Supervised Machine Learning in R

2022-03-25

Cryptography Course IP

Define the question

- Identify which individuals are most likely to click on the ads.
- Create a model that will predict whether an individual is most likely to click on the ad.

Metric of success

- Because we are creating a classification model, our metric of success will be accuracy score. We will set the minimum accuracy score to 90%.

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.

Experimental design taken

1. Define the question, the metric for success, the context, experimental design taken.
2. Read and explore the given dataset.
3. Define the appropriateness of the available data to answer the given question.
4. Find and deal with outliers, anomalies, and missing data within the dataset.
5. Perform univariate, bivariate recording your observations.
6. Perform unsupervised learning with several models
7. Recommendations and conclusions

Appropriateness of the available data

Our dataset is suitable in identifying the traits and characteristics of those who are likely to click on ads.

Checking the dataset

```
# Import and load our dataset
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.1.3
```

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

```
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.8
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1
```

```
## Warning: package 'ggplot2' was built under R version 4.1.3
```

```
## Warning: package 'dplyr' was built under R version 4.1.3
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
crypto <- read.csv("http://bit.ly/IPAdvertisingData")

# Preview the first few rows
head(crypto)
```

```
##   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
```

```
# Preview the last few row
tail(crypto)
```

```
##      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
```

```
# Check number of records and variables
dim(crypto)
```

```
## [1] 1000   10
```

We have 1,000 records and 10 variable

```
# Check the datatypes of our dataset
glimpse(crypto)
```

```
## Rows: 1,000
## Columns: 10
## $ Daily.Time.Spent.on.Site <dbl> 68.95, 80.23, 69.47, 74.15, 68.37, 59.99, 88.~
## $ Age                      <int> 35, 31, 26, 29, 35, 23, 33, 48, 30, 20, 49, 3~
## $ Area.Income              <dbl> 61833.90, 68441.85, 59785.94, 54806.18, 73889~
## $ Daily.Internet.Usage     <dbl> 256.09, 193.77, 236.50, 245.89, 225.58, 226.7~
## $ Ad.Topic.Line            <chr> "Cloned 5thgeneration orchestration", "Monito~
## $ City                     <chr> "Wrightburgh", "West Jodi", "Davidton", "West~
## $ Male                     <int> 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, ~
## $ Country                  <chr> "Tunisia", "Nauru", "San Marino", "Italy", "I~
## $ Timestamp                <chr> "2016-03-27 00:53:11", "2016-04-04 01:39:02",~
## $ Clicked.on.Ad            <int> 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, ~
```

Our dataframe is made up of integer, double and character datatypes

```
# Summary of our dataset
summary(crypto)
```

```
##  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
```

```
# Checking column names
names(crypto)
```

```
##  [1] "Daily.Time.Spent.on.Site" "Age"
##  [3] "Area.Income"              "Daily.Internet.Usage"
##  [5] "Ad.Topic.Line"            "City"
##  [7] "Male"                     "Country"
##  [9] "Timestamp"                "Clicked.on.Ad"
```

Data Cleaning

```
# Checking for duplicate values
sum(crypto[duplicated(crypto)])
```

```
## [1] 0
```

We have no duplicates

```
# Check for missing values
sum(is.na(crypto))
```

```
## [1] 0
```

```
# Check for missing values in each variable
colSums(is.na(crypto))
```

```
## 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
```

We have no missing values

```
# Check for any annomalies
uniquelst <- lapply(crypto,unique)
uniquelst
```

```
## $Daily.Time.Spent.on.Site
##   [1] 68.95 80.23 69.47 74.15 68.37 59.99 88.91 66.00 74.53 69.88 47.64 83.07
##  [13] 69.57 79.52 42.95 63.45 55.39 82.03 54.70 74.58 77.22 84.59 41.49 87.29
##  [25] 41.39 78.74 48.53 51.95 70.20 76.02 67.64 86.41 59.05 55.60 57.64 84.37
##  [37] 62.26 65.82 50.43 38.93 84.98 64.24 82.52 81.38 80.47 37.68 69.62 85.40
##  [49] 44.33 48.01 73.18 79.94 33.33 50.33 62.31 80.60 65.19 44.98 77.63 41.82
##  [61] 85.61 85.84 72.08 86.06 45.96 62.42 63.89 35.33 75.74 78.53 46.13 69.01
##  [73] 55.35 33.21 38.46 64.10 49.81 82.73 56.14 55.13 78.11 73.46 56.64 68.94
##  [85] 70.79 57.76 77.51 52.70 57.70 56.89 69.90 55.79 70.03 50.08 43.67 72.84
##  [97] 45.72 39.94 35.61 79.71 63.60 89.91 68.18 66.49 80.49 72.23 42.39 47.53
## [109] 74.02 66.63 63.24 71.00 69.00 76.99 72.60 61.88 84.45 88.97 86.19 49.58
## [121] 77.65 37.75 62.33 79.57 80.31 89.05 70.41 67.36 46.98 41.67 51.24 75.70
## [133] 43.49 49.89 38.37 38.52 71.89 75.80 83.86 37.51 83.67 69.08 37.47 56.04
## [145] 70.92 49.78 68.61 58.18 78.54 37.00 65.40 87.98 44.64 41.73 80.46 75.55
## [157] 76.32 82.68 72.01 75.83 41.28 34.66 66.18 59.59 86.69 43.77 71.84 74.41
## [169] 63.36 71.74 60.72 72.04 44.57 85.86 39.85 84.53 62.95 67.58 85.56 46.88
## [181] 46.31 77.95 84.73 39.86 60.23 60.70 77.20 71.86 44.78 78.57 73.41 77.05
## [193] 66.40 69.35 35.65 70.04 69.78 58.22 76.90 84.08 59.51 40.15 76.81 41.89
## [205] 76.87 67.28 81.98 66.01 61.57 53.30 34.87 43.60 77.88 49.95 60.94 89.15
## [217] 78.70 57.35 34.86 70.68 76.06 66.67 46.77 78.32 37.32 40.42 76.77 65.65
## [229] 74.32 73.27 80.03 53.68 85.03 70.44 81.22 39.96 57.05 42.44 62.20 76.70
## [241] 61.22 84.54 46.08 56.70 81.03 80.91 40.06 83.47 73.84 74.65 60.25 59.21
## [253] 43.02 84.04 70.66 70.58 72.44 40.17 79.15 44.49 73.04 76.28 68.88 73.10
## [265] 47.66 87.30 89.34 81.37 81.67 46.37 54.88 40.67 71.76 47.51 75.15 56.01
## [277] 82.87 45.05 60.53 50.52 84.71 55.20 81.61 71.55 82.40 73.95 72.07 80.39
## [289] 65.80 69.97 52.62 39.25 77.56 33.52 79.81 84.79 82.70 84.88 54.92 76.56
## [301] 69.74 72.19 84.29 73.89 75.84 73.38 80.72 62.06 51.50 90.97 86.78 84.33
## [313] 36.87 34.78 76.84 67.05 41.47 80.71 80.09 56.30 79.36 86.38 38.94 87.26
## [325] 75.32 74.38 65.90 36.31 88.12 83.97 61.09 65.77 81.58 37.87 76.20 60.91
## [337] 74.49 73.71 78.19 79.54 74.87 87.09 37.45 49.84 51.38 83.40 38.91 62.14
## [349] 79.72 73.30 69.11 71.90 72.45 77.07 74.62 82.07 58.60 36.08 79.44 73.19
## [361] 77.60 89.00 69.20 67.56 81.11 80.22 43.63 77.66 74.63 49.67 80.59 83.49
## [373] 44.46 68.10 63.88 78.83 79.97 80.51 66.99 71.05 42.05 76.24 77.29 35.98
## [385] 84.95 39.34 87.23 57.24 56.34 48.73 51.68 35.34 48.09 78.68 68.82 56.99
```

```
## [397] 86.63 41.18 71.03 72.92 77.14 34.30 83.71 53.38 58.03 43.59 60.07 54.43
## [409] 81.99 84.69 88.72 88.89 69.58 85.23 83.55 56.66 56.39 78.18 46.04 79.40
## [421] 36.44 53.14 32.84 73.72 38.10 73.93 51.87 77.69 43.41 55.92 80.67 83.42
## [433] 82.12 66.17 43.01 80.05 64.88 79.82 48.03 32.99 74.88 36.49 88.04 45.70
## [445] 82.38 52.68 65.59 43.84 67.69 78.37 81.46 47.48 78.76 44.96 39.56 39.76
## [457] 57.11 83.26 69.42 50.60 46.20 66.88 35.49 80.29 50.19 59.12 59.88 59.70
## [469] 67.80 81.59 81.10 41.70 73.94 58.35 51.56 58.21 66.12 49.99 80.30 57.86
## [481] 70.29 59.13 81.51 42.94 84.81 82.79 59.22 35.00 46.61 63.26 79.16 67.94
## [493] 79.91 66.14 43.65 59.61 89.37 65.10 53.44 79.53 91.43 73.57 76.49 61.72
## [505] 72.03 77.47 75.65 78.15 63.80 76.59 42.60 78.77 81.95 44.73 38.35 72.53
## [517] 56.20 79.67 75.42 78.64 59.52 64.75 47.90 80.38 64.51 71.28 50.32 72.76
## [529] 72.80 74.59 46.66 48.86 37.05 81.21 66.89 68.11 69.15 65.72 40.04 68.60
## [541] 56.16 78.60 78.29 43.83 77.31 66.77 57.20 73.15 43.97 77.25 74.84 83.53
## [553] 38.63 84.00 52.13 71.83 78.36 50.18 64.67 69.50 65.22 32.91 39.50 75.19
## [565] 76.21 67.76 40.01 68.41 35.55 74.54 81.75 87.85 87.97 78.17 67.91 85.77
## [577] 41.16 53.54 63.43 70.13 40.19 58.95 35.76 59.36 91.10 61.04 74.06 64.63
## [589] 81.29 76.07 75.92 78.35 46.14 46.43 66.04 84.31 83.66 81.25 85.26 86.53
## [601] 76.44 52.84 85.24 74.71 82.95 76.42 42.04 46.28 48.26 58.05 75.00 79.61
## [613] 52.56 62.18 77.89 66.08 89.21 49.96 77.44 82.58 39.36 47.23 65.57 78.01
## [625] 44.15 43.57 76.83 42.06 76.27 74.27 77.50 87.16 66.26 65.15 68.25 73.49
## [637] 39.19 80.15 86.76 73.88 69.77 87.27 78.84 71.33 81.90 46.89 77.80 45.44
## [649] 69.96 87.35 49.42 71.27 49.19 85.01 67.59 75.71 43.07 39.47 48.22 76.76
## [661] 67.47 81.17 89.66 79.60 65.53 61.87 83.16 44.11 56.57 83.91 79.80 71.23
## [673] 82.37 70.90 62.12 67.35 57.99 66.80 49.13 45.11 54.35 61.82 77.75 70.61
## [685] 82.72 65.07 56.93 36.56 85.73 75.81 72.94 53.63 52.35 51.58 42.32 55.04
## [697] 68.58 85.54 71.14 64.38 88.85 66.79 32.60 43.88 56.46 72.18 52.67 80.55
## [709] 67.85 82.69 35.21 36.37 74.07 59.96 85.62 40.88 36.98 56.56 36.62 49.35
## [721] 75.64 79.22 66.83 53.33 50.63 41.84 53.92 83.89 55.32 53.22 43.16 67.51
## [733] 79.89 84.25 74.18 85.78 80.96 36.91 54.47 57.51 82.30 73.21 79.09 68.47
## [745] 83.69 83.48 66.69 48.46 42.51 42.83 41.46 45.99 68.72 63.11 49.21 55.77
## [757] 44.13 57.82 72.46 78.24 74.61 89.18 44.16 55.74 88.82 70.39 78.58 35.11
## [769] 60.39 81.56 75.03 50.87 82.80 78.51 37.65 83.17 91.37 81.32 76.64 39.53
## [781] 86.58 90.75 67.71 82.41 45.82 76.79 70.05 77.35 40.34 67.39 68.68 66.03
## [793] 47.74 79.18 86.81 41.53 46.84 44.40 52.17 81.45 54.08 76.65 54.39 37.74
## [805] 69.86 85.37 80.99 77.36 55.46 35.66 50.78 40.47 45.62 84.76 80.64 75.94
## [817] 37.01 87.18 56.91 75.24 42.84 34.96 87.46 41.86 34.04 54.96 87.14 78.79
## [829] 65.56 81.05 55.71 45.48 47.00 59.64 72.55 91.15 80.53 82.49 80.94 61.76
## [841] 63.30 36.73 78.41 83.98 63.18 60.83 44.72 79.51 39.30 64.79 89.80 72.82
## [853] 38.65 59.01 78.96 63.99 41.35 62.79 45.53 51.65 54.55 69.95 79.83 85.35
## [865] 56.78 78.67 70.09 60.75 35.25 37.58 68.01 45.08 63.04 40.18 45.17 50.48
## [877] 80.87 41.88 39.87 61.84 54.97 71.40 67.26 76.58 54.37 66.47 72.88 63.37
## [889] 89.71 70.96 35.79 38.96 69.17 64.20 43.70 72.97 51.30 51.63 55.55 45.01
##
## $Age
##  [1] 35 31 26 29 23 33 48 30 20 49 37 24 41 36 40 52 28 34 22 57 53 39 46 32 25
## [26] 43 45 50 47 27 42 38 54 21 60 55 44 58 56 51 19 59 61
##
## $Area.Income
##    [1] 61833.90 68441.85 59785.94 54806.18 73889.99 59761.56 53852.85 24593.33
##    [9] 68862.00 55642.32 45632.51 62491.01 51636.92 51739.63 30976.00 52182.23
##   [17] 23936.86 71511.08 31087.54 23821.72 64802.33 60015.57 32635.70 61628.72
##   [25] 68962.32 64828.00 38067.08 58295.82 32708.94 46179.97 51473.28 45593.93
##   [33] 25583.29 30227.98 45580.92 61389.50 56770.79 76435.30 57425.87 27508.41
##   [41] 57691.95 59784.18 66572.39 64929.61 57519.64 53575.48 50983.75 67058.72
```

```
##   [49] 52723.34 54286.10 61526.25 58526.04 53350.11 62657.53 62722.57 67479.62
##   [57] 75254.88 52336.64 56113.37 24852.90 47708.42 64654.66 71228.44 61601.05
##   [65] 66281.46 73910.90 51317.33 51510.18 61005.87 32536.98 60248.97 74543.81
##   [73] 75509.61 42650.32 58183.04 60465.72 57009.76 54541.56 32689.04 55605.92
##   [81] 63296.87 65653.47 61652.53 30726.26 74535.94 47861.93 73600.28 58543.94
##   [89] 42696.67 37334.78 71392.53 59550.05 64264.25 64147.86 25686.34 52968.22
##   [97] 22473.08 64927.19 51868.85 69456.83 31947.65 51864.77 59593.56 48376.14
##  [105] 56884.74 67186.54 46557.92 66541.05 33258.09 72272.90 60333.38 65229.13
##  [113] 56067.38 37838.72 72683.35 56729.78 66815.54 60223.52 29727.79 49269.98
##  [121] 57669.41 56791.75 63274.88 35466.80 68787.09 61227.59 56366.88 57868.44
##  [129] 66618.21 73104.47 21644.91 53817.02 76368.31 67633.44 50335.46 17709.98
##  [137] 41229.16 42581.23 61617.98 70575.60 64122.36 52097.32 65953.76 60192.72
##  [145] 77460.07 45716.48 65120.86 49995.63 71718.51 61770.34 69112.84 72524.86
##  [153] 36782.38 66699.12 64287.78 56637.59 55787.58 61142.33 61625.87 73234.87
##  [161] 74166.24 62669.59 57756.89 58019.64 50960.08 48246.60 28271.84 53767.12
##  [169] 43662.10 62238.58 49030.03 76003.47 68094.85 64395.85 70053.27 72423.97
##  [177] 42995.80 60309.58 38349.78 63115.34 31343.39 40763.13 36752.24 65044.59
##  [185] 53673.08 43444.86 44248.52 62572.88 39840.55 32593.59 41629.86 43313.73
##  [193] 42993.48 46004.31 49325.48 51633.34 63363.04 64045.93 73049.30 66624.60
##  [201] 77567.85 53431.35 31265.75 74780.74 70410.11 37345.24 66107.84 62336.39
##  [209] 39132.64 38745.29 65172.22 68519.96 54774.77 76246.96 65461.92 34127.21
##  [217] 35253.98 44893.71 59621.02 20856.54 55353.41 67516.07 68737.75 76893.84
##  [225] 59886.58 53441.69 41356.31 49942.66 74430.08 58633.63 72707.87 31092.93
##  [233] 74445.18 49309.14 56735.14 40183.75 58348.41 72209.99 62060.11 67113.46
##  [241] 24030.06 56180.93 62204.93 60372.64 65280.16 34309.24 59610.81 50278.89
##  [249] 43450.11 25408.21 71136.49 63883.81 64902.47 66784.81 62784.85 63727.50
##  [257] 61608.23 56782.18 64447.77 42042.95 67669.06 54875.95 73347.67 50199.77
##  [265] 50723.67 63450.96 56694.12 70547.16 47391.95 62312.23 63100.13 73687.50
##  [273] 52686.47 78119.50 57014.84 27086.40 58337.18 50216.01 53049.44 62927.96
##  [281] 32847.53 32006.82 48913.07 69285.69 53700.57 52011.00 46339.25 67938.77
##  [289] 66348.95 66873.90 72270.88 61610.05 76560.59 62667.51 75687.46 66744.65
##  [297] 67714.82 69710.51 66269.49 60843.32 55041.60 73863.25 62378.05 63336.85
##  [305] 42191.61 56194.56 61771.90 61383.79 63924.82 23975.35 70179.11 66524.80
##  [313] 41851.38 61275.18 60638.38 47160.53 48537.18 53058.91 68614.98 44174.25
##  [321] 67050.16 54520.14 54952.42 69476.42 54989.93 29398.61 42861.42 65883.39
##  [329] 65421.39 60953.93 58476.57 66636.84 67430.96 57260.41 66359.32 57587.00
##  [337] 63060.55 59998.50 74024.61 60550.66 57983.30 52736.33 46653.75 56986.73
##  [345] 55336.18 42162.90 39699.13 56394.82 75044.35 53309.61 58996.12 56605.12
##  [353] 62475.99 70492.60 43698.53 57737.51 31281.01 45800.48 42362.49 66691.23
##  [361] 56369.74 59397.89 66025.11 68211.35 73608.99 61228.96 72325.91 44559.43
##  [369] 73207.15 46722.07 45400.50 41417.27 60845.55 60812.77 64267.88 58151.87
##  [377] 52079.18 26023.99 62318.38 56216.57 61806.31 51662.24 67080.94 51975.41
##  [385] 28019.09 67744.56 66574.00 30487.48 74903.41 19991.72 66050.63 70449.04
##  [393] 64008.55 70203.74 27262.51 49544.41 28357.27 66929.03 75524.78 66265.34
##  [401] 55993.68 56379.30 31215.88 51015.11 46473.14 55479.62 68713.70 34191.23
##  [409] 51067.54 46693.76 19345.36 66225.72 38609.20 37713.23 63764.28 41866.55
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##    [3] "Organic bottom-line service-desk"
##    [4] "Triple-buffered reciprocal time-frame"
##    [5] "Robust logistical utilization"
##    [6] "Sharable client-driven software"
##    [7] "Enhanced dedicated support"
##    [8] "Reactive local challenge"
##    [9] "Configurable coherent function"
##   [10] "Mandatory homogeneous architecture"
##   [11] "Centralized neutral neural-net"
##   [12] "Team-oriented grid-enabled Local Area Network"
##   [13] "Centralized content-based focus group"
##   [14] "Synergistic fresh-thinking array"
##   [15] "Grass-roots coherent extranet"
##   [16] "Persistent demand-driven interface"
##   [17] "Customizable multi-tasking website"
##   [18] "Intuitive dynamic attitude"
##   [19] "Grass-roots solution-oriented conglomeration"
##   [20] "Advanced 24/7 productivity"
##   [21] "Object-based reciprocal knowledgebase"
##   [22] "Streamlined non-volatile analyzer"
##   [23] "Mandatory disintermediate utilization"
##   [24] "Future-proofed methodical protocol"
##   [25] "Exclusive neutral parallelism"
##   [26] "Public-key foreground groupware"
##   [27] "Ameliorated client-driven forecast"
##   [28] "Monitored systematic hierarchy"
##   [29] "Open-architected impactful productivity"
##   [30] "Business-focused value-added definition"
##   [31] "Programmable asymmetric data-warehouse"
##   [32] "Digitized static capability"
##   [33] "Digitized global capability"
##   [34] "Multi-layered 4thgeneration knowledge user"
##   [35] "Synchronized dedicated service-desk"
##   [36] "Synchronized systemic hierarchy"
##   [37] "Profound stable product"
##   [38] "Reactive demand-driven capacity"
##   [39] "Persevering needs-based open architecture"
##   [40] "Intuitive exuding service-desk"
##   [41] "Innovative user-facing extranet"
##   [42] "Front-line intermediate database"
##   [43] "Persevering exuding system engine"
##   [44] "Balanced dynamic application"
##   [45] "Reduced global support"
##   [46] "Organic leadingedge secured line"
##   [47] "Business-focused encompassing neural-net"
##   [48] "Triple-buffered demand-driven alliance"
##   [49] "Visionary maximized process improvement"
##   [50] "Centralized 24/7 installation"
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##   [51] "Organized static focus group"
##   [52] "Visionary reciprocal circuit"
##   [53] "Pre-emptive value-added workforce"
##   [54] "Sharable analyzing alliance"
##   [55] "Team-oriented encompassing portal"
##   [56] "Sharable bottom-line solution"
##   [57] "Cross-group regional website"
##   [58] "Organized global model"
##   [59] "Upgradable asynchronous circuit"
##   [60] "Phased transitional instruction set"
##   [61] "Customer-focused empowering ability"
##   [62] "Front-line heuristic data-warehouse"
##   [63] "Stand-alone national attitude"
##   [64] "Focused upward-trending core"
##   [65] "Streamlined cohesive conglomeration"
##   [66] "Upgradable optimizing toolset"
##   [67] "Synchronized user-facing core"
##   [68] "Organized client-driven alliance"
##   [69] "Ergonomic multi-state structure"
##   [70] "Synergized multimedia emulation"
##   [71] "Customer-focused optimizing moderator"
##   [72] "Advanced full-range migration"
##   [73] "De-engineered object-oriented protocol"
##   [74] "Polarized clear-thinking budgetary management"
##   [75] "Customizable 6thgeneration knowledge user"
##   [76] "Seamless object-oriented structure"
##   [77] "Seamless real-time array"
##   [78] "Grass-roots impactful system engine"
##   [79] "Devolved tangible approach"
##   [80] "Customizable executive software"
##   [81] "Progressive analyzing attitude"
##   [82] "Innovative executive encoding"
##   [83] "Down-sized uniform info-mediaries"
##   [84] "Streamlined next generation implementation"
##   [85] "Distributed tertiary system engine"
##   [86] "Triple-buffered scalable groupware"
##   [87] "Total 5thgeneration encoding"
##   [88] "Integrated human-resource encoding"
##   [89] "Phased dynamic customer loyalty"
##   [90] "Open-source coherent policy"
##   [91] "Down-sized modular intranet"
##   [92] "Pre-emptive content-based focus group"
##   [93] "Versatile 4thgeneration system engine"
##   [94] "Ergonomic full-range time-frame"
##   [95] "Automated directional function"
##   [96] "Progressive empowering alliance"
##   [97] "Versatile homogeneous capacity"
##   [98] "Function-based optimizing protocol"
##   [99] "Up-sized secondary software"
##  [100] "Seamless holistic time-frame"
##  [101] "Persevering reciprocal firmware"
##  [102] "Centralized logistical secured line"
##  [103] "Innovative background conglomeration"
##  [104] "Switchable 3rdgeneration hub"
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##   [3] "Davidton"                "West Terrifurt"
##   [5] "South Manuel"            "Jamieberg"
##   [7] "Brandonstad"             "Port Jefferybury"
##   [9] "West Colin"              "Ramirezton"
##  [11] "West Brandonton"         "East Theresashire"
##  [13] "West Katiefurt"          "North Tara"
##  [15] "West William"            "New Travistown"
##  [17] "West Dylanberg"          "Pruittmouth"
##  [19] "Jessicastad"             "Millertown"
##  [21] "Port Jacqueline"         "Lake Nicole"
##  [23] "South John"              "Pamelamouth"
##  [25] "Harperborough"           "Port Danielleberg"
##  [27] "West Jeremyside"         "South Cathyfurt"
##  [29] "Palmerside"              "West Guybury"
##  [31] "Phelpschester"           "Lake Melindamouth"
##  [33] "North Richardburgh"      "Port Cassie"
##  [35] "New Thomas"              "Johnstad"
##  [37] "West Aprilport"          "Kellytown"
##  [39] "Charlesport"             "Millerchester"
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##  [43] "North Joshua"            "Bowenview"
##  [45] "Jamesberg"               "Lake Cassandraport"
##  [47] "New Sharon"              "Johnport"
##  [49] "Hamiltonfort"            "West Christopher"
##  [51] "Hollandberg"             "Odomville"
##  [53] "East Samanthashire"      "South Lauraton"
##  [55] "Amandahaven"             "Thomasview"
##  [57] "Garciaside"              "Port Sarahshire"
##  [59] "Port Gregory"            "Brendachester"
##  [61] "Lake Amy"                "Lake Annashire"
##  [63] "Smithburgh"              "North Leonmouth"
##  [65] "Robertfurt"              "Jasminefort"
##  [67] "Jensenborough"           "Bradleyburgh"
##  [69] "New Sheila"              "North Regina"
##  [71] "Davidmouth"              "New Michaeltown"
##  [73] "East Tammie"             "Wilcoxport"
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##  [77] "Ramirezhaven"            "Cranemouth"
##  [79] "Lake Edward"             "Lake Conniefurt"
##  [81] "East Shawnchester"       "West Joseph"
##  [83] "Lake Christopherfurt"    "East Tylershire"
##  [85] "Sharpberg"               "Lake Dustin"
##  [87] "North Kristine"          "Grahamberg"
##  [89] "New Tina"                "Nelsonfurt"
##  [91] "Christopherport"         "Port Sarahhaven"
##  [93] "Bradleyborough"          "Whiteport"
##  [95] "New Theresa"             "Wongland"
##  [97] "Williammouth"            "Williamsborough"
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## [109] "Hughesport"              "New Lucasburgh"
## [111] "Michelleside"            "Andersonton"
## [113] "New Rachel"              "Port Susan"
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## [127] "Stewartbury"             "North Wesleychester"
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## [193] "North Elizabeth"         "Kentmouth"
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## [263] "West Alyssa"             "Lake Craigview"
## [265] "Lake David"              "Bruceburgh"
## [267] "South Lauratown"         "Port Robin"
## [269] "Jacksonburgh"            "Erinmouth"
## [271] "Port Aliciabury"         "Port Whitneyhaven"
## [273] "Jeffreyshire"            "Tinaton"
## [275] "North Loriburgh"         "Wendyton"
## [277] "Lake Jacqueline"         "North Christopher"
## [279] "Alexanderfurt"           "West Pamela"
## [281] "West Amanda"             "South Tomside"
## [283] "Bethburgh"               "Jamiefort"
## [285] "Garciamouth"             "West Brenda"
## [287] "South Kyle"              "Combsstad"
## [289] "Lake Allenville"         "Greenechester"
## [291] "Jordantown"              "Gravesport"
## [293] "South Troy"              "Lake Patrick"
## [295] "Millerland"              "Port Jessicamouth"
## [297] "Paulport"                "Clineshire"
## [299] "Cynthiaside"             "Port Juan"
## [301] "Michellefort"            "Port Angelamouth"
## [303] "Jessicahaven"            "North Daniel"
## [305] "New Juan"                "Amyfurt"
## [307] "Harrishaven"             "Roberttown"
## [309] "Jeremyshire"             "Birdshire"
## [311] "New Amanda"              "Curtisview"
## [313] "Jacksonmouth"            "North April"
## [315] "Hayesmouth"              "South Corey"
## [317] "Juliaport"               "Port Paultown"
## [319] "East Vincentstad"        "Kimberlytown"
## [321] "New Steve"               "New Johnberg"
## [323] "Shawstad"                "New Rebecca"
## [325] "Jeffreyburgh"            "Faithview"
## [327] "Richardsontown"          "Port Brookeland"
## [329] "East Christopherbury"    "Port Christinemouth"
## [331] "South Meghan"            "Hessstad"
## [333] "Rhondaborough"           "Lewismouth"
## [335] "New Paul"                "Lake Angela"
## [337] "East Graceland"          "Hartport"
## [339] "East Yvonnechester"      "Burgessside"
## [341] "Hurleyborough"           "Garychester"
## [343] "East Kevinbury"          "Contrerasshire"
## [345] "Erikville"               "Robertsonburgh"
## [347] "Karenton"                "Port Kathleenfort"
## [349] "Lake Adrian"             "Mollyport"
## [351] "Sandraland"              "Charlenetown"
## [353] "Luischester"             "South Johnnymouth"
## [355] "Hannaport"               "East Anthony"
## [357] "West Daleborough"        "Morrismouth"
## [359] "North Andrewstad"        "West Tanya"
## [361] "Novaktown"               "Timothymouth"
## [363] "Robertmouth"             "Stephenborough"
```

```
## [365] "Lake Kurtmouth"          "Lauraburgh"
## [367] "Rogerburgh"              "Davidside"
## [369] "West Thomas"             "Andersonchester"
## [371] "North Ronaldshire"       "Greghaven"
## [373] "Jordanmouth"             "Meyersstad"
## [375] "South Robert"            "New Tyler"
## [377] "Jordanshire"             "Reyesland"
## [379] "New Traceystad"          "Port Brian"
## [381] "Lake Courtney"           "Samuelborough"
## [383] "Christinehaven"          "Thomasstad"
## [385] "Kristintown"             "New Wanda"
## [387] "Mariebury"               "Christopherville"
## [389] "New Jasmine"             "Lopezberg"
## [391] "Jenniferstad"            "West Eduardotown"
## [393] "Davisfurt"               "Bakerhaven"
## [395] "Paulshire"               "West Jane"
## [397] "Lake Brian"              "Alvaradoport"
## [399] "Lake Kevin"              "Richardsonland"
## [401] "East Sheriville"         "Port Michealburgh"
## [403] "Monicaview"              "Katieport"
## [405] "East Brittanyville"      "West Travismouth"
## [407] "Leonchester"             "Ramirezland"
## [409] "Brownton"                "New Jessicaport"
## [411] "New Denisebury"          "Keithtown"
## [413] "Port Melissastad"        "Janiceview"
## [415] "Mataberg"                "West Melaniefurt"
## [417] "Millerfort"              "Alexanderview"
## [419] "South Jade"              "Lake Susan"
## [421] "South Vincentchester"    "Williamsmouth"
## [423] "Taylorport"              "Williamsport"
## [425] "Emilyfurt"               "East Deborahhaven"
## [427] "Port Katelynview"        "Paulhaven"
## [429] "Elizabethmouth"          "Lake Jesus"
## [431] "North Tylerland"         "Munozberg"
## [433] "North Maryland"          "West Barbara"
## [435] "Andrewborough"           "New Gabriel"
## [437] "Port Patrickton"         "West Julia"
## [439] "New Keithburgh"          "Richardsland"
## [441] "North Aaronchester"      "Lake Matthewland"
## [443] "Kevinberg"               "Morganfort"
## [445] "Lovemouth"               "Taylorhaven"
## [447] "Jamesville"              "East Toddfort"
## [449] "East Dana"               "West Lucas"
## [451] "Butlerfort"              "Lindaside"
## [453] "West Chloeborough"       "Jayville"
## [455] "East Lindsey"            "Masseyshire"
## [457] "Sarahton"                "Ryanhaven"
## [459] "Lake Deborahburgh"       "New Williammouth"
## [461] "Port Blake"              "West Richard"
## [463] "Brandymouth"             "Sandraville"
## [465] "Port Jessica"            "Lake Jasonchester"
## [467] "Pearsonfort"             "Sellerstown"
## [469] "Yuton"                   "Smithtown"
## [471] "Joanntown"               "South Peter"
```

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## [473] "Port Mitchell"           "Pottermouth"
## [475] "Lake Jonathanview"       "Alanview"
## [477] "Carterport"              "New Daniellefort"
## [479] "Welchshire"              "Russellville"
## [481] "West Lisa"               "Greentown"
## [483] "Timothyport"             "Teresahaven"
## [485] "Lake Stephenborough"     "Silvaton"
## [487] "West Michaelstad"        "Florestown"
## [489] "New Jay"                 "North Lisachester"
## [491] "Port Stacy"              "Jensenton"
## [493] "North Alexandra"         "Rivasland"
## [495] "Helenborough"            "Garnerberg"
## [497] "North Anaport"           "Pattymouth"
## [499] "South Alexisborough"     "East Jennifer"
## [501] "Hallfort"                "New Charleschester"
## [503] "East Breannafurt"        "East Susanland"
## [505] "Estesfurt"               "Shirleyfort"
## [507] "Douglasview"             "South Lisa"
## [509] "Kingshire"               "Rebeccamouth"
## [511] "Brownbury"               "South Aaron"
## [513] "North Andrew"            "South Walter"
## [515] "Catherinefort"           "East Donna"
## [517] "North Kimberly"          "South Stephanieport"
## [519] "North Isabellaville"     "North Aaronburgh"
## [521] "Port James"              "Danielview"
## [523] "Port Stacey"             "West Kevinfurt"
## [525] "Lake Jennifer"           "Reyesfurt"
## [527] "West Carmenfurt"         "North Stephanieberg"
## [529] "East Valerie"            "Sherrishire"
## [531] "Port Daniel"             "Brownview"
## [533] "Greerton"                "Hatfieldshire"
## [535] "Brianabury"              "New Maria"
## [537] "Colebury"                "Calebberg"
## [539] "Lake Ian"                "Gomezport"
## [541] "Shaneland"               "East Aaron"
## [543] "Dustinborough"           "East Michaelland"
## [545] "East Connie"             "West Shannon"
## [547] "North Lauraland"         "Port Christopher"
## [549] "South Patrickfort"       "East Georgeside"
## [551] "Charlesbury"             "South Renee"
## [553] "South Jackieberg"        "Loriville"
## [555] "Amandaland"              "West Robertside"
## [557] "North Sarashire"         "Port Maria"
## [559] "East Jessefort"          "Port Anthony"
## [561] "Edwardmouth"             "Dustinchester"
## [563] "Rochabury"               "Austinland"
## [565] "Lake Gerald"             "Wrightview"
## [567] "Perryburgh"              "Tracyhaven"
## [569] "South Jaimeview"         "Sandersland"
## [571] "South Meredithmouth"     "Richardsonshire"
## [573] "Kimberlymouth"           "Meghanchester"
## [575] "Tammyshire"              "Lake Elizabethside"
## [577] "Villanuevaton"           "Greerport"
## [579] "North Garyhaven"         "East Sharon"
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## [581] "Johnstonmouth"           "East Heatherside"
## [583] "Richardsonmouth"         "Jenniferhaven"
## [585] "Boyerberg"               "Port Elijah"
## [587] "Knappburgh"              "New Dawnland"
## [589] "Chapmanmouth"            "Robertside"
## [591] "West Raymondmouth"       "Costaburgh"
## [593] "Kristineberg"            "Sandrashire"
## [595] "Andersonfurt"            "Tranland"
## [597] "Michaelland"             "East Rachaelfurt"
## [599] "Lake Johnbury"           "Elizabethstad"
## [601] "West Brad"               "Johnstonshire"
## [603] "Lake Timothy"            "Anthonyfurt"
## [605] "East Brettton"           "New Matthew"
## [607] "Christopherchester"      "Westshire"
## [609] "Alexisland"              "Kevinchester"
## [611] "New Patriciashire"       "Port Brenda"
## [613] "Port Brianfort"          "Portermouth"
## [615] "Hubbardmouth"            "South Brian"
## [617] "Hendrixmouth"            "Julietown"
## [619] "Lukeport"                "New Shane"
## [621] "Lake Jillville"          "Johnsonfort"
## [623] "Adamsbury"               "East Maureen"
## [625] "North Angelastad"        "Amandafort"
## [627] "Michaelmouth"            "Ronaldport"
## [629] "Port Davidland"          "Isaacborough"
## [631] "Lake Michael"            "West Michaelshire"
## [633] "Port Calvintown"         "Parkerhaven"
## [635] "Markhaven"               "Estradashire"
## [637] "Brianland"               "Cassandratown"
## [639] "West Dannyberg"          "East Debraborough"
## [641] "Frankchester"            "Lisafort"
## [643] "Colemanshire"            "Troyville"
## [645] "Hobbsbury"               "Harrisonmouth"
## [647] "Port Eugeneport"         "Karenmouth"
## [649] "Brendaburgh"             "New Christinatown"
## [651] "Jacksonstad"             "South Margaret"
## [653] "Port Georgebury"         "Sanderstown"
## [655] "Perezland"               "Luisfurt"
## [657] "New Karenberg"           "West Leahton"
## [659] "West Sharon"             "Klineside"
## [661] "Lake Cynthia"            "South Cynthiashire"
## [663] "Lake Jacob"              "West Samantha"
## [665] "Jeremybury"              "Blevinstown"
## [667] "Meyerchester"            "Reginamouth"
## [669] "Donaldshire"             "Salazarbury"
## [671] "Lake Joshuafurt"         "Wintersfort"
## [673] "Jamesmouth"              "Laurieside"
## [675] "Andrewmouth"             "West Angela"
## [677] "East Carlos"             "Kennedyfurt"
## [679] "Blairville"              "East Donnatown"
## [681] "Matthewtown"             "Brandonbury"
## [683] "New Jamestown"           "Mosleyburgh"
## [685] "Leahside"                "West Wendyland"
## [687] "Lawrenceborough"         "Kennethview"
```

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## [689] "West Mariafort"          "Port Sherrystad"
## [691] "West Melissashire"       "Lesliefort"
## [693] "Shawnside"               "Josephmouth"
## [695] "Garciatown"              "Chaseshire"
## [697] "Destinyfurt"             "Mezaton"
## [699] "New Kayla"               "Carsonshire"
## [701] "Jacquelineshire"         "South Blakestad"
## [703] "North Mark"              "Kingchester"
## [705] "Evansfurt"               "South Adamhaven"
## [707] "Brittanyborough"         "Barbershire"
## [709] "East Ericport"           "Crawfordfurt"
## [711] "Turnerville"             "Kylieview"
## [713] "West Zacharyborough"     "Watsonfort"
## [715] "Dayton"                  "Nicholasport"
## [717] "Whitneyfort"             "Coffeytown"
## [719] "North Johnside"          "Robinsonland"
## [721] "West Ericaport"          "Haleberg"
## [723] "West Michaelport"        "Ericksonmouth"
## [725] "Yangside"                "Estradafurt"
## [727] "Frankport"               "Williamsside"
## [729] "Johnsonview"             "East Heidi"
## [731] "New Angelview"           "Lake Brandonview"
## [733] "Morganport"              "Browntown"
## [735] "Lake Hailey"             "Olsonside"
## [737] "Coxhaven"                "Meaganfort"
## [739] "North Monicaville"       "Mullenside"
## [741] "Princebury"              "Bradleyside"
## [743] "Elizabethbury"           "West Ryan"
## [745] "New Tammy"               "Sanchezland"
## [747] "Rogerland"               "Vanessaview"
## [749] "Jessicashire"            "Melissachester"
## [751] "Johnsontown"             "New Joshuaport"
## [753] "Hernandezside"           "New Williamville"
## [755] "Gilbertville"            "Newmanberg"
## [757] "West Alice"              "Cannonbury"
## [759] "Shelbyport"              "New Henry"
## [761] "Dustinmouth"             "New Hollyberg"
## [763] "Port Brittanyville"      "East Ronald"
## [765] "South Davidmouth"        "Carterton"
## [767] "Rachelhaven"             "New Timothy"
## [769] "North Jessicaville"      "Staceyfort"
## [771] "South Dianeshire"        "Micheletown"
## [773] "North Brittanyburgh"     "Port Jasmine"
## [775] "New Sabrina"             "Lake Charlottestad"
## [777] "West Rhondamouth"        "North Debra"
## [779] "Villanuevastad"          "North Jeremyport"
## [781] "Lake John"               "Courtneyfort"
## [783] "Tammymouth"              "Lake Vanessa"
## [785] "Lake Amanda"             "Mariemouth"
## [787] "Port Douglasborough"     "Port Aprilville"
## [789] "Lake Faith"              "Wendyville"
## [791] "Angelhaven"              "New Sean"
## [793] "Lake Lisa"               "Valerieland"
## [795] "New Travis"              "North Samantha"
```

```
## [797] "Holderville"             "Patrickmouth"
## [799] "Lake Deannaborough"      "Jeffreymouth"
## [801] "Davieshaven"             "Lake Jessicaville"
## [803] "Hernandezchester"        "North Kennethside"
## [805] "Williamport"             "Smithside"
## [807] "Vanessastad"             "Lake Rhondaburgh"
## [809] "Cunninghamhaven"         "Robertstown"
## [811] "South Mark"              "New Taylorburgh"
## [813] "Port Karenfurt"          "Carterland"
## [815] "East Shawn"              "West Derekmouth"
## [817] "Brandiland"              "Cervantesshire"
## [819] "North Debrashire"        "Deannaville"
## [821] "East Christopher"        "Rickymouth"
## [823] "Port Dennis"             "Lake Michelle"
## [825] "East Johnport"           "Sabrinaview"
## [827] "Kristinfurt"             "Chapmanland"
## [829] "North Jonathan"          "Port Christina"
## [831] "Juanport"                "East Mike"
## [833] "North Angelatown"        "West Steven"
## [835] "Riggsstad"               "Davidview"
## [837] "Port Kevinborough"       "Lawsonshire"
## [839] "Wagnerchester"           "Daisymouth"
## [841] "Port Jacquelinestad"     "New Teresa"
## [843] "Henryfort"               "Lake Joseph"
## [845] "Daviesborough"           "North Brandon"
## [847] "Adamside"                "Wademouth"
## [849] "North Raymond"           "Randolphport"
## [851] "East Troyhaven"          "Clarkborough"
## [853] "Josephberg"              "Lake Jenniferton"
## [855] "Ashleymouth"             "Henryland"
## [857] "Lake Danielle"           "Joshuaburgh"
## [859] "South Jeanneport"        "New Nathan"
## [861] "Jonesshire"              "Mariahview"
## [863] "New Julianberg"          "Randyshire"
## [865] "Philipberg"              "West Dennis"
## [867] "Richardshire"            "Lake James"
## [869] "Austinborough"           "Alexandrafort"
## [871] "Melissastad"             "Gonzalezburgh"
## [873] "Port Jennifer"           "Chrismouth"
## [875] "Port Beth"               "West David"
## [877] "Fraziershire"            "South Pamela"
## [879] "North Laurenview"        "Campbellstad"
## [881] "Port Derekberg"          "West Andrew"
## [883] "West Randy"              "South Christopher"
## [885] "Lake Michellebury"       "Zacharyton"
## [887] "West James"              "Millerview"
## [889] "Hawkinsbury"             "Elizabethport"
## [891] "Wadestad"                "Mauriceshire"
## [893] "West Arielstad"          "Adamsstad"
## [895] "Blairborough"            "New Marcusbury"
## [897] "Evansville"              "Huffmanchester"
## [899] "New Cynthia"             "Joshuamouth"
## [901] "West Benjamin"           "Williamsfort"
## [903] "North Tiffany"           "Edwardsport"
```

```
## [905] "Lake Evantown"           "South Henry"
## [907] "Harmonhaven"             "West Gregburgh"
## [909] "Hansenland"              "Port Michaelmouth"
## [911] "Tylerport"               "West Lacey"
## [913] "North Jenniferburgh"     "South Davidhaven"
## [915] "North Charlesbury"       "Jonathanland"
## [917] "North Virginia"          "West Tanner"
## [919] "Jonesmouth"              "West Annefort"
## [921] "East Jason"              "North Cassie"
## [923] "Hintonport"              "New James"
## [925] "North Destiny"           "Mclaughlinbury"
## [927] "West Gabriellamouth"     "Alvarezland"
## [929] "New Julie"               "North Frankstad"
## [931] "Claytonside"             "Melanieton"
## [933] "Lake Michaelport"        "East Benjaminville"
## [935] "Garrettborough"          "Port Raymondfort"
## [937] "Waltertown"              "Cameronberg"
## [939] "Kaylashire"              "Fosterside"
## [941] "Davidstad"               "Lake Tracy"
## [943] "Taylormouth"             "Dianaville"
## [945] "Collinsburgh"            "Port Rachel"
## [947] "South Rebecca"           "Port Joshuafort"
## [949] "Robinsontown"            "Beckton"
## [951] "New Frankshire"          "North Derekville"
## [953] "West Sydney"             "Lake Matthew"
## [955] "Lake Zacharyfurt"        "Lindsaymouth"
## [957] "Sarahland"               "Michaelshire"
## [959] "Sarafurt"                "South Denise"
## [961] "North Katie"             "Mauricefurt"
## [963] "New Patrick"             "Edwardsmouth"
## [965] "Nicholasland"            "Duffystad"
## [967] "New Darlene"             "South Jessica"
## [969] "Ronniemouth"
##
## $Male
## [1] 0 1
##
## $Country
##   [1] "Tunisia"
##   [2] "Nauru"
##   [3] "San Marino"
##   [4] "Italy"
##   [5] "Iceland"
##   [6] "Norway"
##   [7] "Myanmar"
##   [8] "Australia"
##   [9] "Grenada"
##  [10] "Ghana"
##  [11] "Qatar"
##  [12] "Burundi"
##  [13] "Egypt"
##  [14] "Bosnia and Herzegovina"
##  [15] "Barbados"
##  [16] "Spain"
```

```
##  [17] "Palestinian Territory"
##  [18] "Afghanistan"
##  [19] "British Indian Ocean Territory (Chagos Archipelago)"
##  [20] "Russian Federation"
##  [21] "Cameroon"
##  [22] "Korea"
##  [23] "Tokelau"
##  [24] "Monaco"
##  [25] "Tuvalu"
##  [26] "Greece"
##  [27] "British Virgin Islands"
##  [28] "Bouvet Island (Bouvetoya)"
##  [29] "Peru"
##  [30] "Aruba"
##  [31] "Maldives"
##  [32] "Senegal"
##  [33] "Dominica"
##  [34] "Luxembourg"
##  [35] "Montenegro"
##  [36] "Ukraine"
##  [37] "Saint Helena"
##  [38] "Liberia"
##  [39] "Turkmenistan"
##  [40] "Niger"
##  [41] "Sri Lanka"
##  [42] "Trinidad and Tobago"
##  [43] "United Kingdom"
##  [44] "Guinea-Bissau"
##  [45] "Micronesia"
##  [46] "Turkey"
##  [47] "Croatia"
##  [48] "Israel"
##  [49] "Svalbard & Jan Mayen Islands"
##  [50] "Azerbaijan"
##  [51] "Iran"
##  [52] "Saint Vincent and the Grenadines"
##  [53] "Bulgaria"
##  [54] "Christmas Island"
##  [55] "Canada"
##  [56] "Rwanda"
##  [57] "Turks and Caicos Islands"
##  [58] "Norfolk Island"
##  [59] "Cook Islands"
##  [60] "Guatemala"
##  [61] "Cote d'Ivoire"
##  [62] "Faroe Islands"
##  [63] "Ireland"
##  [64] "Moldova"
##  [65] "Nicaragua"
##  [66] "Montserrat"
##  [67] "Timor-Leste"
##  [68] "Puerto Rico"
##  [69] "Central African Republic"
##  [70] "Venezuela"
```

```
##  [71] "Wallis and Futuna"
##  [72] "Jersey"
##  [73] "Samoa"
##  [74] "Antarctica (the territory South of 60 deg S)"
##  [75] "Albania"
##  [76] "Hong Kong"
##  [77] "Lithuania"
##  [78] "Bangladesh"
##  [79] "Western Sahara"
##  [80] "Serbia"
##  [81] "Czech Republic"
##  [82] "Guernsey"
##  [83] "Tanzania"
##  [84] "Bhutan"
##  [85] "Guinea"
##  [86] "Madagascar"
##  [87] "Lebanon"
##  [88] "Eritrea"
##  [89] "Guyana"
##  [90] "United Arab Emirates"
##  [91] "Martinique"
##  [92] "Somalia"
##  [93] "Benin"
##  [94] "Papua New Guinea"
##  [95] "Uzbekistan"
##  [96] "South Africa"
##  [97] "Hungary"
##  [98] "Falkland Islands (Malvinas)"
##  [99] "Saint Martin"
## [100] "Cuba"
## [101] "United States Minor Outlying Islands"
## [102] "Belize"
## [103] "Kuwait"
## [104] "Thailand"
## [105] "Gibraltar"
## [106] "Holy See (Vatican City State)"
## [107] "Netherlands"
## [108] "Belarus"
## [109] "New Zealand"
## [110] "Togo"
## [111] "Kenya"
## [112] "Palau"
## [113] "Cambodia"
## [114] "Costa Rica"
## [115] "Liechtenstein"
## [116] "Angola"
## [117] "Equatorial Guinea"
## [118] "Mongolia"
## [119] "Brazil"
## [120] "Chad"
## [121] "Portugal"
## [122] "Malawi"
## [123] "Singapore"
## [124] "Kazakhstan"
```

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## [125] "China"
## [126] "Vietnam"
## [127] "Mayotte"
## [128] "Jamaica"
## [129] "Bahamas"
## [130] "Algeria"
## [131] "Fiji"
## [132] "Argentina"
## [133] "Philippines"
## [134] "Suriname"
## [135] "Guam"
## [136] "Antigua and Barbuda"
## [137] "Georgia"
## [138] "Jordan"
## [139] "Saudi Arabia"
## [140] "Sao Tome and Principe"
## [141] "Cyprus"
## [142] "Kyrgyz Republic"
## [143] "Pakistan"
## [144] "Seychelles"
## [145] "Mauritania"
## [146] "Chile"
## [147] "Poland"
## [148] "Estonia"
## [149] "Latvia"
## [150] "Bahrain"
## [151] "Colombia"
## [152] "Brunei Darussalam"
## [153] "Taiwan"
## [154] "Saint Pierre and Miquelon"
## [155] "Finland"
## [156] "French Southern Territories"
## [157] "Sierra Leone"
## [158] "Tajikistan"
## [159] "Ecuador"
## [160] "Switzerland"
## [161] "France"
## [162] "Malaysia"
## [163] "Mauritius"
## [164] "Japan"
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##  [628] "2016-03-28 09:15:58" "2016-06-23 11:05:01" "2016-01-24 01:53:14"
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##  [691] "2016-02-11 11:50:26" "2016-03-16 20:33:10" "2016-04-25 19:31:39"
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##  [706] "2016-06-29 07:20:46" "2016-03-15 06:54:21" "2016-06-11 06:47:55"
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##  [757] "2016-06-10 00:35:15" "2016-01-04 00:44:57" "2016-01-01 15:14:24"
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##  [778] "2016-06-10 22:21:10" "2016-05-19 06:37:38" "2016-03-28 23:01:24"
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##  [793] "2016-02-03 22:11:13" "2016-02-02 19:59:17" "2016-04-07 20:38:02"
##  [796] "2016-03-15 19:35:19" "2016-03-11 12:39:19" "2016-05-17 18:06:46"
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##  [952] "2016-03-03 03:51:27" "2016-05-30 20:08:51" "2016-04-22 22:01:21"
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##  [979] "2016-05-24 17:07:08" "2016-03-30 14:36:55" "2016-05-27 05:54:03"
##  [982] "2016-01-03 16:30:51" "2016-06-25 18:17:53" "2016-02-24 10:36:43"
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##  [988] "2016-03-23 12:53:23" "2016-02-17 07:00:38" "2016-06-26 07:01:47"
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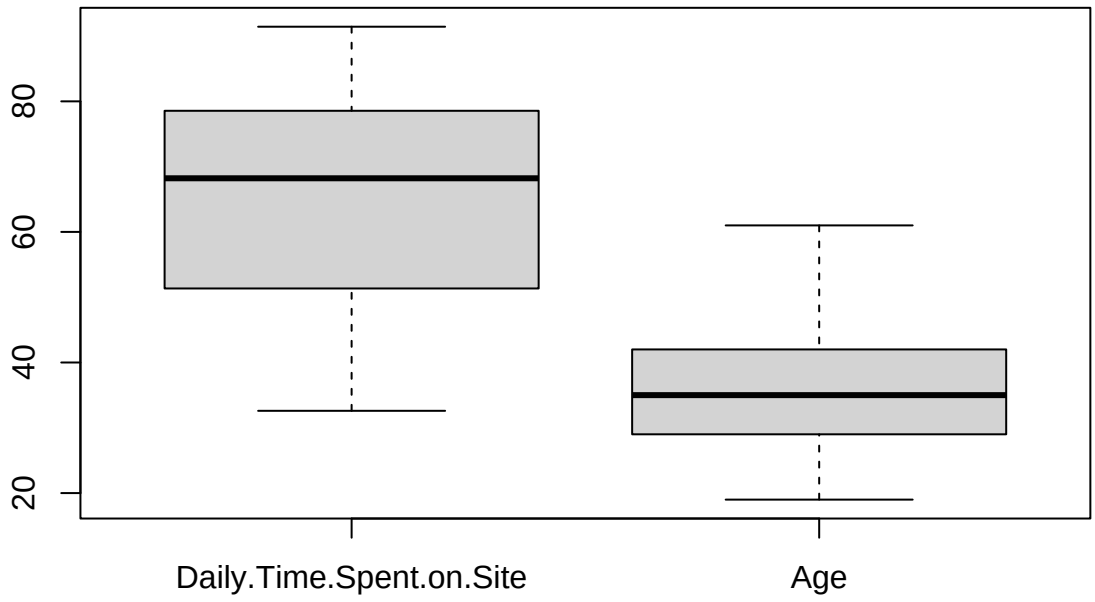
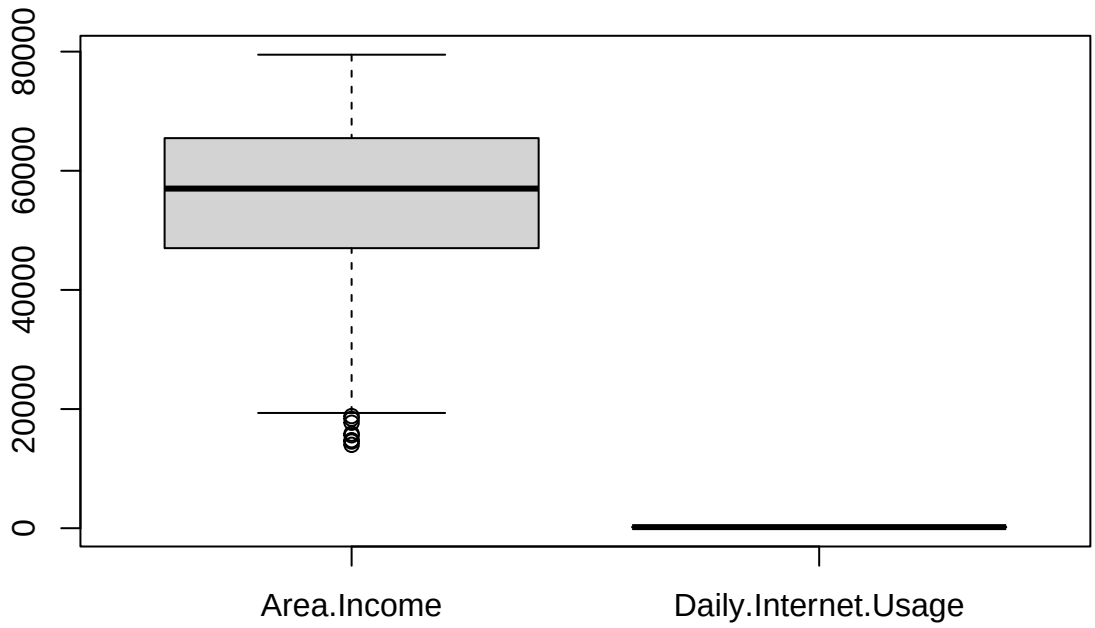
##  [997] "2016-04-22 02:07:01" "2016-02-01 17:24:57" "2016-03-24 02:35:54"
## [1000] "2016-06-03 21:43:21"
##
## $Clicked.on.Ad
## [1] 0 1
```

We have no noticeable anomalies when scheming the unique values

```
# Check for outliers in "Daily Time Spent on Site" and "Age"
boxplot(crypto[,1:2])
```



```
# Check for outliers in "Area Income"and"Daily Internet Usage"
boxplot(crypto[,3:4])
```



There are outliers in Area income, this makes sense because different people have different income which in turn affects area income

```
# Change the datatypes of male and clicked on ad to factor because the values
# represent whether someone is male or not and whether they clicked on the ad or not
crypto$"Male" <- as.factor(crypto$"Male")
crypto$"Clicked.on.Ad" <- as.factor(crypto$"Clicked.on.Ad")
```

```
# Confirm changes made
is.factor(crypto$"Male")
```

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

```
is.factor(crypto$"Clicked.on.Ad")
```

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

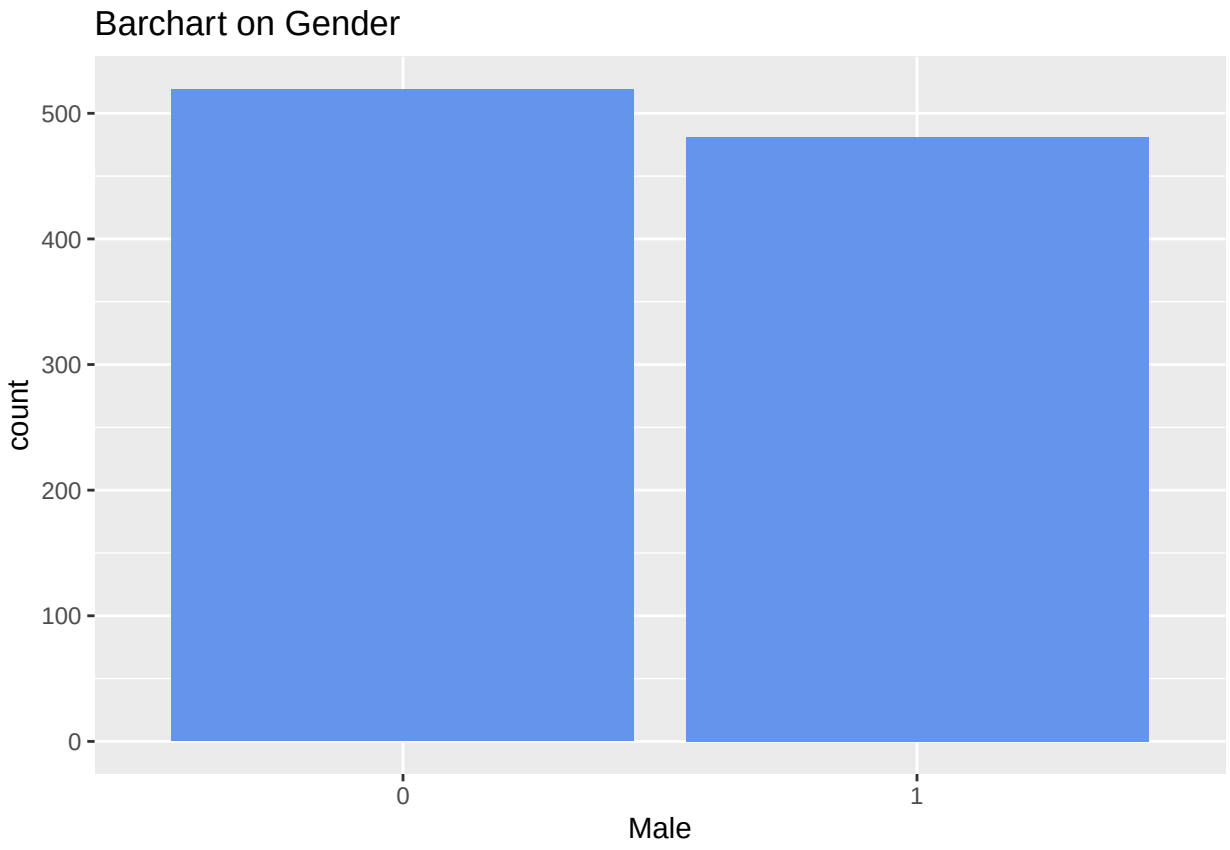
```
# Convert timestamp from character to date datatype
crypto$Timestamp <- as.Date(crypto$Timestamp)
typeof(crypto$Timestamp)
```

```
## [1] "double"
```

```
# Confirm changes made
glimpse(crypto)
```

```
## Rows: 1,000
## Columns: 10
## $ Daily.Time.Spent.on.Site <dbl> 68.95, 80.23, 69.47, 74.15, 68.37, 59.99, 88.~
## $ Age                      <int> 35, 31, 26, 29, 35, 23, 33, 48, 30, 20, 49, 3~
## $ Area.Income              <dbl> 61833.90, 68441.85, 59785.94, 54806.18, 73889~
## $ Daily.Internet.Usage     <dbl> 256.09, 193.77, 236.50, 245.89, 225.58, 226.7~
## $ Ad.Topic.Line            <chr> "Cloned 5thgeneration orchestration", "Monito~
## $ City                     <chr> "Wrightburgh", "West Jodi", "Davidton", "West~
## $ Male                     <fct> 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, ~
## $ Country                  <chr> "Tunisia", "Nauru", "San Marino", "Italy", "I~
## $ Timestamp                <date> 2016-03-27, 2016-04-04, 2016-03-13, 2016-01-~
## $ Clicked.on.Ad            <fct> 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, ~
```

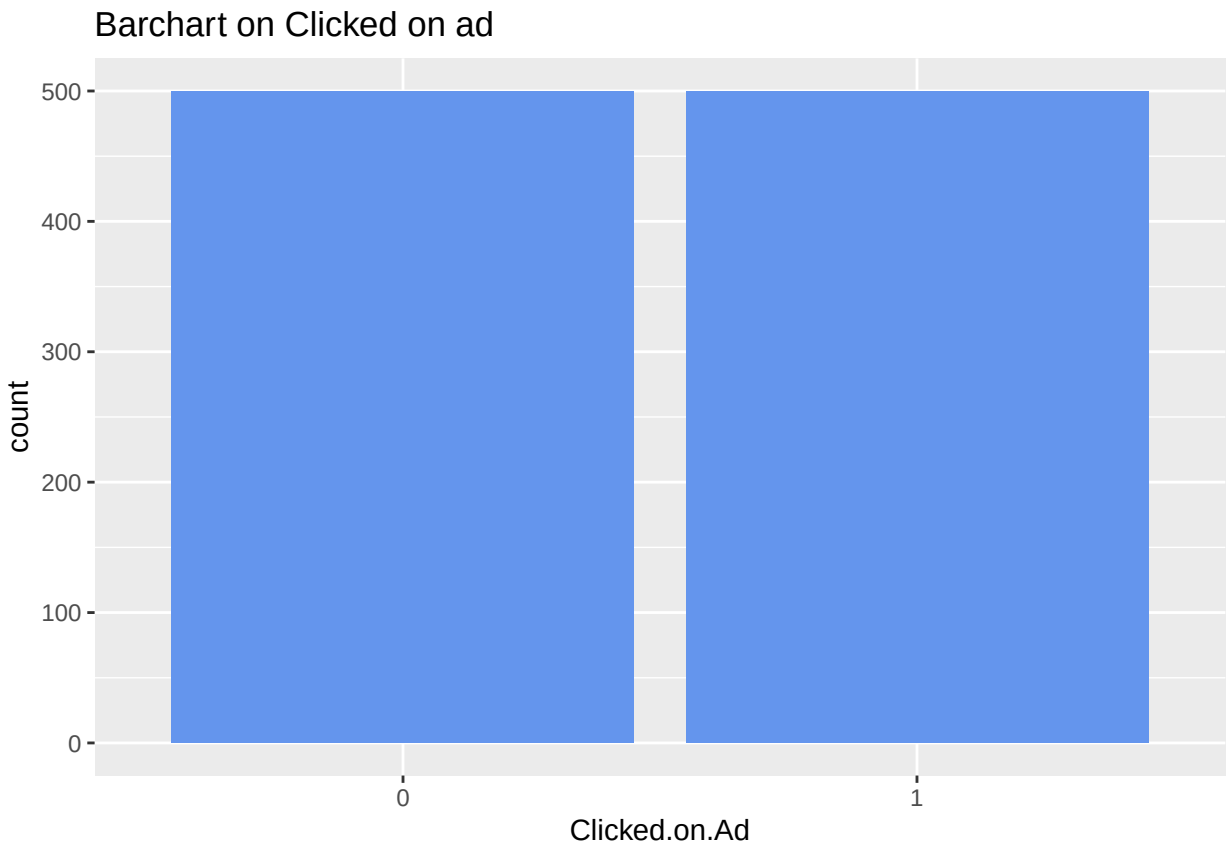
```
# Bar chart on Gender
gg.1 <- ggplot (data = crypto, aes(x= Male)) +
  geom_bar(fill = "cornflowerblue")
gg.1 + ggtitle("Barchart on Gender")
```



Most audience members are not male

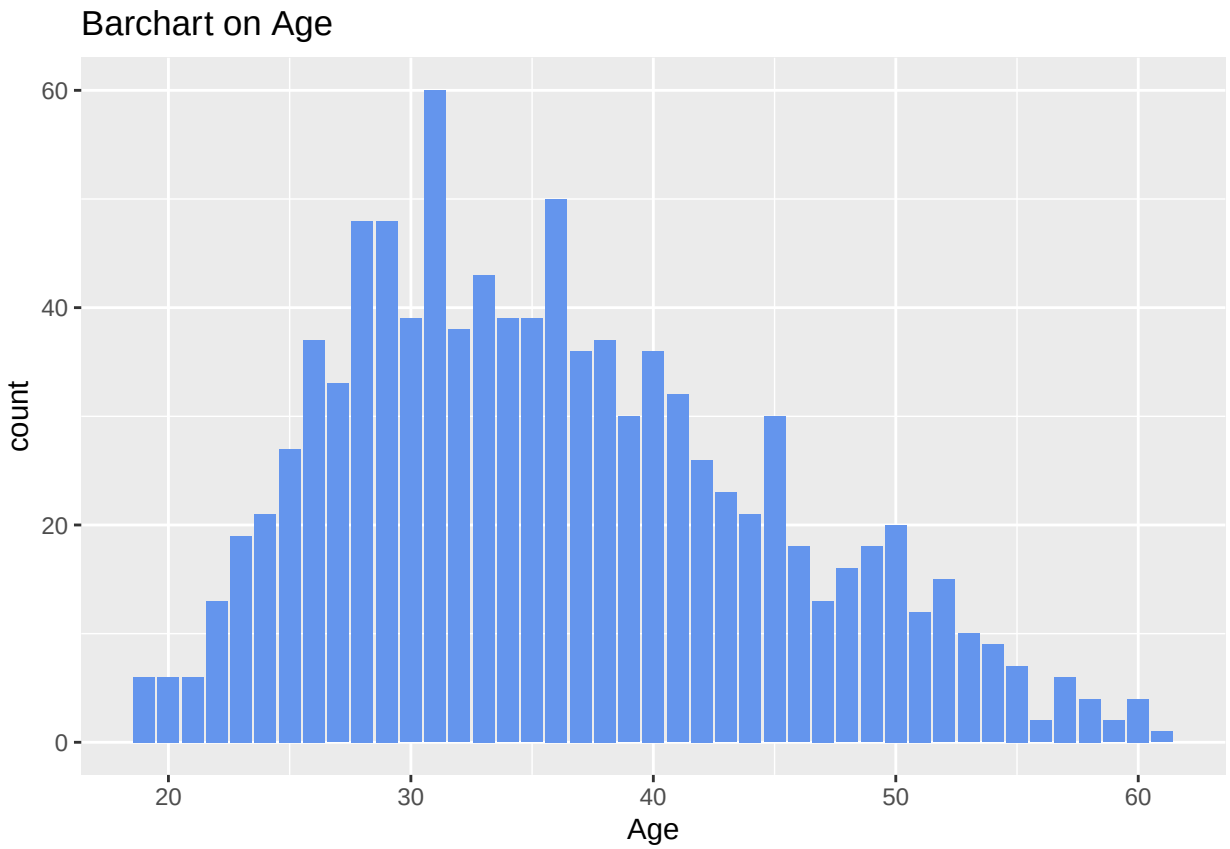
```
# Bar chart on Clicked on ad
gg_2 <- ggplot (data = crypto, aes(x= Clicked.on.Ad)) +
```

```
  geom_bar(fill = "cornflowerblue")
gg_2+ ggtitle("Barchart on Clicked on ad")
```



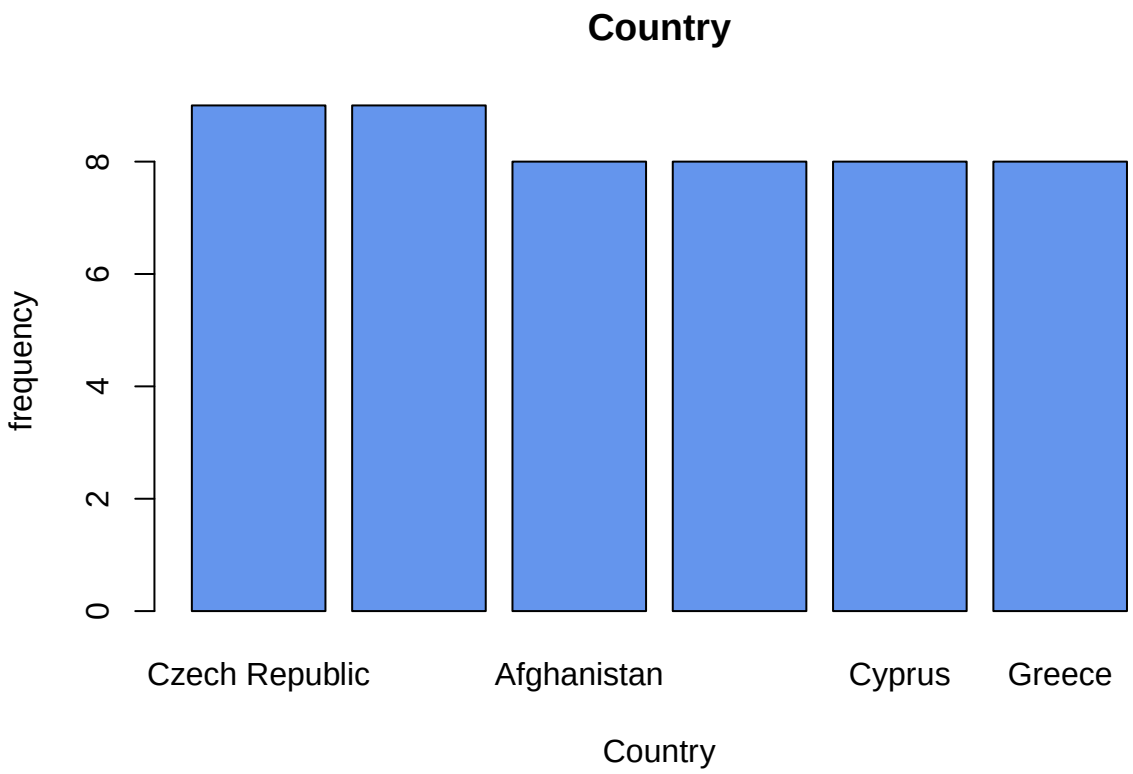
There's an equal number of people who clicked and did not click on the ad

```
# Bar chart on age
gg_3 <- ggplot (data = crypto, aes(x= Age)) +
  geom_bar(fill = "cornflowerblue")
gg_3 + ggtitle("Barchart on Age")
```



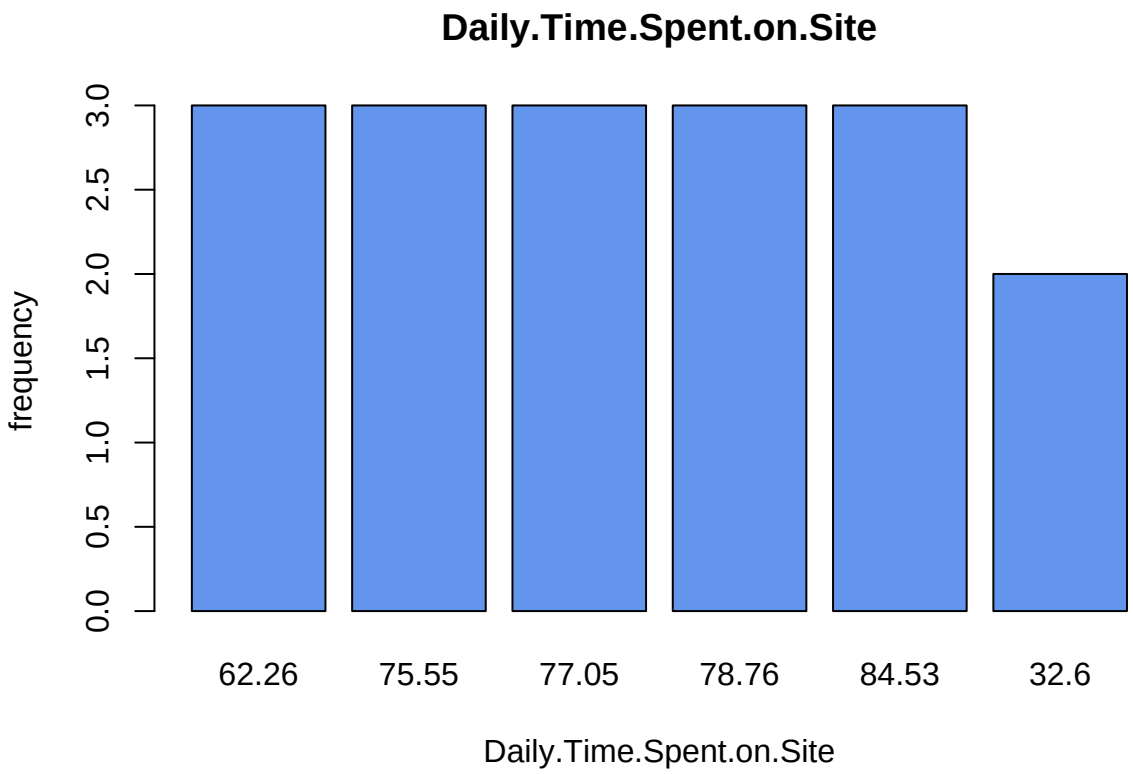
Most people are 31 years old

```
# Bar chart on Country
freq_country <- table(crypto$"Country")
barplot(head(sort(freq_country , decreasing = T), n=6),xlab =
          "Country", ylab = "frequency", main = "Country", col =
          "cornflowerblue")
```



Most people are from Czech Republic and France

```
# Bar chart on daily time spent on app
freq_time <- table(crypto$"Daily.Time.Spent.on.Site")
barplot(head(sort(freq_time , decreasing = T), n=6),xlab =
          "Daily.Time.Spent.on.Site", ylab = "frequency",
        main = "Daily.Time.Spent.on.Site",
        col =  "cornflowerblue")
```



The Most daily time spent on the site 62.26,75.55,77.05,78.76,84.53

```
# Frequency table on Daily internet usage
freq_int <- table(crypto$Daily.Internet.Usage)
head(sort(freq_int, decreasing = T), n= 50)
```

```
##
## 113.53 115.91  117.3  119.3 120.06 125.45 132.38 135.24 136.18 138.35 158.22
##      2      2      2      2      2      2      2      2      2      2      2
## 161.16 162.44 164.25 167.22  169.4 178.75 182.65 190.95 194.23 201.15 211.87
##      2      2      2      2      2      2      2      2      2      2      2
## 214.42 215.18 219.72 222.11 223.16 228.81 230.36 234.75 235.28 236.96 247.05
##      2      2      2      2      2      2      2      2      2      2      2
##  256.4 104.78    105 105.04 105.15 105.22 105.63 105.69 105.71 105.86 105.94
##      2      1      1      1      1      1      1      1      1      1      1
## 106.04 106.86 106.96 107.19 107.56 107.92
##      1      1      1      1      1      1
```

The most daily internet usage is 113.53 115.91 117.3 119.3 120.06 125.45 132.38 135.24 136.18 138.35 158.22 161.16 162.44 164.25 167.22 169.4 178.75 182.65 190.95 194.23 201.15 211.87 214.42 215.18 219.72 222.11 223.16 228.81 230.36 234.75 235.28 236.96 247.05 256.4

```
# Frequency table on City
freq_city <- table(crypto$City)
head(sort(freq_city, decreasing = T))
```

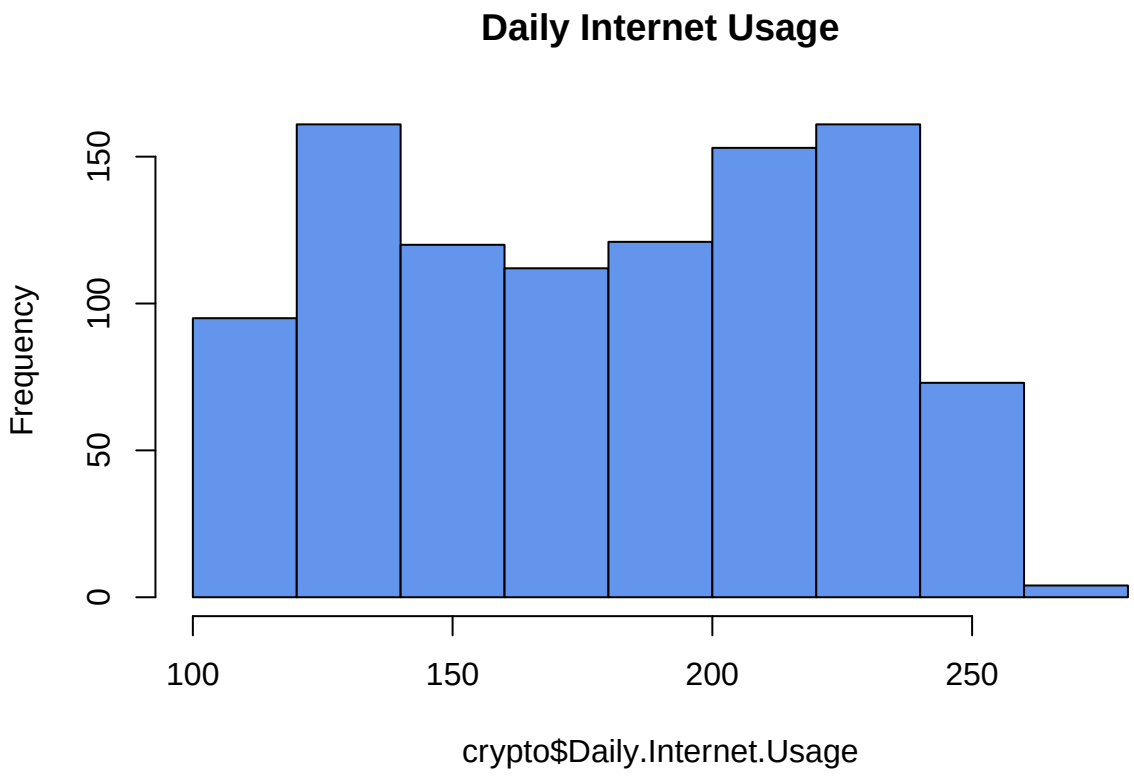
```
##
##       Lisamouth    Williamsport Benjaminchester       East John    East Timothy
##               3               3               2               2               2
##        Johnstad
##               2
```

Most people are from Lisamouth and Williamsport

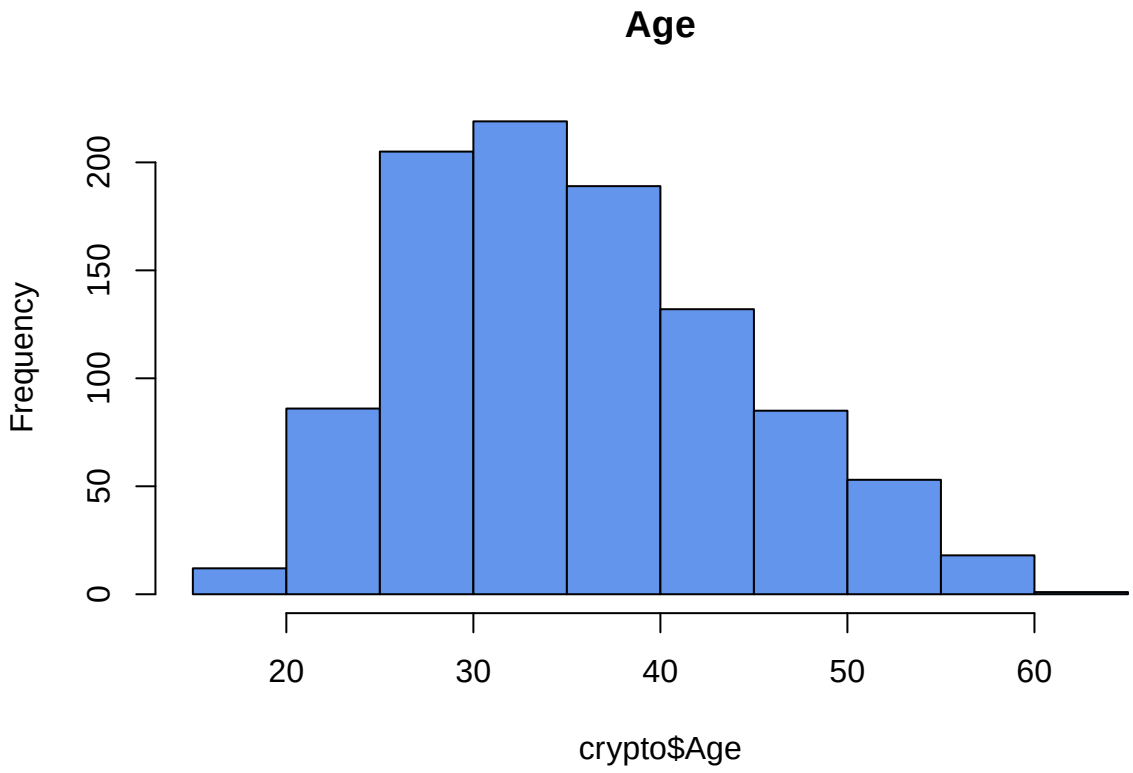
```
# Display the mean, median, mode, max , min and quantiles of our variables
summary(crypto)
```

```
##  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        0:519   Length:1000
##  Class :character   Class :character   1:481   Class :character
##  Mode  :character   Mode  :character           Mode  :character
##
##
##
##    Timestamp          Clicked.on.Ad
##  Min.   :2016-01-01   0:500
##  1st Qu.:2016-02-17   1:500
##  Median :2016-04-07
##  Mean   :2016-04-09
##  3rd Qu.:2016-05-31
##  Max.   :2016-07-24
```

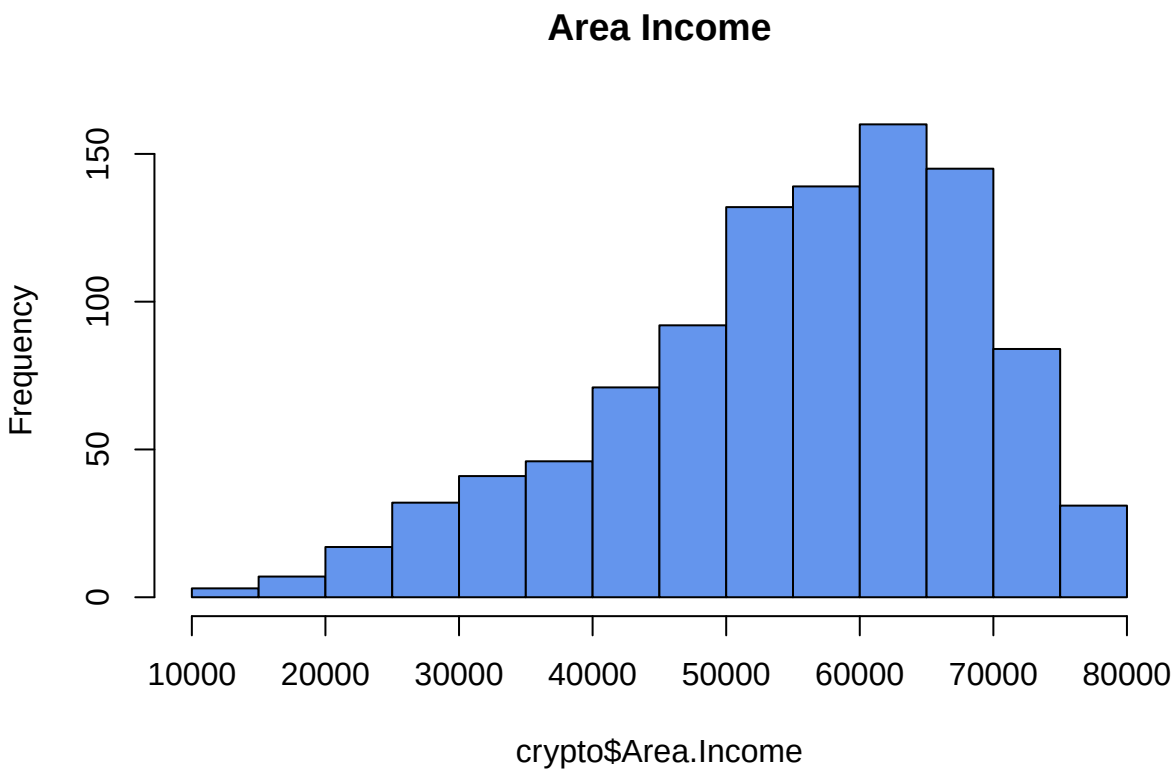
```
# Histogram of Daily.Time.Spent.on.Site
hist(crypto$Daily.Internet.Usage, col = "cornflowerblue",
     main ="Daily Internet Usage")
```



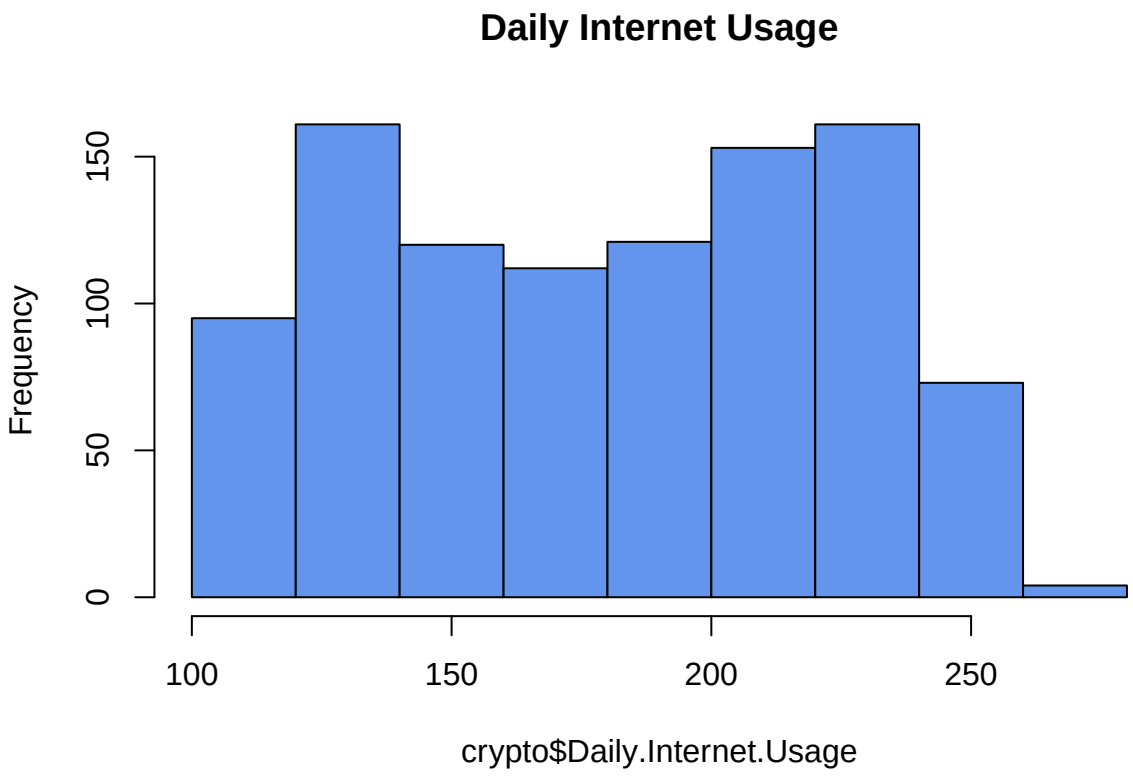

```
# Histogram of Age
hist(crypto$Age, col = "cornflowerblue", main ="Age")
```




```
# Histogram of Area income
hist(crypto$Area.Income, col = "cornflowerblue",main ="Area Income")
```

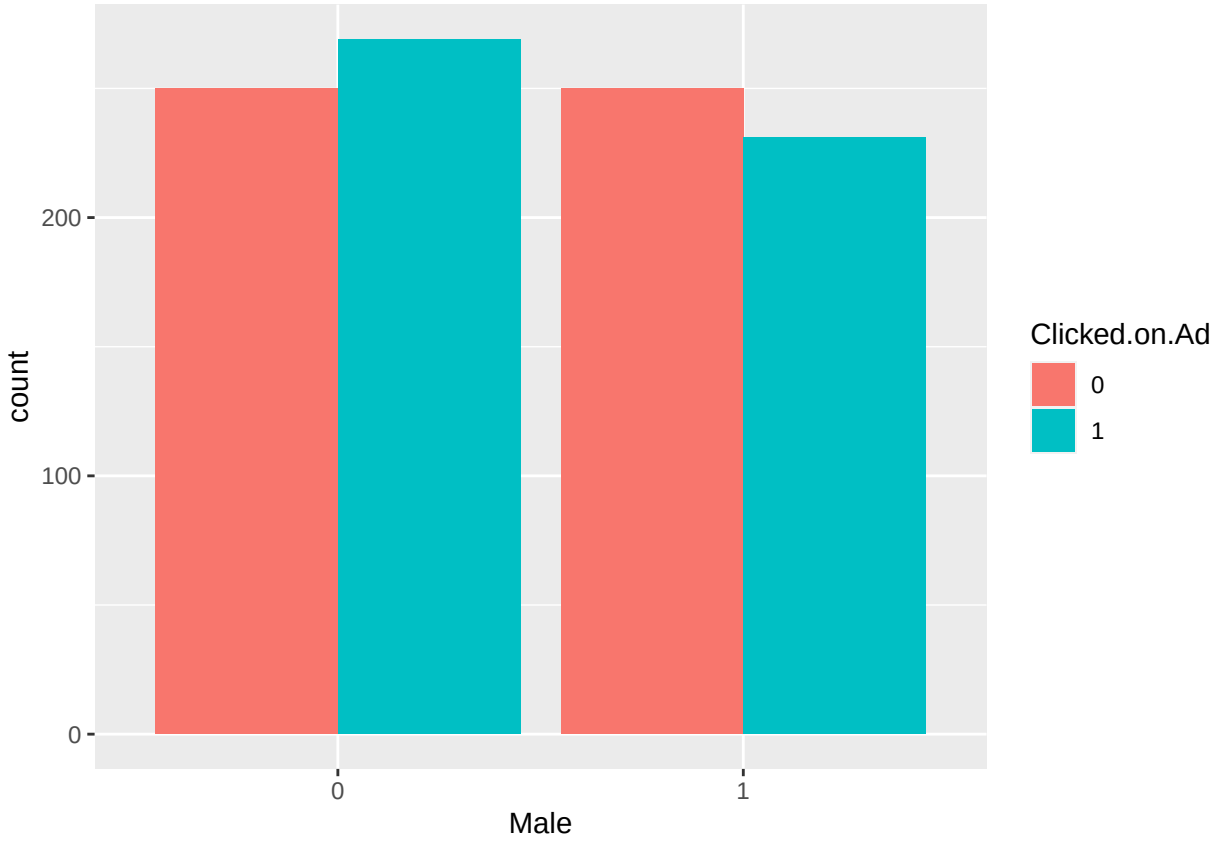



```
# Histogram of Daily internet usage
hist(crypto$Daily.Internet.Usage, col = "cornflowerblue",
     main ="Daily Internet Usage")
```



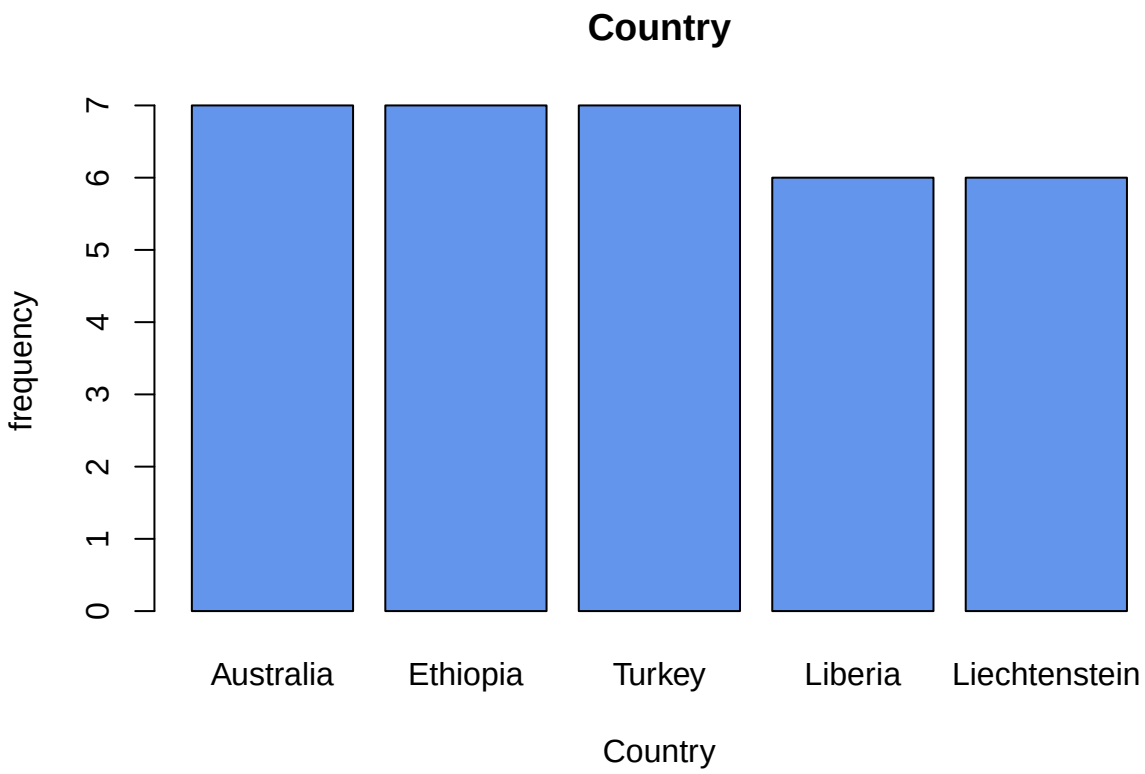
Bivariate analysis

```
# Bar chart of Gender vs Clicked on ad
ggplot(crypto, aes(Male, fill=Clicked.on.Ad)) + geom_bar(position = "dodge")
```



Most people who clicked on the ad are not male

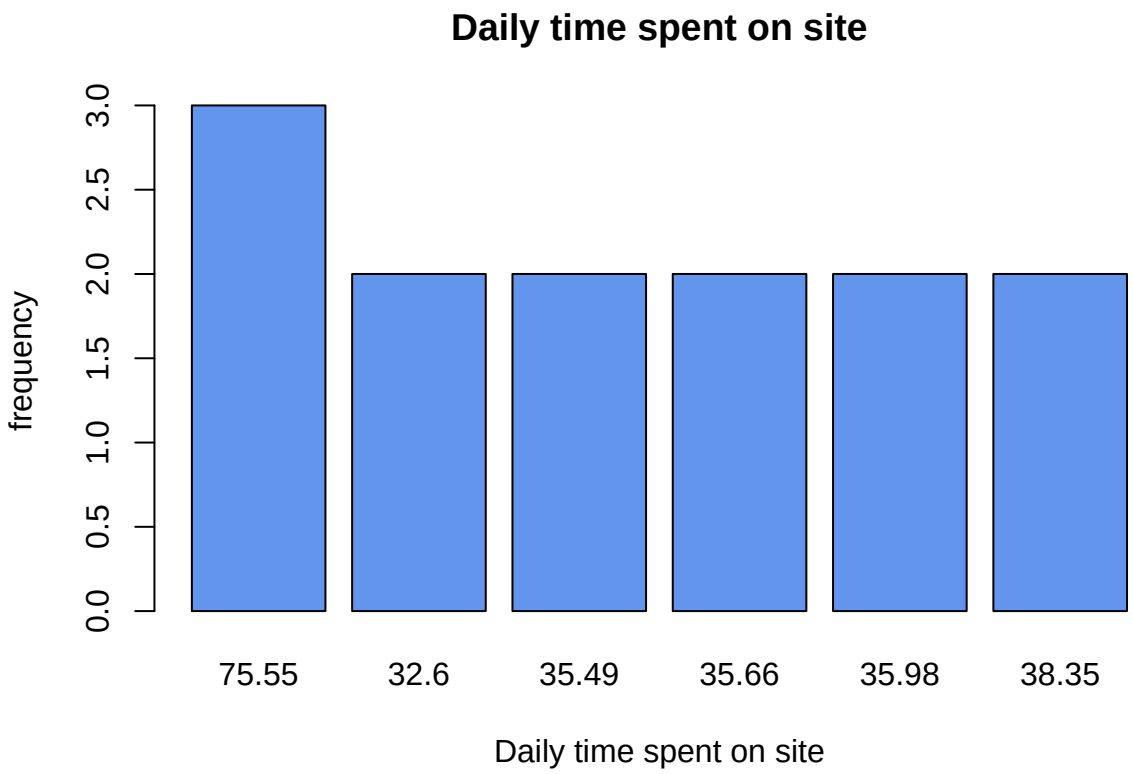
```
# Barchart of Gender vs Clicked on ad
# Filter out the dataset to only records where the ad was clicked
crypto_df <- crypto[crypto$Clicked.on.Ad == 1,]
# Countries that clicked the ad the most
freq_country_df <- table(crypto_df$"Country")
barplot(head(sort(freq_country_df , decreasing = T),n=5),
        xlab = "Country", ylab = "frequency", main = "Country",
        col = "cornflowerblue" )
```



Most people who clicked on the ad were from Australia, Ethiopia and Turkey

```
# Daily time spent on the site for people who clicked the ad
freq_dtime_df <- table(crypto_df$"Daily.Time.Spent.on.Site")

barplot(head(sort(freq_dtime_df , decreasing = T)),
        xlab = "Daily time spent on site",
        ylab = "frequency", main = "Daily time spent on site",
        col = "cornflowerblue")
```



Most people who clicked on the ad daily time spent on the site is 75.55

```
# Frequency table on Daily internet usage of people who clicked the ad
freq_int_df <- table(crypto_df$Daily.Internet.Usage)
head(sort(freq_int_df, decreasing = T), n=15)
```

```
##
## 113.53 115.91  117.3  119.3 120.06 125.45 132.38 135.24 136.18 138.35 158.22
##      2      2      2      2      2      2      2      2      2      2      2
## 161.16 167.22  169.4 104.78
##      2      2      2      1
```

Most people who clicked on the ad daily internet usage is 113.53 115.91 117.3 119.3 120.06 125.45 132.38 135.24 136.18 138.35 158.22 161.16 167.22 169.4

```
# Frequency table on the age of people who clicked the ad
freq_age_df <- table(crypto_df$Age)
head(sort(freq_age_df, decreasing = T))
```

```
##
## 45 36 38 41 42 40
## 27 25 25 22 20 19
```

Most people who clicked the ad were 45,36 and 38 years old

```
# Frequency table on City with the most people who clicked the ad
freq_city_df <- table(crypto_df$City)
head(sort(freq_city_df, decreasing = T),n=15)
```

```
##
##    Lake David    Lake James     Lisamouth  Michelleside    Millerbury
##             2             2             2             2             2
##    Robertfurt    South Lisa   West Amanda  West Shannon  Williamsport
##             2             2             2             2             2
##     Adamsbury      Adamside Alexanderfurt Alexanderview    Aliciatown
##             1             1             1             1             1
```

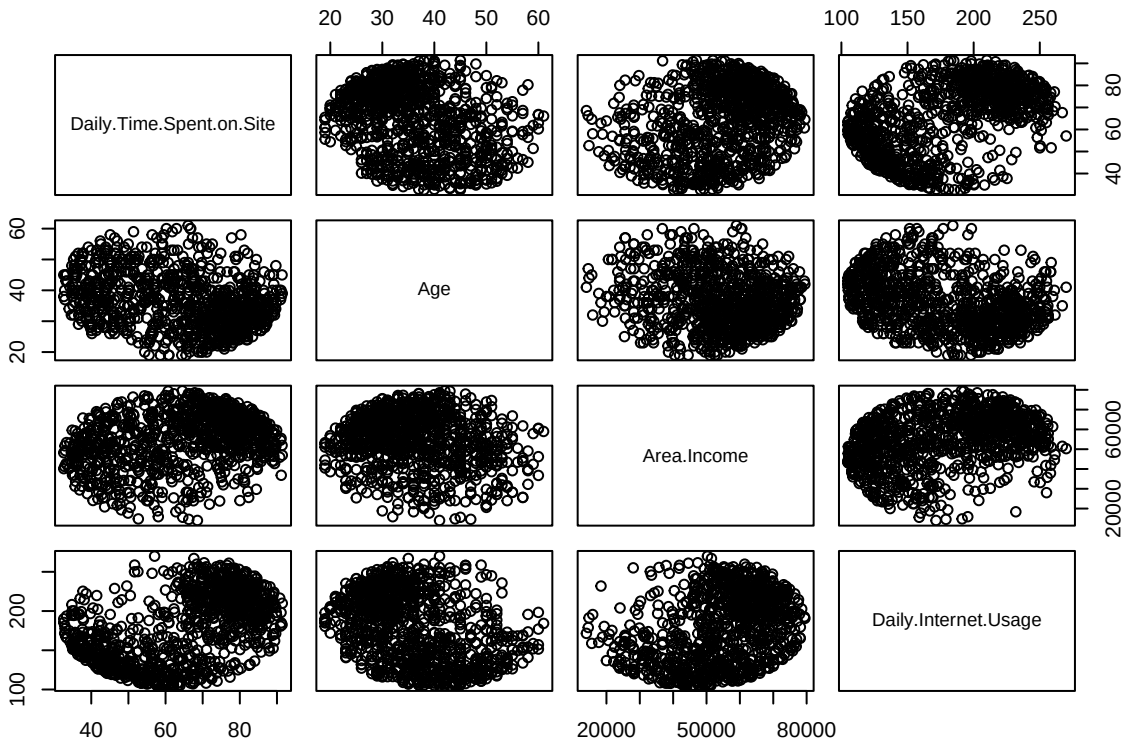
Most people who clicked on the ad were from Lake David Lake James Lisamouth Michelleside Millerbury Robertfurt South Lisa West Amanda West Shannon Williamsport

```
# Plot a correlation matrix
cor(crypto[,1:4])
```

```
##                           Daily.Time.Spent.on.Site        Age Area.Income
## Daily.Time.Spent.on.Site                1.0000000 -0.3315133   0.3109544
## Age                                    -0.3315133  1.0000000  -0.1826050
## Area.Income                             0.3109544 -0.1826050   1.0000000
## Daily.Internet.Usage                    0.5186585 -0.3672086   0.3374955
##                           Daily.Internet.Usage
## Daily.Time.Spent.on.Site            0.5186585
## Age                                -0.3672086
## Area.Income                         0.3374955
## Daily.Internet.Usage                1.0000000
```

There is a moderate positive correlation between Daily internet usage and daily time spent on site There is a weak negative correlation between daily time spent on site and area income There is a weak negative correlation between Daily internet usage and age

```
# Plot pairplot
pairs(crypto[,1:4])
```




```
# Load and install heatmaply package
library(heatmaply)
```

```
## Warning: package 'heatmaply' was built under R version 4.1.3
```

```
## Loading required package: plotly
```

```
##
## Attaching package: 'plotly'
```

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

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

```
## The following object is masked from 'package:graphics':
##
##     layout
```

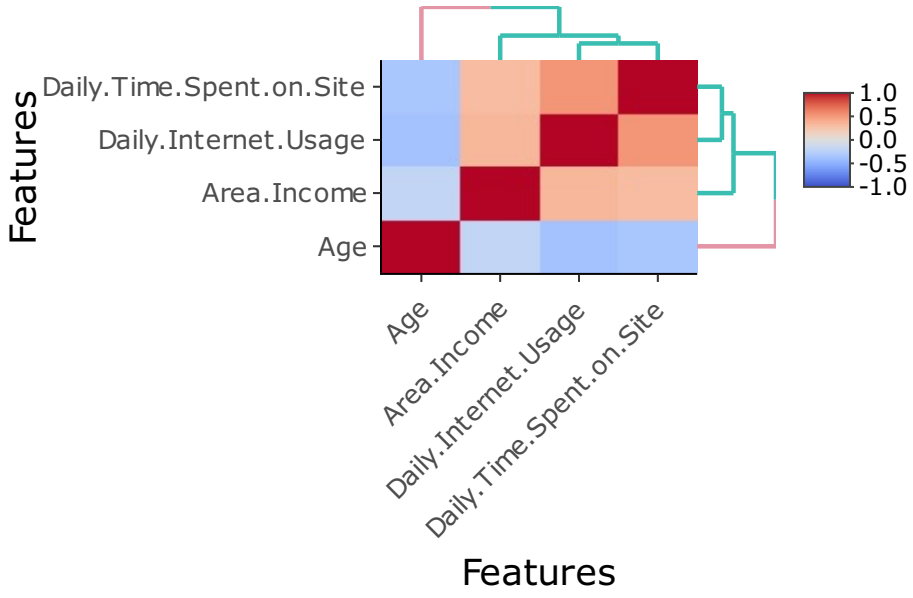
```
## Loading required package: viridis
```

```
## Warning: package 'viridis' was built under R version 4.1.3
```

```
## Loading required package: viridisLite
```

```
##
## ======================
## Welcome to heatmaply version 1.3.0
##
## Type citation('heatmaply') for how to cite the package.
## Type ?heatmaply for the main documentation.
##
## The github page is: https://github.com/talgalili/heatmaply/
## Please submit your suggestions and bug-reports at: https://github.com/talgalili/heatmaply/issues
## You may ask questions at stackoverflow, use the r and heatmaply tags:
##   https://stackoverflow.com/questions/tagged/heatmaply
## ======================
```

```r
# plotting corr heatmap
heatmaply_cor(x = cor(crypto[,1:4]), xlab = "Features",
              ylab = "Features", k_col = 2, k_row = 2)
```



Modelling

Data Preprocessing

```
# Label encoding our categorical variable
# We will start with converting our categorical data to numerical data type
# Convert our variables to factor datatype
final <- crypto
final$Country <- as.factor(final$Country)
final$City <- as.factor(final$City)
```

```
# Convert our variables from factor to numeric datatype
final$Country <- as.numeric(final$Country)
final$City <- as.numeric(final$City)
```

```
# Confirm the changes made
head(final)
```

```
##   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  Timestamp
## 1    Cloned 5thgeneration orchestration  962    0     216 2016-03-27
## 2    Monitored national standardization  904    1     148 2016-04-04
## 3      Organic bottom-line service-desk  112    0     185 2016-03-13
## 4 Triple-buffered reciprocal time-frame  940    1     104 2016-01-10
## 5         Robust logistical utilization  806    0      97 2016-06-03
## 6       Sharable client-driven software  283    1     159 2016-05-19
##   Clicked.on.Ad
## 1             0
## 2             0
## 3             0
## 4             0
## 5             0
## 6             0
```

```
# We will create a new dataframe without Ad topic line because it's not
# necessary in our analysis
final.df <- final[,c(1,2,3,4,6,7,8,10)]
head(final.df)
```

```
##   Daily.Time.Spent.on.Site Age Area.Income Daily.Internet.Usage City Male
## 1                    68.95  35    61833.90               256.09  962    0
## 2                    80.23  31    68441.85               193.77  904    1
## 3                    69.47  26    59785.94               236.50  112    0
## 4                    74.15  29    54806.18               245.89  940    1
## 5                    68.37  35    73889.99               225.58  806    0
```

```
## 6                   59.99  23    59761.56              226.74  283    1
##   Country Clicked.on.Ad
## 1     216             0
## 2     148             0
## 3     185             0
## 4     104             0
## 5      97             0
## 6     159             0
```

```
# Let's scale our data
final.df$Male <- as.numeric(final.df$Male)
final.scale <- final.df
final.scale[,c(-8)] <- scale(final.scale[,c(-8)])
head(final.scale)
```

```
##   Daily.Time.Spent.on.Site        Age Area.Income Daily.Internet.Usage
## 1                0.2491419 -0.1148475  0.50943618            1.7331628
## 2                0.9606516 -0.5701399  1.00202882            0.3136484
## 3                0.2819420 -1.1392555  0.35677007            1.2869451
## 4                0.5771428 -0.7977862 -0.01444841            1.5008289
## 5                0.2125572 -0.1148475  1.40816290            1.0382112
## 6               -0.3160289 -1.4807248  0.35495265            1.0646335
##         City       Male    Country Clicked.on.Ad
## 1  1.6994534 -0.9622138  1.4239054             0
## 2  1.4918000  1.0382307  0.4516733             0
## 3 -1.3437431 -0.9622138  0.9806820             0
## 4  1.6206883  1.0382307 -0.1774181             0
## 5  1.1409373 -0.9622138 -0.2775008             0
## 6 -0.7315236  1.0382307  0.6089462             0
```

Logistic Regrssion

```
# Splitting the data into train  and test sets
# Make this example reproducible
set.seed(100)

# Split the data into 70-30
sample <- sample(c(TRUE, FALSE), nrow(final.scale), replace=TRUE, prob=c(0.7,0.3))
train <- final.scale[sample, ]
test <- final.scale[!sample, ]
```

```
# Fit the model
logreg <- glm(Clicked.on.Ad ~Daily.Time.Spent.on.Site+Age+Area.Income+
                Daily.Internet.Usage+City+Male+Country,
              family="binomial", data=train)
```

```
# Disable scientific notation for model summary
options(scipen=999)

# Display model summary
summary(logreg)
```

```
##
## Call:
## glm(formula = Clicked.on.Ad ~ Daily.Time.Spent.on.Site + Age +
##     Area.Income + Daily.Internet.Usage + City + Male + Country,
##     family = "binomial", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.8674  -0.1051  -0.0310   0.0057   3.2836
##
## Coefficients:
##                           Estimate Std. Error z value         Pr(>|z|)
## (Intercept)                 2.5700     0.5529   4.648 0.00000334673980 ***
## Daily.Time.Spent.on.Site   -3.7445     0.5331  -7.024 0.00000000000215 ***
## Age                         2.1579     0.4061   5.314 0.00000010718910 ***
## Area.Income                -2.2849     0.4144  -5.514 0.00000003505436 ***
## Daily.Internet.Usage       -3.0523     0.4397  -6.942 0.00000000000387 ***
## City                       -0.6181     0.2964  -2.085           0.0371 *
## Male                       -0.3002     0.2837  -1.058           0.2899
## Country                     0.1013     0.2671   0.379           0.7044
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 941.116  on 678  degrees of freedom
## Residual deviance:  94.958  on 671  degrees of freedom
## AIC: 110.96
##
## Number of Fisher Scoring iterations: 9
```

More stars indicate more statistical significance. Hence Country and males are not statistically significant

```
# Predict test data
predict_logreg <- predict(logreg,test , type = "response")

# Changing probabilities
predict_logreg <- ifelse(predict_logreg >0.5, 1, 0)

# Evaluating model accuracy
# using confusion matrix
table(test$Clicked.on.Ad, predict_logreg)
```

```
##    predict_logreg
##       0   1
##   0 150   5
##   1   7 159
```

```
# Evaluating model accuracy
# using accuracy score
missing_classerr <- mean(predict_logreg != test$Clicked.on.Ad)
print(paste('Accuracy =', 1 - missing_classerr))
```

```
## [1] "Accuracy = 0.962616822429907"
```

```
#calculate VIF values for each predictor variable in our model
car::vif(logreg)
```

```
## Daily.Time.Spent.on.Site                     Age             Area.Income
##                 1.767940                2.021331                2.089243
##     Daily.Internet.Usage                    City                    Male
##                 1.640208                1.173471                1.041041
##                  Country
##                 1.025085
```

There is no presence of multicollinearity in our variables

KNN

```
# Fitting KNN Model
library(class)
```

```
## Warning: package 'class' was built under R version 4.1.3
```

```
knn.model <- knn(train = train[,c(-8)],
                      test = test[,c(-8)],
                      cl = train$Clicked.on.Ad,
                      k = 2)
# Confusion Matrix
cm <- table(test$Clicked.on.Ad, knn.model)
cm
```

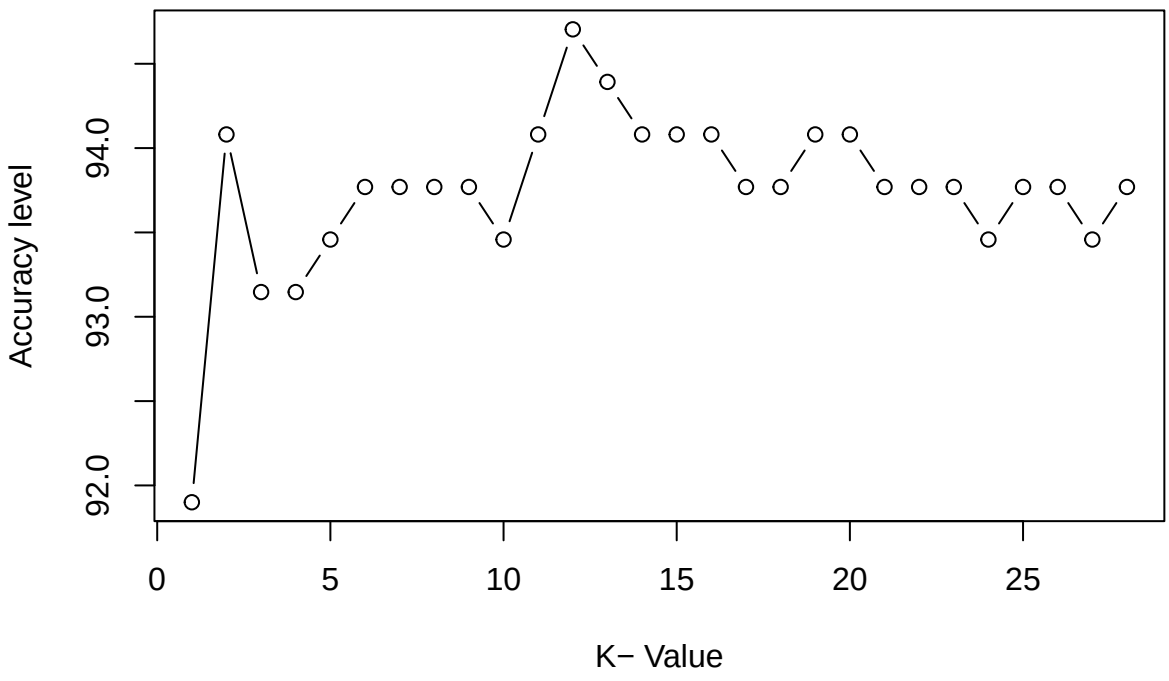
```
##    knn.model
##       0   1
##   0 146   9
##   1  17 149
```

```
# Find optimal k values
i=1
k.optm=1
for (i in 1:28){
    knn.mod <-  knn(train=train[,c(-8)], test=test[,c(-8)],
                    cl=train$Clicked.on.Ad, k=i)
    k.optm[i] <- 100 * sum(test$Clicked.on.Ad == knn.mod)/
      NROW(test$Clicked.on.Ad)
    k=i
    cat(k,'=',k.optm[i],'\n')
}
```

```
## 1 = 91.90031
## 2 = 94.081
## 3 = 93.14642
## 4 = 93.14642
## 5 = 93.45794
```

```
## 6 = 93.76947
## 7 = 93.76947
## 8 = 93.76947
## 9 = 93.76947
## 10 = 93.45794
## 11 = 94.081
## 12 = 94.70405
## 13 = 94.39252
## 14 = 94.081
## 15 = 94.081
## 16 = 94.081
## 17 = 93.76947
## 18 = 93.76947
## 19 = 94.081
## 20 = 94.081
## 21 = 93.76947
## 22 = 93.76947
## 23 = 93.76947
## 24 = 93.45794
## 25 = 93.76947
## 26 = 93.76947
## 27 = 93.45794
## 28 = 93.76947
```

```
# Plot to show the optimal k value
plot(k.optm, type="b", xlab="K- Value",ylab="Accuracy level")
```



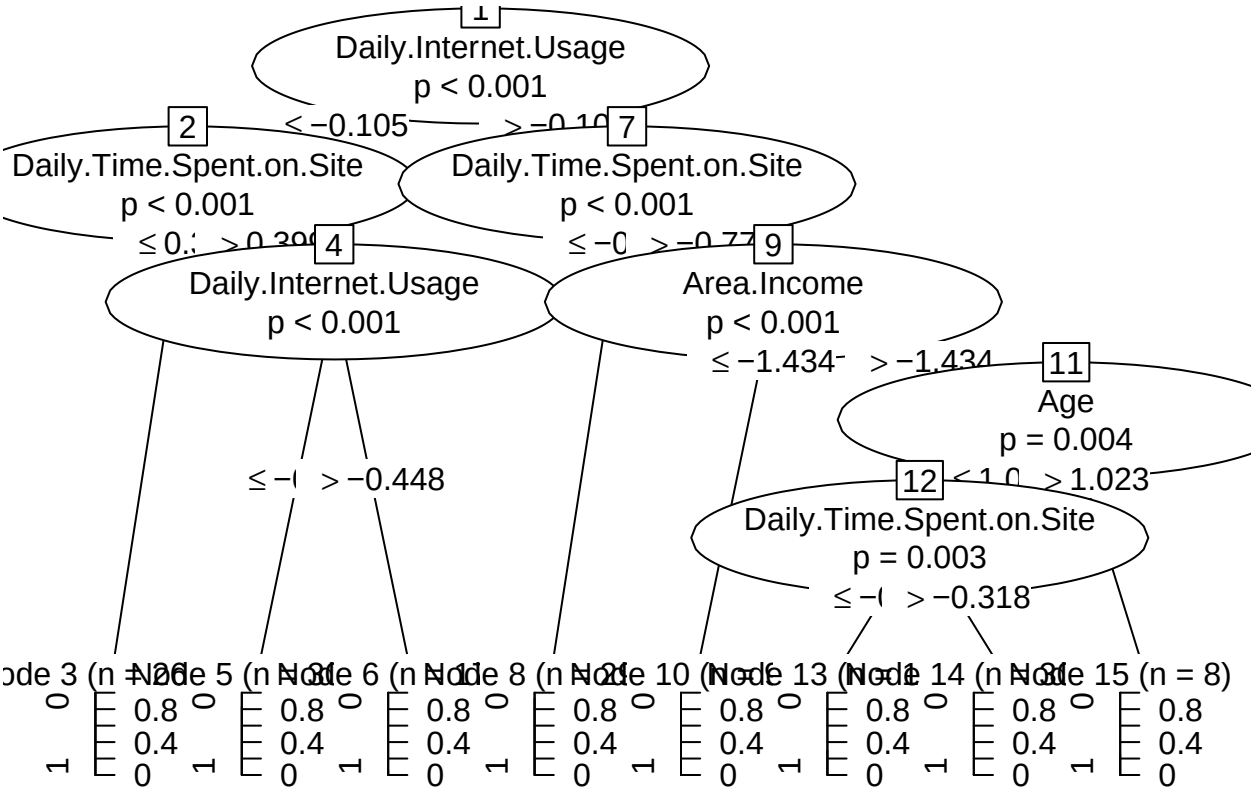
12 is the optimal value of k in our KNN model with an accuracy score of 94.70%

Decision Tree

```
# Fit the decision tree model
library("party")
```

```
## Warning: package 'party' was built under R version 4.1.3

## Loading required package: grid

## Loading required package: mvtnorm

## Loading required package: modeltools

## Loading required package: stats4

## Loading required package: strucchange

## Warning: package 'strucchange' was built under R version 4.1.3

## Loading required package: zoo

## Warning: package 'zoo' was built under R version 4.1.3

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

## Loading required package: sandwich

## Warning: package 'sandwich' was built under R version 4.1.3

##
## Attaching package: 'strucchange'

## The following object is masked from 'package:stringr':
##
##     boundary
```

```
tree.model <- ctree(Clicked.on.Ad ~Daily.Time.Spent.on.Site+Age+Area.Income+
                Daily.Internet.Usage+City+Male+Country , train)
# Plot the decision tree
plot(tree.model)
```



The variables used in our tree is Daily internet usage, Daily time spent on site, Area income and age

```
# Make predictions
predict_tree <-predict(tree.model, test)
# Evaluate the model
# using confusion matrix
cm.tree <- table(test$Clicked.on.Ad, predict_tree)
cm.tree
```

```
##    predict_tree
##       0   1
##   0 148   7
##   1  13 153
```

```
# Evaluate the model
# using accuracy score
sum(diag(cm.tree)) / sum(cm.tree)
```

```
## [1] 0.9376947
```

The decision tree model has an accuracy score of 93.77%

SVM

```
# Fit the SVM model
library("e1071")
```

```
## Warning: package 'e1071' was built under R version 4.1.3
```

```
## Registered S3 methods overwritten by 'proxy':
##   method               from
##   print.registry_field registry
##   print.registry_entry registry
```

```
model_svm = svm(formula = Clicked.on.Ad ~Daily.Time.Spent.on.Site+Age+
                  Area.Income+Daily.Internet.Usage+City+Male+Country,
                data = train, type = "C-classification", kernel = "linear")
model_svm
```

```
##
## Call:
## svm(formula = Clicked.on.Ad ~ Daily.Time.Spent.on.Site + Age + Area.Income +
##     Daily.Internet.Usage + City + Male + Country, data = train, type = "C-classification",
##     kernel = "linear")
##
##
## Parameters:
##    SVM-Type:  C-classification
##  SVM-Kernel:  linear
##        cost:  1
##
## Number of Support Vectors:  53
```

```
# Predicting with the test set
pred_svm  = predict(model_svm, newdata = test[-8])
# Evaluating our model
# using the Confusion Matrix
cm_svm = table(test[,8], pred_svm)
cm_svm
```

```
##    pred_svm
##       0   1
##   0 151   4
##   1   8 158
```

```
# Evaluate the model
# using accuracy score
sum(diag(cm_svm)) / sum(cm_svm)
```

```
## [1] 0.9626168
```

```
# SVM Polynomial Kernel
# Fit the model
poly_svm = svm(formula = Clicked.on.Ad ~Daily.Time.Spent.on.Site+Age+
```

```
                  Area.Income+Daily.Internet.Usage+City+Male+Country,
                data = train, type = "C-classification", kernel = "polynomial")
# Predicting with the test set
pred_svm_poly  = predict(poly_svm, newdata = test[-8])
# Evaluating our model
# using the Confusion Matrix
cm_svm_poly = table(test[,8], pred_svm_poly)
cm_svm_poly
```

```
##    pred_svm_poly
##       0   1
##   0 151   4
##   1  14 152
```

```
# Evaluate the model
# using accuracy score
sum(diag(cm_svm_poly)) / sum(cm_svm_poly)
```

```
## [1] 0.9439252
```

```
# SVM rbf Kernel
# Fit the model
rbf_svm = svm(formula = Clicked.on.Ad ~Daily.Time.Spent.on.Site+Age+
                  Area.Income+Daily.Internet.Usage+City+Male+Country,
                data = train, type = "C-classification", kernel = "radial")
# Predicting with the test set
pred_svm_rbf  = predict(rbf_svm, newdata = test[-8])
# Evaluating our model
# using the Confusion Matrix
cm_svm_rbf = table(test[,8], pred_svm_rbf)
cm_svm_rbf
```

```
##    pred_svm_rbf
##       0   1
##   0 149   6
##   1  11 155
```

```
# Evaluate the model
# using accuracy score
sum(diag(cm_svm_rbf)) / sum(cm_svm_rbf)
```

```
## [1] 0.9470405
```

The SVM model(linear kernel) performed the best with an accuracy score of 96.26%

Naive Bayes

```r
# Fitting the model
set.seed(100)
model_nb <- naiveBayes(Clicked.on.Ad ~Daily.Time.Spent.on.Site+Age+
                  Area.Income+Daily.Internet.Usage+City+Male+Country,
                  data = train)
model_nb
```

```
##
## Naive Bayes Classifier for Discrete Predictors
##
## Call:
## naiveBayes.default(x = X, y = Y, laplace = laplace)
##
## A-priori probabilities:
## Y
##         0         1
## 0.5081001 0.4918999
##
## Conditional probabilities:
##    Daily.Time.Spent.on.Site
## Y         [,1]      [,2]
##   0  0.7430886 0.4788745
##   1 -0.7645108 0.7981949
##
##    Age
## Y         [,1]      [,2]
##   0 -0.5338485 0.6920577
##   1  0.5074309 0.9796427
##
##    Area.Income
## Y         [,1]      [,2]
##   0  0.4916872 0.6329996
##   1 -0.5253211 1.0766753
##
##    Daily.Internet.Usage
## Y         [,1]      [,2]
##   0  0.7681619 0.5362102
##   1 -0.7944405 0.6805285
##
##    City
## Y          [,1]      [,2]
##   0  0.05560841 0.9647097
##   1 -0.04588787 0.9963754
##
##    Male
## Y          [,1]      [,2]
##   0  0.03510925 1.0016708
##   1 -0.02188510 0.9999255
##
##    Country
## Y          [,1]      [,2]
##   0 -0.03440131 0.9907891
##   1  0.01649755 0.9872385
```

```r
# Predicting with the test set
pred_nb <- predict(model_nb, newdata = test)
# Model Evaluation
# Confusion Matrix
cm_nb <- table(test$Clicked.on.Ad, pred_nb)
cm_nb
```

```
##    pred_nb
##       0   1
##   0 149   6
##   1   7 159
```

```r
# Accuracy score
sum(diag(cm_nb)) / sum(cm_nb)
```

```
## [1] 0.9595016
```

The naive bayes model has an accuracy score of 95.95%

Conclusion

Most people who clicked on the ad are not male

Most people who clicked on the ad were from Australia, Ethiopia and Turkey

Most people who clicked on the ad daily time spent on the site is 75.55

Most people who clicked on the ad daily internet usage is 113.53 115.91 117.3 119.3 120.06 125.45 132.38 135.24 136.18 138.35 158.22 161.16 167.22 169.4

Most people who clicked the ad were 45 ,36 and 38 years old

Most people who clicked on the ad were from Lake David,Lake James,Lisamouth,Michelleside, Millerbury Robertfurt,South Lisa, West Amanda ,West Shannon.Williamsport

Model Conclusions:

Model Accuracy score Logistic Regression 96.26% Decision Tree 93.77% KNN 94.70% Naive Bayes 95.95% SVM 96.26%

Recommendations

The company should target their ads to the people with the above characteristics. I would also recommend Logistic regression and Naive Bayes model in predicting whether or not someone clicks on an ad with an accuracy score of 96.26%