 158                    Open-source even-keeled database    West Raymondmouth
## 159                    Customizable hybrid system engine         Sandrashire
## 160          Future-proofed fresh-thinking conglomeration        Elizabethstad
## 161                     Sharable multimedia conglomeration       East Brettton
## 162                  Team-oriented high-level orchestration          New Matthew
## 163                 Robust object-oriented Graphic Interface          Westshire
## 164                     Configurable interactive contingency        Hendrixmouth
## 165                          Optimized systemic capability           Julietown
## 166                       Right-sized system-worthy project          Adamsbury
## 167          Proactive actuating Graphical User Interface         East Maureen
## 168                       Versatile optimizing projection     North Angelastad
## 169                    Universal multi-state system engine          Amandafort
## 170                          Ergonomic empowering frame          Estradashire
## 171                        Multi-tiered mobile encoding           Hobbsbury
## 172                          Organic logistical adapter    New Christinatown
## 173                User-centric intermediate knowledge user       South Margaret
## 174                   Multi-layered user-facing parallelism   South Cynthiashire
## 175       Implemented context-sensitive Local Area Network          Blevinstown
## 176                   Front-line upward-trending groupware      Lake Joshuafurt
## 177                       Stand-alone empowering benchmark            Leahside
## 178                    Polarized mission-critical structure          Chaseshire
## 179                   Enhanced intermediate standardization             Mezaton
## 180                   Ameliorated well-modulated complexity      Jacquelineshire
## 181                Versatile solution-oriented secured line           North Mark
## 182                Phased leadingedge budgetary management          Kingchester
## 183             Monitored zero administration collaboration        East Ericport
## 184                  Team-oriented systematic installation         Crawfordfurt
## 185                               Inverse national core            Turnerville
## 186                         Organic next generation matrix           Lake David
## 187                  Optimized upward-trending productivity             Yangside
## 188                      Quality-focused maximized extranet           Frankport
## 189                         Innovative homogeneous alliance        New Angelview
## 190                             Sharable reciprocal project            Browntown
## 191                      Proactive interactive service-desk          Lake Hailey
## 192                         Reactive demand-driven strategy          Bradleyside
## 193                            Universal empowering adapter        Elizabethbury
## 194                            Front-line zero-defect array          Vanessaview
## 195                  Synergistic asynchronous superstructure       Melissachester
```

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## 196                Quality-focused optimizing parallelism        Hernandezside
## 197                   Multi-tiered interactive neural-net            New Henry
## 198                           Enhanced methodical database          Dustinmouth
## 199              Persevering 5thgeneration knowledge user        New Hollyberg
## 200               Advanced disintermediate data-warehouse          New Timothy
## 201             Quality-focused zero-defect data-warehouse   North Jessicaville
## 202                   Front-line actuating functionalities  North Brittanyburgh
## 203                                Inverse stable synergy   Lake Charlottestad
## 204                         Operative full-range forecast          Tammymouth
## 205                     Operative secondary functionalities        Lake Vanessa
## 206                  Business-focused transitional solution          Lake Amanda
## 207                                Managed 24hour analyzer  Port Douglasborough
## 208                     Horizontal client-server database      Port Aprilville
## 209                           Implemented didactic support         Williamsport
## 210                 Ameliorated coherent open architecture       North Samantha
## 211             Re-engineered zero-defect open architecture         Jeffreymouth
## 212                         Synchronized full-range portal            Smithside
## 213                       Devolved human-resource circuit            Lisamouth
## 214                       Integrated impactful groupware          Robertstown
## 215                                    Realigned 24/7 core           Carterland
## 216                  Fully-configurable high-level groupware           East Shawn
## 217                         Ameliorated discrete extranet      West Derekmouth
## 218                       Centralized asynchronous portal           Brandiland
## 219                         Innovative interactive portal          Port Dennis
## 220                     Networked asymmetric infrastructure        Lake Michelle
## 221                       Upgradable logistical flexibility          Kristinfurt
## 222                            Extended analyzing emulation       North Jonathan
## 223                              Automated stable help-desk            Davidview
## 224                         Optional tangible productivity     South Jeanneport
## 225                Virtual homogeneous budgetary management            Jonesshire
## 226                               Phased zero-defect portal            Mariahview
## 227                            Optional modular throughput       New Julianberg
## 228                   Innovative cohesive pricing structure            Philipberg
## 229                               Balanced uniform algorithm           Lake James
## 230                          Exclusive systematic algorithm           Chrismouth
## 231                            Exclusive cohesive intranet            Port Beth
## 232          Vision-oriented asynchronous Internet solution           West David
## 233                           Sharable 5thgeneration access         Fraziershire
## 234           Monitored homogeneous artificial intelligence           Robertfurt
## 235           Secured encompassing Graphical User Interface       Port Derekberg
## 236                            Team-oriented executive core            West Randy
## 237                             Enhanced optimizing website    Lake Michellebury
## 238                          Right-sized mobile initiative           West James
## 239                            Open-source stable paradigm          Hawkinsbury
## 240                     Public-key disintermediate emulation           West Amanda
## 241                          Upgradable 4thgeneration portal           Lake James
## 242                         Networked client-server solution         Blairborough
## 243     Public-key bi-directional Graphical User Interface       New Marcusbury
## 244                Re-contextualized human-resource success           Evansville
## 245                  Front-line fresh-thinking installation       Huffmanchester
## 246          Customer-focused fault-tolerant implementation    Port Michaelmouth
## 247                    Customizable homogeneous contingency             Tylerport
## 248                  Cross-group systemic customer loyalty  North Jenniferburgh
## 249                           Re-engineered optimal policy  West Gabriellamouth
```

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## 250                          Implemented uniform synergy          Alvarezland
## 251                             Intuitive global website           Waltertown
## 252            Exclusive disintermediate Internet solution          Cameronberg
## 253                     Synergized clear-thinking protocol           Fosterside
## 254                        Down-sized background groupware          Taylormouth
## 255                           Switchable real-time product           Dianaville
## 256                            Streamlined exuding adapter          Port Rachel
## 257                  Business-focused user-facing benchmark        South Rebecca
## 258                            Up-sized asymmetric firmware         Lake Matthew
## 259                          Enterprise-wide tangible model           North Katie
## 260                  Versatile mission-critical application          Mauricefurt
## 261                         Grass-roots cohesive monitoring          New Darlene
## 262                           Expanded intangible solution        South Jessica
##     Male                                                 Country
## 1      0                                                   Qatar
## 2      0                                  Palestinian Territory
## 3      1 British Indian Ocean Territory (Chagos Archipelago)
## 4      0                                                Burundi
## 5      0                                                Tokelau
## 6      0                                                 Greece
## 7      1                                               Maldives
## 8      1                                               Dominica
## 9      1                                           Saint Helena
## 10     0                                                Liberia
## 11     1                                           Turkmenistan
## 12     1                                       Trinidad and Tobago
## 13     0                                                  Italy
## 14     1                                          Guinea-Bissau
## 15     1                                             Micronesia
## 16     0                           Svalbard & Jan Mayen Islands
## 17     0                                                   Iran
## 18     0                                        Christmas Island
## 19     1                                            Cook Islands
## 20     1                                                  Turkey
## 21     1                                               Guatemala
## 22     1                                           Faroe Islands
## 23     1                                                 Ireland
## 24     0                                                 Ukraine
## 25     0                                              Montserrat
## 26     0                                             Puerto Rico
## 27     1                                        Wallis and Futuna
## 28     1                                                  Greece
## 29     1                                               Hong Kong
## 30     0                                               Lithuania
## 31     0                                                   Egypt
## 32     0                                          Western Sahara
## 33     0                                        Christmas Island
## 34     1                                                  Guyana
## 35     0                                              Uzbekistan
## 36     0                                               Lithuania
## 37     0                                             Saint Martin
## 38     0                                                    Cuba
## 39     0                                                  Belize
## 40     1                                                  Belize
```

```
## 41     0        Antarctica (the territory South of 60 deg S)
## 42     1                     Saint Vincent and the Grenadines
## 43     1                                                Korea
## 44     1                                       Czech Republic
## 45     1                                          Netherlands
## 46     0                                             Dominica
## 47     1                                                Kenya
## 48     0                                               Belize
## 49     0                                    Equatorial Guinea
## 50     1                                               Brazil
## 51     1                                             Portugal
## 52     0                                              Vietnam
## 53     0                                            Singapore
## 54     1                                              Jamaica
## 55     0                                              Algeria
## 56     1                          Bouvet Island (Bouvetoya)
## 57     1                                             Suriname
## 58     1                                              Georgia
## 59     0                                            Australia
## 60     1                               Sao Tome and Principe
## 61     0                                               Cyprus
## 62     0                                       Czech Republic
## 63     0                                                Chile
## 64     0                                           Turkmenistan
## 65     0                                                Bahrain
## 66     1                                                   Chad
## 67     1                                               Norway
## 68     1                                            Micronesia
## 69     1                                              Guernsey
## 70     1                                          Sierra Leone
## 71     0                                            Tajikistan
## 72     0                                                France
## 73     1                                                  Peru
## 74     1                                          Liechtenstein
## 75     0                                              Thailand
## 76     1                               Sao Tome and Principe
## 77     0                                       French Guiana
## 78     0                                               Lebanon
## 79     1                                        American Samoa
## 80     0                          French Southern Territories
## 81     1                             United States of America
## 82     0                                           Seychelles
## 83     0                                              Mayotte
## 84     0                                             Cambodia
## 85     0                            Saint Pierre and Miquelon
## 86     0                                              Anguilla
## 87     1                                          South Africa
## 88     1                                          New Caledonia
## 89     1                       Falkland Islands (Malvinas)
## 90     0                                              Eritrea
## 91     1                                               Gambia
## 92     0                                 Antigua and Barbuda
## 93     0                                                Samoa
## 94     0                                          Afghanistan
```

```
## 95     0                                        Samoa
## 96     1                United States Minor Outlying Islands
## 97     0                                  Cote d'Ivoire
## 98     1                                        Albania
## 99     1                                       Mongolia
## 100    1                                         Canada
## 101    1                                    El Salvador
## 102    0                                     Bangladesh
## 103    1                                         Latvia
## 104    1                                       Anguilla
## 105    0                                  Faroe Islands
## 106    0                                         Taiwan
## 107    0                                        Bahamas
## 108    1                                        Myanmar
## 109    1                           Libyan Arab Jamahiriya
## 110    1                                  French Guiana
## 111    1                                          Congo
## 112    1                                     Luxembourg
## 113    0                              Dominican Republic
## 114    1                                          Chile
## 115    1                                        Estonia
## 116    1                                      Greenland
## 117    0                              Trinidad and Tobago
## 118    0                                    Afghanistan
## 119    0                          United States of America
## 120    1                                          Malta
## 121    0                                        Ecuador
## 122    1                 Lao People's Democratic Republic
## 123    0                                      Australia
## 124    1               Heard Island and McDonald Islands
## 125    1                                Western Sahara
## 126    0                                        Belgium
## 127    0                                American Samoa
## 128    0                                       Thailand
## 129    0                                          China
## 130    0                                          Macao
## 131    0                                      Australia
## 132    0                                       Djibouti
## 133    0                                        Romania
## 134    1                                         Turkey
## 135    1                                        Moldova
## 136    1                                       Honduras
## 137    1                                       Mongolia
## 138    0                                       Ethiopia
## 139    0                                Western Sahara
## 140    0                                    New Zealand
## 141    1                           Libyan Arab Jamahiriya
## 142    0                                       Cambodia
## 143    0                                      Australia
## 144    1                                           Guam
## 145    1                                        Bahamas
## 146    1                                        Vanuatu
## 147    1                                        Bolivia
## 148    0                                 United Kingdom
```

```
## 149    0                                    Yemen
## 150    0                       Antigua and Barbuda
## 151    0                            French Guiana
## 152    1                       Antigua and Barbuda
## 153    0                             Saudi Arabia
## 154    0                              New Zealand
## 155    1                     United Arab Emirates
## 156    1                                Indonesia
## 157    0                         Papua New Guinea
## 158    1                                 Ethiopia
## 159    1                                  Grenada
## 160    0                             South Africa
## 161    0                                  Ecuador
## 162    1                                   Zambia
## 163    0                                Micronesia
## 164    1                                Venezuela
## 165    0                                    Palau
## 166    0                                   France
## 167    1                                 Slovenia
## 168    0                                     Peru
## 169    0                                  Belarus
## 170    0                                   Guyana
## 171    0                                  Senegal
## 172    0                                    Qatar
## 173    1                            Liechtenstein
## 174    1                                   Zambia
## 175    1                                  Tokelau
## 176    1                         French Polynesia
## 177    0                                Guatemala
## 178    1                                   Turkey
## 179    0                                    China
## 180    1                                    Congo
## 181    0                                  Hungary
## 182    1                         Pitcairn Islands
## 183    1                                   Turkey
## 184    1                                   Uganda
## 185    0                           Norfolk Island
## 186    1       Saint Vincent and the Grenadines
## 187    1           Svalbard & Jan Mayen Islands
## 188    1                                    Korea
## 189    0                               Costa Rica
## 190    0                              Netherlands
## 191    0                                   Sweden
## 192    0                             Sierra Leone
## 193    1                             Saint Martin
## 194    1                                  Liberia
## 195    1                   Bosnia and Herzegovina
## 196    1                           Czech Republic
## 197    0                                  Mayotte
## 198    1                                  Somalia
## 199    0                                   Jersey
## 200    1     United States Minor Outlying Islands
## 201    1                                 Kiribati
## 202    0                           Liechtenstein
```

```
## 203    0                                        Kenya
## 204    0                                   Luxembourg
## 205    0                                       Cyprus
## 206    1                                       Turkey
## 207    0                                  Netherlands
## 208    0                United States Virgin Islands
## 209    1                          Marshall Islands
## 210    0                                     Zimbabwe
## 211    0                                      Moldova
## 212    0                                      Vietnam
## 213    1                                    Indonesia
## 214    1                                        Malta
## 215    0                                       Mexico
## 216    1                                        Chile
## 217    1                                         Cuba
## 218    1                                      Belarus
## 219    1                                        Spain
## 220    1                                    Hong Kong
## 221    1                                       Uganda
## 222    1                                     Anguilla
## 223    1                                      Bahrain
## 224    0                                      Mayotte
## 225    0                                        Macao
## 226    1                                       France
## 227    1                            Equatorial Guinea
## 228    1                                      Mayotte
## 229    0                                      Denmark
## 230    0                                       Taiwan
## 231    0                                         Peru
## 232    0                                      Liberia
## 233    0                                      Burundi
## 234    0                                        Macao
## 235    0                                   San Marino
## 236    0                                Norfolk Island
## 237    1                                      Tunisia
## 238    1                                    Macedonia
## 239    1                                     Ethiopia
## 240    1                                        Niger
## 241    1                                        Korea
## 242    1          Lao People's Democratic Republic
## 243    0                                      Bahamas
## 244    1                                       Guyana
## 245    0                                     Ethiopia
## 246    0                                       Brazil
## 247    0                         Syrian Arab Republic
## 248    1                                      Grenada
## 249    0                                       Canada
## 250    0           Svalbard & Jan Mayen Islands
## 251    0                                         Iran
## 252    1                                     Bulgaria
## 253    0                                      Liberia
## 254    1                                        Palau
## 255    0                                       Malawi
## 256    1                                       Cyprus
```

```
## 257    1                                                  Mexico
## 258    0                                                  Mexico
## 259    1                                                   Tonga
## 260    1                                                 Comoros
## 261    1                                  Bosnia and Herzegovina
## 262    1                                                Mongolia
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## 5   2016-06-13 17:27:09             1
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## 8   2016-03-15 03:12:25             1
## 9   2016-05-07 17:11:49             1
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## 43  2016-06-14 11:59:58             1
## 44  2016-01-26 03:56:18             1
## 45  2016-02-07 08:02:31             1
## 46  2016-06-29 02:43:29             1
## 47  2016-03-24 06:36:52             1
```

```
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## 122 2016-03-09 00:41:46            1
## 123 2016-06-28 09:19:06            1
## 124 2016-01-02 12:25:36            1
## 125 2016-05-13 11:57:12            1
## 126 2016-04-03 11:38:36            1
## 127 2016-04-08 14:35:44            1
## 128 2016-03-25 19:02:35            1
## 129 2016-05-27 05:35:27            1
## 130 2016-06-12 21:21:53            1
## 131 2016-01-07 13:58:51            1
## 132 2016-02-07 17:06:35            1
## 133 2016-03-24 09:34:00            1
## 134 2016-06-09 17:11:02            1
## 135 2016-04-12 12:35:39            1
## 136 2016-01-13 02:39:00            1
## 137 2016-06-18 16:02:34            1
## 138 2016-01-01 20:17:49            1
## 139 2016-05-08 22:24:27            1
## 140 2016-04-05 05:54:15            1
## 141 2016-04-04 22:00:15            1
## 142 2016-07-11 18:12:43            1
## 143 2016-02-14 10:06:49            1
## 144 2016-01-27 18:25:42            1
## 145 2016-04-21 18:31:27            1
## 146 2016-06-24 08:42:20            1
## 147 2016-05-27 18:45:35            0
## 148 2016-02-24 19:08:11            1
## 149 2016-04-27 18:25:30            1
## 150 2016-03-09 02:07:17            1
## 151 2016-01-09 17:33:03            1
## 152 2016-02-03 05:47:09            1
## 153 2016-01-29 05:39:16            1
## 154 2016-03-19 11:09:36            1
## 155 2016-05-18 03:19:03            1
```

```
## 156 2016-01-30 09:54:03            1
## 157 2016-04-07 10:51:05            1
## 158 2016-01-28 17:03:54            1
## 159 2016-06-20 04:24:41            1
## 160 2016-07-17 14:26:04            1
## 161 2016-03-01 22:06:37            1
## 162 2016-01-31 08:50:38            1
## 163 2016-01-13 20:38:35            1
## 164 2016-03-28 09:15:58            1
## 165 2016-06-23 11:05:01            1
## 166 2016-01-18 02:51:13            1
## 167 2016-06-20 08:34:46            1
## 168 2016-07-18 04:53:22            1
## 169 2016-07-01 01:12:04            1
## 170 2016-01-14 09:27:59            1
## 171 2016-07-16 10:14:04            1
## 172 2016-02-03 16:54:33            1
## 173 2016-06-18 22:31:22            1
## 174 2016-04-04 00:02:20            1
## 175 2016-06-22 05:22:58            1
## 176 2016-06-25 17:33:35            1
## 177 2016-01-23 21:15:57            1
## 178 2016-07-17 13:22:43            1
## 179 2016-05-04 05:01:37            1
## 180 2016-07-07 18:07:19            1
## 181 2016-05-12 12:11:12            1
## 182 2016-02-28 23:21:22            1
## 183 2016-02-11 20:45:46            1
## 184 2016-07-06 23:09:07            1
## 185 2016-03-22 19:14:47            0
## 186 2016-04-20 16:49:15            1
## 187 2016-03-17 22:24:02            1
## 188 2016-05-25 19:45:16            1
## 189 2016-02-12 08:46:15            1
## 190 2016-01-05 16:26:44            1
## 191 2016-06-20 08:22:09            0
## 192 2016-06-10 00:35:15            1
## 193 2016-01-04 00:44:57            1
## 194 2016-01-08 18:13:43            1
## 195 2016-06-29 10:50:45            1
## 196 2016-06-15 05:43:02            1
## 197 2016-05-02 18:37:01            1
## 198 2016-06-04 17:24:07            1
## 199 2016-05-19 06:37:38            1
## 200 2016-03-25 06:36:53            1
## 201 2016-04-22 00:28:18            1
## 202 2016-04-13 07:07:36            1
## 203 2016-04-07 20:38:02            1
## 204 2016-03-10 15:07:44            1
## 205 2016-05-01 08:27:12            1
## 206 2016-06-12 11:17:25            1
## 207 2016-03-18 09:08:39            1
## 208 2016-05-26 06:03:57            1
## 209 2016-07-06 03:40:17            1
```

```
## 210 2016-02-24 07:13:00            1
## 211 2016-03-31 08:53:43            1
## 212 2016-06-14 12:08:10            1
## 213 2016-01-21 23:33:22            1
## 214 2016-05-23 08:06:24            1
## 215 2016-02-28 03:34:35            1
## 216 2016-03-15 14:33:12            1
## 217 2016-03-03 20:20:32            1
## 218 2016-04-06 14:16:52            1
## 219 2016-05-25 00:34:59            1
## 220 2016-02-11 16:45:41            1
## 221 2016-04-23 03:46:34            1
## 222 2016-03-11 13:07:30            1
## 223 2016-03-09 06:22:03            1
## 224 2016-05-23 00:32:54            1
## 225 2016-05-15 18:44:50            1
## 226 2016-06-30 00:43:40            1
## 227 2016-02-24 06:17:18            1
## 228 2016-06-02 04:14:37            1
## 229 2016-05-27 12:45:37            1
## 230 2016-02-21 23:07:11            1
## 231 2016-04-29 14:08:26            1
## 232 2016-02-11 17:02:07            1
## 233 2016-07-22 07:44:43            1
## 234 2016-06-26 02:34:15            1
## 235 2016-03-20 02:44:13            1
## 236 2016-04-01 05:17:28            1
## 237 2016-03-21 11:02:49            1
## 238 2016-06-01 16:10:30            1
## 239 2016-03-26 15:28:07            1
## 240 2016-02-28 09:31:31            1
## 241 2016-03-06 23:26:44            1
## 242 2016-05-19 04:23:41            1
## 243 2016-04-29 20:40:21            1
## 244 2016-05-03 01:09:01            1
## 245 2016-06-27 21:51:47            1
## 246 2016-01-15 22:49:45            1
## 247 2016-02-12 03:39:09            1
## 248 2016-03-12 02:48:18            1
## 249 2016-02-04 03:10:17            1
## 250 2016-02-21 20:09:12            1
## 251 2016-01-03 04:39:47            1
## 252 2016-04-13 13:04:47            1
## 253 2016-03-27 08:32:37            1
## 254 2016-01-27 14:41:10            1
## 255 2016-05-16 18:51:59            1
## 256 2016-02-28 23:54:44            1
## 257 2016-06-13 06:11:33            1
## 258 2016-06-25 18:17:53            1
## 259 2016-04-20 13:36:42            1
## 260 2016-07-21 16:02:40            1
## 261 2016-04-22 02:07:01            1
## 262 2016-02-01 17:24:57            1
```

5. Conclusion

1. 262 individuals who are most likely to click on the ad have been selected.
2. Most individuals who clicked on the ad where below the age of 60.
3. Users who spent less time online were more likely to click on the ad than people who spent more time.
4. People from Australia, Ethopia, turkey and Liechtenstein had highest click on the ad

6. Recommendation

1.Client should focus on people who had a higher daily internet usage as they were likely to click on her ads.
2. Client could also try reduce the price of the course, to attract more peoples

7. Modelling

7.1 KNN

```
head(advert)
```

```
##   Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage
## 1                    68.95  35    61833.90               256.09
## 2                    80.23  31    68441.85               193.77
## 3                    69.47  26    59785.94               236.50
## 4                    74.15  29    54806.18               245.89
## 5                    68.37  35    73889.99               225.58
## 6                    59.99  23    59761.56               226.74
##                          Ad.Topic.Line           City Male    Country
## 1    Cloned 5thgeneration orchestration    Wrightburgh    0    Tunisia
## 2    Monitored national standardization      West Jodi    1      Nauru
## 3      Organic bottom-line service-desk       Davidton    0 San Marino
## 4 Triple-buffered reciprocal time-frame West Terrifurt    1      Italy
## 5         Robust logistical utilization   South Manuel    0    Iceland
## 6       Sharable client-driven software      Jamieberg    1     Norway
##             Timestamp Clicked.on.Ad
## 1 2016-03-27 00:53:11             0
## 2 2016-04-04 01:39:02             0
## 3 2016-03-13 20:35:42             0
## 4 2016-01-10 02:31:19             0
## 5 2016-06-03 03:36:18             0
## 6 2016-05-19 14:30:17             0
```

```
##converting some columns into factors for easy analysis

advert$Clicked.on.Ad <- as.factor(advert$Clicked.on.Ad)

is.factor(advert$Clicked.on.Ad)
```

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

```r
# Randomizing the rows, will create a uniform distribution of 1000
set.seed(1234)
random <- runif(1000)
random
```

```
##    [1] 0.1137034113 0.6222994048 0.6092747329 0.6233794417 0.8609153836
##    [6] 0.6403106053 0.0094957564 0.2325505060 0.6660837582 0.5142511413
##   [11] 0.6935912918 0.5449748356 0.2827335836 0.9234334843 0.2923158403
##   [16] 0.8372956282 0.2862232847 0.2668207800 0.1867227897 0.2322259105
##   [21] 0.3166124548 0.3026933707 0.1590460029 0.0399959181 0.2187995410
##   [26] 0.8105985525 0.5256975468 0.9146581660 0.8313450469 0.0457702633
##   [31] 0.4560914824 0.2651866719 0.3046722030 0.5073068701 0.1810962083
##   [36] 0.7596706355 0.2012480376 0.2588098187 0.9921504175 0.8073523403
##   [41] 0.5533335907 0.6464060941 0.3118243071 0.6218191981 0.3297701757
##   [46] 0.5019974730 0.6770945273 0.4849912392 0.2439288273 0.7654597876
##   [51] 0.0737798801 0.3096866019 0.7172717433 0.5045459121 0.1529989589
##   [56] 0.5039334882 0.4939609230 0.7512001970 0.1746498239 0.8483924104
##   [61] 0.8648338320 0.0418572752 0.3171821553 0.0137499392 0.2390257267
##   [66] 0.7064946173 0.3080947571 0.5085475657 0.0516466193 0.5645698400
##   [71] 0.1214801872 0.8928363817 0.0146272557 0.7831211037 0.0899613330
##   [76] 0.5191899808 0.3842666876 0.0700524973 0.3206444222 0.6684953971
##   [81] 0.9264004764 0.4719097211 0.1426153432 0.5442697550 0.1961746519
##   [86] 0.8985804892 0.3894997847 0.3108707797 0.1600286630 0.8961858496
##   [91] 0.1663937804 0.9004245962 0.1340781951 0.1316141342 0.1052875025
##   [96] 0.5115835811 0.3001990539 0.0267168954 0.3096474314 0.7421196571
##  [101] 0.0354567270 0.5650761120 0.2802577761 0.2041963164 0.1337388987
##  [106] 0.3256819244 0.1550619695 0.1299621395 0.4355310597 0.0386426526
##  [111] 0.7133015629 0.1007690411 0.9503049385 0.1218177627 0.2196566209
##  [116] 0.9130877669 0.9458531211 0.2791562229 0.1234710878 0.7971604594
##  [121] 0.7442772151 0.9159742238 0.9945982450 0.9423607150 0.4861354076
##  [126] 0.2834595428 0.2515457012 0.5032551708 0.4969661732 0.3184458097
##  [131] 0.9622228269 0.6340993682 0.1274333980 0.4230469938 0.9143169096
##  [136] 0.4677923333 0.9081691455 0.5977432837 0.6317428160 0.8691583187
##  [141] 0.5027498226 0.9836351147 0.3243860274 0.4813749485 0.3569870775
##  [146] 0.6274776841 0.7416001905 0.5659668173 0.9807865066 0.5768127355
##  [151] 0.4390420518 0.2285996950 0.0821580656 0.8502649218 0.2346612616
##  [156] 0.9881674468 0.6018975459 0.9987408081 0.3755993766 0.5551266309
##  [161] 0.4294439629 0.5758777808 0.4325073974 0.2248457640 0.0849847377
##  [166] 0.6372982597 0.4310163704 0.0727160936 0.8024020193 0.3252783034
##  [171] 0.7572890350 0.5842715173 0.7088394067 0.4269757664 0.3435727020
##  [176] 0.7591199852 0.4240302080 0.5608872538 0.1161357744 0.3030217977
##  [181] 0.4788026859 0.3448305468 0.6007141401 0.0760833232 0.9559926111
##  [186] 0.0222068231 0.8417106324 0.6324424488 0.3100941652 0.7425693662
##  [191] 0.6389113136 0.9925159873 0.1282697883 0.8832395778 0.8100833879
##  [196] 0.8218511783 0.8347026624 0.7327322206 0.9830440243 0.6392045827
##  [201] 0.6607546343 0.5283593780 0.3174938215 0.7678554691 0.5263084925
##  [206] 0.7323018843 0.3076657406 0.4041732512 0.2044024453 0.9856330883
##  [211] 0.5663107571 0.2803751451 0.1850557232 0.7580613962 0.5667812813
##  [216] 0.9321735711 0.6386933164 0.7007481344 0.4792224686 0.8503119163
##  [221] 0.4223306754 0.0313921231 0.2581466483 0.3348447348 0.1335496686
##  [226] 0.4995463854 0.8021356328 0.3371532431 0.5089206153 0.4944385618
##  [231] 0.7970529040 0.5669588954 0.1066968180 0.8076484452 0.5671120710
##  [236] 0.2122409279 0.7495792548 0.3072183500 0.4895184434 0.9897098928
##  [241] 0.4241091781 0.2444030046 0.2171347148 0.6891175066 0.9802127087
```

```
##   [246] 0.4770330393 0.7735236220 0.5743129447 0.9659397006 0.7969238409
##   [251] 0.5319050872 0.5966237611 0.2638864736 0.2795427088 0.0651032443
##   [256] 0.5630813465 0.2623556822 0.0032823312 0.5895165436 0.5200511648
##   [261] 0.8446347348 0.0295568136 0.5997693492 0.2684197696 0.1206089044
##   [266] 0.1007054616 0.7481611404 0.0159606293 0.0494611457 0.7476237861
##   [271] 0.3572376638 0.7589581960 0.3759563426 0.7994627089 0.0256927656
##   [276] 0.5063585502 0.8212286464 0.5447565762 0.2666844544 0.3446373220
##   [281] 0.3691759529 0.4292520846 0.9185143732 0.7843448154 0.7378315323
##   [286] 0.2807726238 0.4568266282 0.2875376416 0.6962910676 0.8207562983
##   [291] 0.6551535316 0.4135046774 0.9518294146 0.2431094602 0.6086850266
##   [296] 0.7579514689 0.6936673617 0.1154277963 0.6359116645 0.3090253684
##   [301] 0.3529985021 0.9809583162 0.5388827636 0.4440338630 0.9493667777
##   [306] 0.4524833714 0.1906258035 0.9916091496 0.5484554477 0.7688157670
##   [311] 0.9134216728 0.6821120020 0.4072514204 0.4075922994 0.1460827903
##   [316] 0.1966677140 0.1922093395 0.4084144006 0.3482213062 0.8345428484
##   [321] 0.1984000071 0.8618053095 0.3971853103 0.1532537669 0.3392833832
##   [326] 0.3671804396 0.4273790829 0.1863369043 0.6580166004 0.9204113812
##   [331] 0.7338940627 0.8823192716 0.9533465311 0.1949015351 0.4726167354
##   [336] 0.3860506560 0.3741658572 0.0278556566 0.9293552118 0.4105292757
##   [341] 0.9558402160 0.2721528402 0.5172464938 0.9783098423 0.3696964863
##   [346] 0.3104304392 0.0342096325 0.6675658475 0.9209163769 0.0449895980
##   [351] 0.2011326319 0.7435148843 0.1305568311 0.7088835938 0.9988318114
##   [356] 0.9439130460 0.5929038990 0.7312956364 0.4867341756 0.7681519960
##   [361] 0.0031454624 0.5579412982 0.4602552892 0.3297151451 0.8354756273
##   [366] 0.9777016630 0.6605149473 0.2335748596 0.8192004203 0.7246848950
##   [371] 0.9763571532 0.2651130287 0.8788200426 0.4878892123 0.3054682855
##   [376] 0.3950969989 0.7593397161 0.1008016423 0.4213596904 0.6577642476
##   [381] 0.2952640920 0.2059864998 0.0021467118 0.1078426787 0.2148670219
##   [386] 0.1151536738 0.6871594316 0.1932722302 0.9849218933 0.9470379758
##   [391] 0.6917069692 0.7398919435 0.7324402984 0.6525984439 0.1670463069
##   [396] 0.9231808581 0.5646048458 0.5364956353 0.0188437472 0.3663996276
##   [401] 0.6862422745 0.4166287233 0.7570262463 0.7757948679 0.5735870199
##   [406] 0.1886987926 0.7582653339 0.0926830929 0.6223585266 0.4159132016
##   [411] 0.7765108705 0.8078028020 0.9672963202 0.2159032512 0.8670089110
##   [416] 0.4169180284 0.5130287160 0.7749373205 0.1325433177 0.4119076421
##   [421] 0.6620475734 0.9077197670 0.3444916373 0.1052430642 0.9323459219
##   [426] 0.1999332728 0.0540183072 0.4258400758 0.3387958198 0.2756013027
##   [431] 0.6634905422 0.7838960970 0.4396973667 0.9303238676 0.2722072056
##   [436] 0.6590290293 0.3802892941 0.9353907774 0.7355009299 0.5900904534
##   [441] 0.8146524148 0.8824088296 0.7454413087 0.5017915608 0.9885014733
##   [446] 0.5552680509 0.8797018330 0.6304392638 0.6132155319 0.0336092997
##   [451] 0.2547006856 0.7759688012 0.9982450008 0.9601184016 0.7509288136
##   [456] 0.6805038610 0.2468864541 0.6065629770 0.5739705635 0.0495949083
##   [461] 0.3728201450 0.8947680488 0.3917717456 0.5169452706 0.1752800765
##   [466] 0.1926054636 0.5465086957 0.3931208388 0.6251974967 0.5722047726
##   [471] 0.1406190705 0.2892716692 0.0006121558 0.9553637172 0.3994099500
##   [476] 0.9770535454 0.5117741989 0.4671611886 0.7238354937 0.1420735531
##   [481] 0.5235777793 0.5604211201 0.6603428058 0.3722657019 0.1361519932
##   [486] 0.0738809260 0.7615121801 0.7027949130 0.7638952618 0.1570562583
##   [491] 0.5993446065 0.7633417868 0.9126529882 0.3080208497 0.6570658754
##   [496] 0.3378046290 0.6042503819 0.0839550188 0.6056672356 0.5959110265
##   [501] 0.6689191493 0.8010432960 0.8554558854 0.0501399101 0.6744340854
##   [506] 0.8458932983 0.7463983176 0.8295644040 0.1279001259 0.7941084381
##   [511] 0.3555059133 0.9480816713 0.9301581059 0.5924445491 0.1104942642
```

```
##  [516] 0.7838354679 0.6018229409 0.0882744200 0.6572622757 0.3320809370
##  [521] 0.8354190320 0.2477733262 0.3635909229 0.9246486337 0.5630180079
##  [526] 0.8068653576 0.0389287404 0.0398254376 0.6325429690 0.2390867730
##  [531] 0.2525250022 0.6246245001 0.4056898011 0.7984730732 0.1174629412
##  [536] 0.9944972815 0.6498573283 0.6556109313 0.7474796236 0.5142732125
##  [541] 0.3803301165 0.6113082704 0.9660003211 0.2158586672 0.7487493630
##  [546] 0.4323756348 0.8285962390 0.8833405196 0.9797886356 0.9140007265
##  [551] 0.2574865802 0.2234478178 0.7906329180 0.1650948089 0.8380758595
##  [556] 0.9719204390 0.4975382260 0.0398080489 0.6251565958 0.8303859085
##  [561] 0.1558116069 0.9902037513 0.6808823370 0.8646979360 0.2416607619
##  [566] 0.8625790973 0.7920866730 0.6123247666 0.2085591650 0.0594121274
##  [571] 0.6252874383 0.8039313646 0.1986306231 0.6656501235 0.4029327796
##  [576] 0.3869626867 0.0602284134 0.4202804118 0.5510972508 0.8160757187
##  [581] 0.8377968394 0.0120980635 0.5726980967 0.3016408621 0.0386787029
##  [586] 0.3583329110 0.2674532351 0.9740237382 0.9511434464 0.6160606141
##  [591] 0.9648370075 0.8780345162 0.1199900017 0.5962578633 0.3569201881
##  [596] 0.6748864641 0.6381902022 0.6968670192 0.6251959745 0.1222220890
##  [601] 0.2809718144 0.1741881554 0.1702244373 0.5605436335 0.4288005915
##  [606] 0.3891867667 0.8437064125 0.2087907058 0.5094247796 0.3949653304
##  [611] 0.2581600642 0.8029614384 0.3069992187 0.0781303388 0.9467787365
##  [616] 0.3786684813 0.3274520368 0.6648268595 0.7773210085 0.4841216214
##  [621] 0.9294515708 0.0498878444 0.6713575637 0.8255119289 0.3366140190
##  [626] 0.9315205917 0.4840459090 0.9460469969 0.3112607158 0.5990518702
##  [631] 0.8902234128 0.6073635472 0.4405584221 0.5600596257 0.9394272438
##  [636] 0.8345116014 0.2871900161 0.8435600812 0.2587780301 0.3393378323
##  [641] 0.5569070971 0.1878760487 0.5096489282 0.9270732831 0.3069720590
##  [646] 0.3562869385 0.0568936686 0.8847315591 0.5119929586 0.8047118725
##  [651] 0.2368176600 0.6868353374 0.8605094308 0.4501529348 0.1703747334
##  [656] 0.5086963247 0.8700193819 0.0333066215 0.2581552805 0.9370862804
##  [661] 0.6150363816 0.9495189879 0.8155944902 0.0493154514 0.3019702085
##  [666] 0.5120426093 0.7103606241 0.2846530925 0.4649487969 0.7293889807
##  [671] 0.1281430512 0.9342953495 0.3935495033 0.2491241221 0.9473612858
##  [676] 0.8416525447 0.4152223791 0.8916959967 0.2067407048 0.9501987083
##  [681] 0.4784584530 0.1102770171 0.6293535226 0.2934964148 0.8302932212
##  [686] 0.3279664356 0.8736798677 0.0276332614 0.5400351961 0.4789401426
##  [691] 0.8779045155 0.4868288476 0.2223561769 0.5091449048 0.0095259694
##  [696] 0.0884908563 0.3185763857 0.5453064234 0.3029776684 0.7398838575
##  [701] 0.0102781467 0.5986387285 0.7131026797 0.4659931685 0.2165860315
##  [706] 0.1164272521 0.4105797180 0.6391855688 0.0562446604 0.5683156576
##  [711] 0.7079906715 0.9757936925 0.9707029760 0.1169157147 0.1899509421
##  [716] 0.1869201926 0.4551901366 0.2038997530 0.9743351496 0.0994084384
##  [721] 0.8248006778 0.1010262312 0.9721297773 0.0053628031 0.4979119201
##  [726] 0.9856622049 0.4394909204 0.3435957879 0.3051547669 0.9866527512
##  [731] 0.9242956992 0.0122110262 0.0992497059 0.5411191899 0.6206978902
##  [736] 0.7936123651 0.4815281834 0.8071745096 0.9878338575 0.9275750027
##  [741] 0.2715825546 0.0987931858 0.0656125834 0.1873251994 0.5919763285
##  [746] 0.0008630857 0.4841866000 0.6553977022 0.2006995643 0.6645026628
##  [751] 0.5526229665 0.7441225741 0.3914565546 0.8356535558 0.2486454002
##  [756] 0.8860823966 0.6917566981 0.9165655458 0.3700721294 0.6150684627
##  [761] 0.0332543079 0.6476548435 0.0040038908 0.5773450769 0.2807610431
##  [766] 0.6105293497 0.9270527456 0.5732149626 0.7990209830 0.3004978194
##  [771] 0.8878271687 0.8550552714 0.8370745510 0.0721003956 0.6239091882
##  [776] 0.5107358950 0.0658973011 0.2241470253 0.5814365137 0.3622224077
##  [781] 0.9448925692 0.0565309483 0.0003418126 0.2899808860 0.2172976583
```

```
##  [786] 0.6885741784 0.8648701455 0.0298377264 0.7015088277 0.1667423935
##  [791] 0.7850592399 0.1458532037 0.6762002339 0.5202723837 0.7049989968
##  [796] 0.2645380092 0.5058415511 0.8223392977 0.1797051979 0.8646464990
##  [801] 0.1099460442 0.8714367896 0.5144197687 0.2856988220 0.3367340211
##  [806] 0.5696520146 0.1842292922 0.4393714704 0.6618221807 0.4203386179
##  [811] 0.5609762191 0.1956236530 0.9283050264 0.6735741969 0.1310370171
##  [816] 0.3768865855 0.3023030679 0.8052576943 0.4701284021 0.4414459956
##  [821] 0.0795966187 0.3735353299 0.3879347476 0.3902946142 0.2394194803
##  [826] 0.7895856642 0.0158712207 0.3987600550 0.3882675874 0.4577801591
##  [831] 0.2966457983 0.8032375281 0.8713950089 0.9445756134 0.2728989087
##  [836] 0.6754392071 0.7114110326 0.2016571660 0.5567085175 0.6235133451
##  [841] 0.1080694934 0.5848401678 0.6458513984 0.1885790734 0.4577570041
##  [846] 0.9174875303 0.5659459098 0.9422312926 0.7447421285 0.7167671463
##  [851] 0.5453664022 0.9767362811 0.9435349118 0.1765267355 0.5459967637
##  [856] 0.6448610609 0.1049211815 0.0382077270 0.7709153660 0.9573111415
##  [861] 0.1106834277 0.4022474787 0.0274988688 0.4143887600 0.2089883683
##  [866] 0.9180756707 0.2282334333 0.9819308324 0.2717576043 0.5315367309
##  [871] 0.9459464359 0.9049140171 0.9490382764 0.3010218127 0.7661085380
##  [876] 0.1893898065 0.1013609685 0.0859864308 0.5092333122 0.5776511210
##  [881] 0.6869137934 0.2515672981 0.4455045264 0.5412310294 0.5681811818
##  [886] 0.9304210341 0.1723820523 0.0392490570 0.0989390847 0.0155072559
##  [891] 0.9203997736 0.7464458942 0.6054088911 0.3776960922 0.3414908806
##  [896] 0.3275395611 0.6275120932 0.6329661196 0.9804190102 0.8694249380
##  [901] 0.6415731595 0.4095242864 0.9209373307 0.4514219440 0.9142726245
##  [906] 0.0263550885 0.3419393084 0.2560775015 0.7771316250 0.2960546212
##  [911] 0.2574584300 0.4713358963 0.0702871464 0.2265955168 0.1147465222
##  [916] 0.0799787233 0.4408870994 0.9824255591 0.9638371458 0.7975955033
##  [921] 0.5417362035 0.4557757070 0.2110341974 0.2306389480 0.5910997964
##  [926] 0.2582380513 0.7574036478 0.5515460693 0.0976253275 0.1505063956
##  [931] 0.1457857946 0.9905682108 0.0260923174 0.6067343464 0.1021205992
##  [936] 0.5094256019 0.1874213456 0.5072218911 0.3851755147 0.5886653271
##  [941] 0.9207440454 0.5835579261 0.8129020869 0.7675330476 0.6075635189
##  [946] 0.5337823096 0.2854788974 0.1241884707 0.4839640744 0.3673567923
##  [951] 0.7080209046 0.9515685702 0.3071189800 0.8207250747 0.8552160852
##  [956] 0.0459401198 0.8637784163 0.4761403869 0.1217052343 0.6558956904
##  [961] 0.2275585500 0.4601899209 0.8862336075 0.7933290135 0.0457805442
##  [966] 0.0677916221 0.6626513049 0.2288734971 0.5923129355 0.3301717055
##  [971] 0.9993030254 0.7087918075 0.0031697885 0.7697339621 0.2002311687
##  [976] 0.6894992553 0.7498534597 0.2383271190 0.9529667778 0.5847832749
##  [981] 0.7994580676 0.9346025025 0.0765929217 0.6636016299 0.9874346673
##  [986] 0.2523310662 0.0394362193 0.9856219713 0.1328507625 0.1761907323
##  [991] 0.4827948108 0.6360850439 0.9869790701 0.0995346869 0.6936827919
##  [996] 0.0013087022 0.7674259357 0.3199795457 0.9580128449 0.1953975793
```

```
advert_random <- advert[order(random),]
# Selecting the first 6 rows from iris_random
head(advert_random)
```

```
##     Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage
## 783                    80.46  29    56909.30               230.78
## 473                    78.37  24    55015.08               207.27
## 746                    57.99  50    62466.10               124.58
## 996                    72.97  30    71384.57               208.58
## 383                    77.66  29    67080.94               168.15
```

```
## 361                    38.91  33    56369.74               150.80
##                                      Ad.Topic.Line          City Male
## 783                     Mandatory coherent groupware     Carterton    0
## 473 Quality-focused zero-defect budgetary management   Pearsonfort    0
## 746                  Innovative homogeneous alliance New Angelview    0
## 996                    Fundamental modular algorithm     Duffystad    1
## 383                     Operative scalable emulation     Reyesland    0
## 361                   Versatile reciprocal structure   Morrismouth    1
##         Country           Timestamp Clicked.on.Ad
## 783       India 2016-06-04 09:13:29             0
## 473    Pakistan 2016-01-23 04:47:37             0
## 746  Costa Rica 2016-02-12 08:46:15             1
## 996     Lebanon 2016-02-11 21:49:00             1
## 383       Gabon 2016-06-19 22:08:15             0
## 361 Philippines 2016-07-13 07:41:42             1
```

```
#lets drop columns we dont need
advert_random <- subset(advert_random, select = -c(5,6,7,8,9))
head(advert_random)
```

```
##     Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage Clicked.on.Ad
## 783                    80.46  29    56909.30               230.78             0
## 473                    78.37  24    55015.08               207.27             0
## 746                    57.99  50    62466.10               124.58             1
## 996                    72.97  30    71384.57               208.58             1
## 383                    77.66  29    67080.94               168.15             0
## 361                    38.91  33    56369.74               150.80             1
```

```
# Normalizing the numerical variables of the data set.
normal <- function(x) (
  return( ((x - min(x)) /(max(x)-min(x))) )
)
normal(1:5)
```

```
## [1] 0.00 0.25 0.50 0.75 1.00
```

```
advert_new <- as.data.frame(lapply(advert_random[,1:4], normal))
head(advert_new)
```

```
##   Daily.Time.Spent.on.Site       Age Area.Income Daily.Internet.Usage
## 1                0.8135305 0.2380952   0.6552743             0.7628042
## 2                0.7780044 0.1190476   0.6263497             0.6204746
## 3                0.4315825 0.7380952   0.7401261             0.1198692
## 4                0.6862145 0.2619048   0.8763103             0.6284054
## 5                0.7659357 0.2380952   0.8105943             0.3836421
## 6                0.1072582 0.3333333   0.6470353             0.2786052
```

```
summary(advert_new)
```

```
##  Daily.Time.Spent.on.Site      Age          Area.Income
##  Min.   :0.0000           Min.   :0.0000   Min.   :0.0000
```

```
##  1st Qu.:0.3189          1st Qu.:0.2381   1st Qu.:0.5044
##  Median :0.6054          Median :0.3810   Median :0.6568
##  Mean   :0.5507          Mean   :0.4050   Mean   :0.6261
##  3rd Qu.:0.7810          3rd Qu.:0.5476   3rd Qu.:0.7860
##  Max.   :1.0000          Max.   :1.0000   Max.   :1.0000
##  Daily.Internet.Usage
##  Min.   :0.0000
##  1st Qu.:0.2061
##  Median :0.4743
##  Mean   :0.4554
##  3rd Qu.:0.6902
##  Max.   :1.0000
```

```
# creating test and train sets
train <- advert_new[1:800,]
test <- advert_new[801:1000,]
train_sp <- advert_random[1:800,5]
test_sp <- advert_random[801:1000,5]
```

```
head(train)
```

```
##   Daily.Time.Spent.on.Site       Age Area.Income Daily.Internet.Usage
## 1                0.8135305 0.2380952   0.6552743            0.7628042
## 2                0.7780044 0.1190476   0.6263497            0.6204746
## 3                0.4315825 0.7380952   0.7401261            0.1198692
## 4                0.6862145 0.2619048   0.8763103            0.6284054
## 5                0.7659357 0.2380952   0.8105943            0.3836421
## 6                0.1072582 0.3333333   0.6470353            0.2786052
```

```
head(test)
```

```
##     Daily.Time.Spent.on.Site       Age Area.Income Daily.Internet.Usage
## 801                0.5701173 0.5238095   0.9787466            0.3662066
## 802                0.6566378 0.7857143   0.4203007            0.1078218
## 803                0.1075982 0.4761905   0.2063256            0.3468943
## 804                0.7771545 0.2142857   0.5392206            0.8157162
## 805                0.7832738 0.2380952   0.7975351            0.6251968
## 806                0.7581166 0.3333333   0.5394701            0.9036808
```

```
head(train_sp)
```

```
## [1] 0 0 1 1 0 1
## Levels: 0 1
```

```
head(test_sp)
```

```
## [1] 0 1 1 1 0 0
## Levels: 0 1
```

```
# Now we can use the K-NN algorithm. Lets call the "class" package which contains the K-NN algorithm.
# We then have to provide 'k' value which is no. of nearest neighbours(NN) to look for

library(class)
require(class)
model <- knn(train= train,test=test, ,cl= train_sp,k=12)
table(factor(model))
```

```
##
##   0   1
## 108  92
```

```
table(test_sp,model)
```

```
##        model
## test_sp   0   1
##       0 104   4
##       1   4  88
```

We have an accuracy score of 95.7% Which is great!

7.2 Decision tree

```
library("partykit")
```

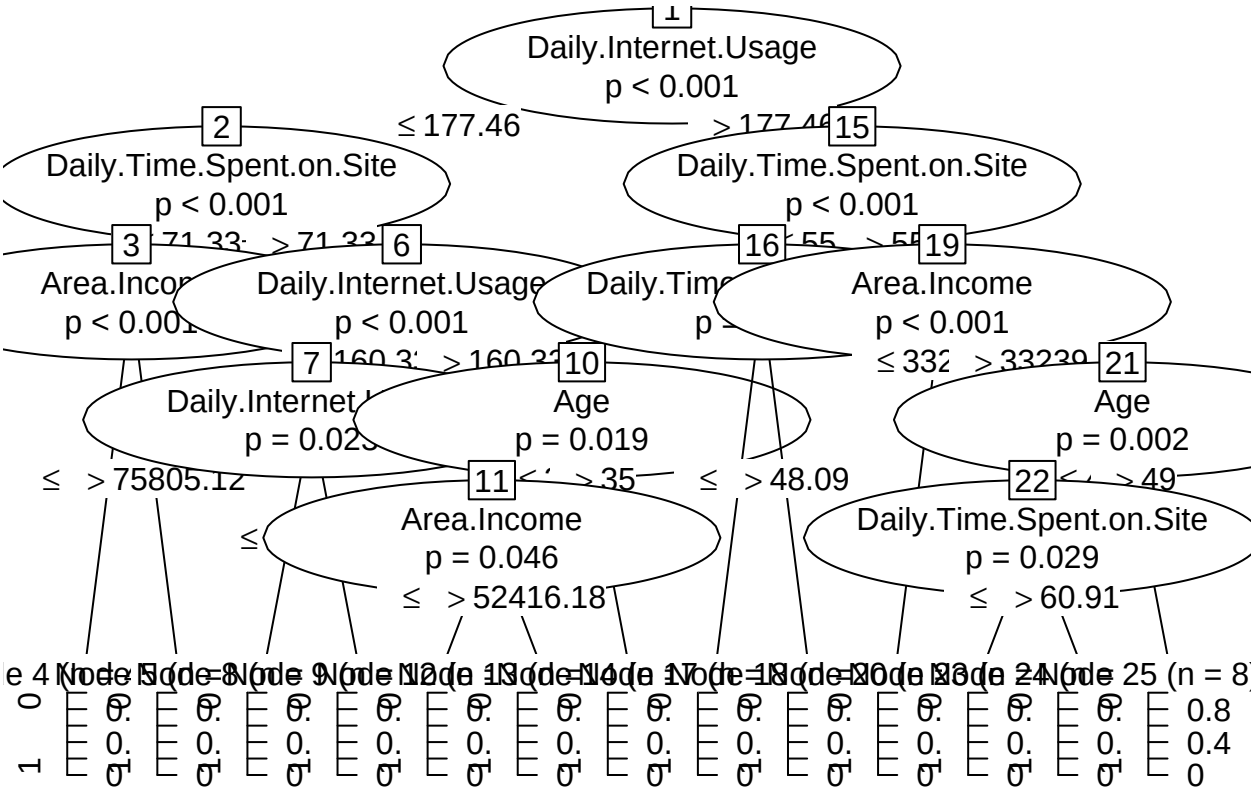
```
## Loading required package: grid
```

```
## Loading required package: libcoin
```

```
## Loading required package: mvtnorm
```

```
  output.tree <- ctree(
  Clicked.on.Ad ~ Daily.Time.Spent.on.Site + Age + Area.Income + Daily.Internet.Usage, data = advert)

#Plotting the tree.
plot(output.tree)
```



The decision tree has classified our dataset but since our dataset is large the output is crowded and not great for presentation and analysis of our dataset.

7.3 SVM

```
#spliting the data into training and test set
library(caret)
```

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

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

```
intrain <- createDataPartition(y = advert_random$Clicked.on.Ad, p= 0.7, list = FALSE)
training_svm <- advert_random[intrain,]
testing_svm <- advert_random[-intrain,]
```

```
dim(training_svm)
```

```
## [1] 700   5
```

```
dim(testing_svm)
```

```
## [1] 300   5
```

```
# We then clean the data using the anyNA() method that checks for any null values.
# ---
#
anyNA(advert_random)
```

```
## [1] FALSE
```

There is no missing values

```
#we then check summerry of our data
summary(advert_random)
```

```
##  Daily.Time.Spent.on.Site      Age         Area.Income    Daily.Internet.Usage
##  Min.   :32.60            Min.   :19.00   Min.   :13996   Min.   :104.8
##  1st Qu.:51.36            1st Qu.:29.00   1st Qu.:47032   1st Qu.:138.8
##  Median :68.22            Median :35.00   Median :57012   Median :183.1
##  Mean   :65.00            Mean   :36.01   Mean   :55000   Mean   :180.0
##  3rd Qu.:78.55            3rd Qu.:42.00   3rd Qu.:65471   3rd Qu.:218.8
##  Max.   :91.43            Max.   :61.00   Max.   :79485   Max.   :270.0
##  Clicked.on.Ad
##  0:500
##  1:500
##
##
##
##
```

```
# Before we train our model we will need to control all the computational overheads.
# We will implement this through the trainControl() method.
# This will allow us to use the train() function provided by the caret package.
library(e1071)
trctrl <- trainControl(method = "repeatedcv", number = 10, repeats = 3)
svm_Linear_model <- train(Clicked.on.Ad ~., data = training_svm, method = "svmLinear", trControl=trctrl
```

ls(training_svm)

```
# We can then check the reult of our train() model as shown below
# ---
#
svm_Linear_model
```

```
## Support Vector Machines with Linear Kernel
##
## 700 samples
##   4 predictor
##   2 classes: '0', '1'
##
## Pre-processing: centered (4), scaled (4)
## Resampling: Cross-Validated (10 fold, repeated 3 times)
## Summary of sample sizes: 630, 630, 630, 630, 630, 630, ...
## Resampling results:
```

```
##
##   Accuracy   Kappa
##   0.9661905  0.932381
##
## Tuning parameter 'C' was held constant at a value of 1
```

```r
# We can use the predict() method for predicting results as shown below.

test_pred_svm <- predict(svm_Linear_model, newdata = testing_svm)
test_pred_svm
```

```
##   [1] 0 1 1 0 1 1 0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 1 1 0 1 1 1 1 0 0 0 1 1
##  [38] 1 1 0 0 1 0 1 1 1 0 0 0 1 0 1 0 1 1 0 0 1 1 0 0 0 0 1 1 1 1 1 0 0 1 0 1 0
##  [75] 0 0 0 0 1 0 1 0 1 1 1 0 1 1 0 0 0 1 1 0 0 0 0 1 0 1 1 0 0 1 0 1 0 1 0 1 1
## [112] 0 0 0 1 0 0 1 0 1 0 0 1 1 1 0 0 0 0 1 0 1 0 1 1 0 1 0 1 0 0 0 0 1 0 1 1 0
## [149] 1 0 1 0 0 1 1 0 0 1 0 0 0 0 0 1 1 1 0 0 1 1 0 1 0 1 1 0 1 1 1 1 1 0 1 1 1
## [186] 0 0 1 0 1 1 0 0 0 1 0 1 0 1 0 1 1 0 0 0 1 0 1 0 1 1 1 0 0 1 1 1 1 0 1 1 0
## [223] 0 0 0 0 0 1 1 1 1 0 0 1 1 1 0 0 1 0 1 1 0 1 1 0 0 1 0 0 0 1 0 0 1 0 0 0 1
## [260] 0 0 1 0 1 1 0 0 1 1 0 1 1 0 0 0 1 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 1
## [297] 1 1 0 1
## Levels: 0 1
```

```r
confusionMatrix(table(test_pred_svm, testing_svm$Clicked.on.Ad))
```

```
## Confusion Matrix and Statistics
##
##
## test_pred_svm   0   1
##             0 149   8
##             1   1 142
##
##                Accuracy : 0.97
##                  95% CI : (0.9438, 0.9862)
##     No Information Rate : 0.5
##     P-Value [Acc > NIR] : <2e-16
##
##                   Kappa : 0.94
##
##  Mcnemar's Test P-Value : 0.0455
##
##             Sensitivity : 0.9933
##             Specificity : 0.9467
##          Pos Pred Value : 0.9490
##          Neg Pred Value : 0.9930
##              Prevalence : 0.5000
##          Detection Rate : 0.4967
##    Detection Prevalence : 0.5233
##       Balanced Accuracy : 0.9700
##
##        'Positive' Class : 0
##
```

We have an accuracy of 97%.

7.4 Naive bayes

```
# We will now install and load the required packages
# ---
#
#install.packages('tidyverse')
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v tibble  3.1.4     v purrr   0.3.4
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   2.0.1     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::between()   masks data.table::between()
## x dplyr::filter()    masks stats::filter()
## x dplyr::first()     masks data.table::first()
## x dplyr::lag()       masks stats::lag()
## x dplyr::last()      masks data.table::last()
## x purrr::lift()      masks caret::lift()
## x purrr::transpose() masks data.table::transpose()
```

```
#install.packages('ggplot2')
library(ggplot2)
#install.packages('caret')
library(caret)
#install.packages('caretEnsemble')
library(caretEnsemble)
```

```
##
## Attaching package: 'caretEnsemble'

## The following object is masked from 'package:ggplot2':
##
##     autoplot
```

```
#install.packages('psych')
library(psych)
```

```
##
## Attaching package: 'psych'

## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
#install.packages('Amelia')
library(Amelia)
```

```
## Loading required package: Rcpp
```

```
## ##
## ## Amelia II: Multiple Imputation
## ## (Version 1.8.0, built: 2021-05-26)
## ## Copyright (C) 2005-2021 James Honaker, Gary King and Matthew Blackwell
## ## Refer to http://gking.harvard.edu/amelia/ for more information
## ##
```

```
#install.packages('mice')
library(mice)
```

```
##
## Attaching package: 'mice'
```

```
## The following object is masked from 'package:stats':
##
##     filter
```

```
## The following objects are masked from 'package:base':
##
##     cbind, rbind
```

```
#install.packages('GGally')
library(GGally)
```

```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg   ggplot2
```

```
#install.packages('rpart')
library(rpart)
#install.packages('randomForest')
library(randomForest)
```

```
## randomForest 4.6-14
```

```
## Type rfNews() to see new features/changes/bug fixes.
```

```
##
## Attaching package: 'randomForest'
```

```
## The following object is masked from 'package:psych':
##
##     outlier
```

```
## The following object is masked from 'package:ggplot2':
##
##     margin

## The following object is masked from 'package:dplyr':
##
##     combine
```

```
head(advert_random)
```

```
##     Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage Clicked.on.Ad
## 783                    80.46  29    56909.30               230.78             0
## 473                    78.37  24    55015.08               207.27             0
## 746                    57.99  50    62466.10               124.58             1
## 996                    72.97  30    71384.57               208.58             1
## 383                    77.66  29    67080.94               168.15             0
## 361                    38.91  33    56369.74               150.80             1
```

```
# Splitting data into training and test data sets

Train1 <- createDataPartition(y = advert_random$Clicked.on.Ad,p = 0.7,list = FALSE)
training_naive <- advert_random[Train1,]
testing_naive <- advert_random[-Train1,]
```

```
# Checking dimensions of the split
# ---
#
prop.table(table(advert_random$Clicked)) * 100
```

```
##
##  0  1
## 50 50
```

```
prop.table(table(training_naive$Clicked.on.Ad)) * 100
```

```
##
##  0  1
## 50 50
```

```
prop.table(table(testing_naive$Clicked.on.Ad)) * 100
```

```
##
##  0  1
## 50 50
```

```
# Comparing the outcome of the training and testing phase
# ---

#
x = advert_random[,-5]
y =  advert_random$Clicked.on.Ad
```

```r
##building  model
# ---
#
library(e1071)
model_NB = train(x,y,'nb',trControl=trainControl(method='cv',number=10))
```

```
## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 1

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 2

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 3

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 4

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 5

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 6

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 7

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 8

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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## observation 66

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 67

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 68
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 99

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 100
```

```
#  Evalution of Model
# ---
# Predicting our testing set
library(klaR)
```

```
## Loading required package: MASS

##
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':
##
##     select
```

```
#
Predict_NB <- predict(model_NB,newdata = advert_random)
```

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## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 1

## Warning in FUN(X[[i]], ...): Numerical 0 probability for all classes with
## observation 2

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## observation 1000
```

```
# Getting the confusion matrix to see accuracy value and other parameter values
# ---
#
confusionMatrix(Predict_NB, advert_random$Clicked.on.Ad)
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction   0   1
##          0 485  18
##          1  15 482
##
##                Accuracy : 0.967
##                  95% CI : (0.954, 0.9772)
##     No Information Rate : 0.5
##     P-Value [Acc > NIR] : <2e-16
##
##                   Kappa : 0.934
##
##  Mcnemar's Test P-Value : 0.7277
##
##             Sensitivity : 0.9700
##             Specificity : 0.9640
##          Pos Pred Value : 0.9642
##          Neg Pred Value : 0.9698
##              Prevalence : 0.5000
##          Detection Rate : 0.4850
##    Detection Prevalence : 0.5030
##       Balanced Accuracy : 0.9670
##
##        'Positive' Class : 0
##
```

The accuracy of Naive Bayes is 96.7%

SVM is the best model as it had the highest accuracy score of 97%.

Follow Up Questions

1. We had the right data as our classification models had very high accuracy scores