Assignment2_RandomForestxx

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```
library(rsample ) # data splitting
```

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

```
library(randomForest ) # basic implementation
```

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

```
## randomForest 4.7-1
```

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

```
library(ranger ) # a faster implementation of randomForest
```

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

```
##
## Attaching package: 'ranger'
```

```
## The following object is masked from 'package:randomForest':
##
##     importance
```

```
library(caret ) # an aggregator package for performing many machine learning models
```

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

```
##
## Attaching package: 'ggplot2'
```

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

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

```
library(h2o ) # an extremely fast java based platform
```

```
## Warning: package 'h2o' was built under R version 4.1.3
```

```
##
## ----------------------------------------------------------------------
##
## Your next step is to start H2O:
##     > h2o.init()
##
## For H2O package documentation, ask for help:
##     > ??h2o
##
## After starting H2O, you can use the Web UI at http://localhost:54321
## For more information visit https://docs.h2o.ai
##
## ----------------------------------------------------------------------
```

```
##
## Attaching package: 'h2o'
```

```
## The following objects are masked from 'package:stats':
##
##     cor, sd, var
```

```
## The following objects are masked from 'package:base':
##
##     %*%, %in%, &&, ||, apply, as.factor, as.numeric, colnames,
##     colnames<-, ifelse, is.character, is.factor, is.numeric, log,
##     log10, log1p, log2, round, signif, trunc
```

```
library(AmesHousing ) # The Carseat Data
```

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

```
library(broom )
```

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

```
library(ISLR)
library(rpart)
library(rpart.plot)
```

```
## Warning: package 'rpart.plot' was built under R version 4.1.2
```

```
library(class)
library(caret)
library(lattice)
library(ggplot2)
library(ISLR)
library(pROC)
```

```
## Type 'citation("pROC")' for a citation.

##
## Attaching package: 'pROC'

## The following object is masked from 'package:h2o':
##
##     var

## The following objects are masked from 'package:stats':
##
##     cov, smooth, var
```

```
library(tidyr)
library(dplyr)
```

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

## The following object is masked from 'package:randomForest':
##
##     combine

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

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

```
library(tidyverse)
```

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

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

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::combine()  masks randomForest::combine()
## x dplyr::filter()   masks stats::filter()
## x dplyr::lag()      masks stats::lag()
## x purrr::lift()     masks caret::lift()
## x ggplot2::margin() masks randomForest::margin()
```

```
library(e1071)
```

```
##
## Attaching package: 'e1071'
```

```
## The following object is masked from 'package:rsample':
##
##     permutations
```

```
library(rattle)
```

```
## Warning: package 'rattle' was built under R version 4.1.2
```

```
## Loading required package: bitops
```

```
## Rattle: A free graphical interface for data science with R.
## Version 5.4.0 Copyright (c) 2006-2020 Togaware Pty Ltd.
## Type 'rattle()' to shake, rattle, and roll your data.
```

```
##
## Attaching package: 'rattle'
```

```
## The following object is masked from 'package:ranger':
##
##     importance
```

```
## The following object is masked from 'package:randomForest':
##
##     importance
```

```
library(esquisse)
```

```
## Warning: package 'esquisse' was built under R version 4.1.2
```

```
library(magrittr)
```

```
##
## Attaching package: 'magrittr'
```

```
## The following object is masked from 'package:purrr':
##
##     set_names
```

```
## The following object is masked from 'package:tidyr':
##
##     extract
```

```
library(modeest)
```

```
## Warning: package 'modeest' was built under R version 4.1.2
```

```
## Registered S3 method overwritten by 'rmutil':
##   method         from
##   print.response httr
```

```
## Registered S3 method overwritten by 'statip':
##   method         from
##   predict.kmeans rattle

##
## Attaching package: 'modeest'

## The following object is masked from 'package:e1071':
##
##     skewness
```

```
library(corrplot)
```

```
## corrplot 0.90 loaded
```

```
library(rpart.plot)
library(boot)
```

```
##
## Attaching package: 'boot'

## The following object is masked from 'package:lattice':
##
##     melanoma
```

```
library(corrplot)
```

R Markdown

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Problem Statement

randomForest() Model

Data Preparation

```
getwd()
```

```
## [1] "C:/Users/Mukht/OneDrive/Desktop/Kent State University/54050-Project-ADM/Assignment2"
```

```
setwd("C:\\Users\\Mukht\\OneDrive\\Desktop\\Kent State University\\54050-Project-ADM\\Assignment2")
```

```
ADM_Assignment2RF<-read.csv("carseats_ADM.csv")
str(ADM_Assignment2RF)
```

```
## 'data.frame':    400 obs. of  11 variables:
##  $ ï..Sales   : num  9.5 11.22 10.06 7.4 4.15 ...
##  $ Income     : int  73 48 35 100 64 113 105 81 110 113 ...
##  $ Advertising: int  11 16 10 4 3 13 0 15 0 0 ...
##  $ Population : int  276 260 269 466 340 501 45 425 108 131 ...
##  $ Price      : int  120 83 80 97 128 72 108 120 124 124 ...
##  $ Age        : int  42 65 59 55 38 78 71 67 76 76 ...
##  $ Education  : int  17 10 12 14 13 16 15 10 10 17 ...
##  $ Urban      : chr  "Yes" "Yes" "Yes" "Yes" ...
##  $ US         : chr  "Yes" "Yes" "Yes" "Yes" ...
##  $ CompPrice  : int  138 111 113 117 141 124 115 136 132 132 ...
##  $ ShelveLoc  : chr  "Bad" "Good" "Medium" "Medium" ...
```

```
head(ADM_Assignment2RF)
```

```
##   ï..Sales Income Advertising Population Price Age Education Urban  US
## 1     9.50     73          11        276   120  42        17   Yes Yes
## 2    11.22     48          16        260    83  65        10   Yes Yes
## 3    10.06     35          10        269    80  59        12   Yes Yes
## 4     7.40    100           4        466    97  55        14   Yes Yes
## 5     4.15     64           3        340   128  38        13   Yes  No
## 6    10.81    113          13        501    72  78        16    No Yes
##   CompPrice ShelveLoc
## 1       138       Bad
## 2       111      Good
## 3       113    Medium
## 4       117    Medium
## 5       141       Bad
## 6       124       Bad
```

#Three of the variables are factors, while the rest are numeric. Currently there are no missing observations.

```
Carseats_Filteredx <- ADM_Assignment2RF %>% select("ï..Sales", "Price", "Advertising","Population","Age
Carseats_Filteredx
```

```
##     ï..Sales Price Advertising Population Age Income Education
## 1       9.50   120          11        276  42     73        17
## 2      11.22    83          16        260  65     48        10
## 3      10.06    80          10        269  59     35        12
## 4       7.40    97           4        466  55    100        14
## 5       4.15   128           3        340  38     64        13
## 6      10.81    72          13        501  78    113        16
## 7       6.63   108           0         45  71    105        15
## 8      11.85   120          15        425  67     81        10
## 9       6.54   124           0        108  76    110        10
## 10      4.69   124           0        131  76    113        17
## 11      9.01   100           9        150  26     78        10
## 12     11.96    94           4        503  50     94        13
```

```
## 13      3.98   136          2        393  62     35        18
## 14     10.96    86         11         29  53     28        18
## 15     11.17   118         11        148  52    117        18
## 16      8.71   144          5        400  76     95        18
## 17      7.58   110          0        284  63     32        13
## 18     12.29   131         13        251  52     74        10
## 19     13.91    68          0        408  46    110        17
## 20      8.73   121         16         58  69     76        12
## 21      6.41   131          2        367  35     90        18
## 22     12.13   109         12        239  62     29        18
## 23      5.08   138          6        497  42     46        13
## 24      5.87   109          0        292  79     31        10
## 25     10.14   113         16        294  42    119        12
## 26     14.90    82          0        176  54     32        11
## 27      8.33   131         11        496  50    115        11
## 28      5.27   107          0         19  64    118        17
## 29      2.99    97          0        359  55     74        11
## 30      7.81   102         15        226  58     99        17
## 31     13.55    89          0        447  30     94        12
## 32      8.25   131         16        241  44     58        18
## 33      6.20   137         12        236  64     32        10
## 34      8.77   128         13        317  50     38        16
## 35      2.67   128          0        406  42     54        17
## 36     11.07    96         11         29  44     84        17
## 37      8.89   100          0        270  60     76        18
## 38      4.95   110          5        412  54     41        10
## 39      6.59   102          0        454  65     73        15
## 40      3.24   138          0        144  38     60        10
## 41      2.07   126          0         18  73     98        17
## 42      7.96   124          0        403  58     53        16
## 43     10.43    24          0         25  50     69        18
## 44      4.12   134         11         16  59     42        13
## 45      4.16    95          6        325  69     79        13
## 46      4.56   135          0        168  44     63        12
## 47     12.44    70         14         16  48     90        15
## 48      4.38   108          0        173  55     98        16
## 49      3.91    98          0        349  69     52        18
## 50     10.61   149          0         51  32     93        17
## 51      1.42   108         18        341  80     32        16
## 52      4.42   108          0        150  75     90        16
## 53      7.91   129          3        112  39     40        18
## 54      6.92   119         13         39  61     64        17
## 55      4.90   144         13         25  76    103        17
## 56      6.85   154          5         60  61     81        18
## 57     11.91    84          0         54  50     82        17
## 58      0.91   117          0         22  75     91        11
## 59      5.42   103         15        188  74     93        16
## 60      5.21   114          4        148  80     71        13
## 61      8.32   123         19        469  29    102        13
## 62      7.32   107          0        358  26     32        13
## 63      1.82   133          0        146  77     45        17
## 64      8.47   101         10        170  61     88        13
## 65      7.80   104         12        184  32     67        16
## 66      4.90   128          0        197  55     26        13
```

```
## 67      8.85    91           0        508  56     92        18
## 68      9.01   115          14        152  47     61        16
## 69     13.39   134          20        366  60     69        13
## 70      7.99    99           0        339  65     59        12
## 71      9.46    99          15        237  74     81        12
## 72      6.50   150          16        148  58     51        17
## 73      5.52   116           0        432  25     45        15
## 74     12.61   104          10         54  31     90        11
## 75      6.20   136           5        125  64     68        13
## 76      8.55    92          23        480  36    111        16
## 77     10.64    70          10        346  64     87        15
## 78      7.70    89          12         44  67     71        18
## 79      4.43   145           1        139  65     48        12
## 80      9.14    90           0        286  41     67        13
## 81      8.01    79          16        353  68    100        11
## 82      7.52   128           0        237  70     72        13
## 83     11.62   139           4        325  28     83        17
## 84      4.42    94           7        468  56     36        11
## 85      2.23   121           0         52  43     25        18
## 86      8.47   112           0        304  49    103        13
## 87      8.70   134           9        432  64     84        15
## 88     11.70   126           7        272  54     67        16
## 89      6.56   111           7        144  62     42        10
## 90      7.95   119           3        493  45     66        16
## 91      5.33   103           0        491  64     22        11
## 92      4.81   107          11        267  80     46        15
## 93      4.53   125           0         97  29    113        12
## 94      8.86   104           0         67  55     30        17
## 95      8.39    84           5        134  55     97        11
## 96      5.58   148          10        237  59     25        13
## 97      9.48   132          10        407  73     42        16
## 98      7.45   129           5        287  33     82        16
## 99     12.49   127          24        382  36     77        16
## 100     4.88   107           3        220  56     47        16
## 101     4.11   106          11         94  76     69        12
## 102     6.20   118           0         89  34     93        18
## 103     5.30    97           0         57  65     22        16
## 104     5.07    96           0        334  78     91        17
## 105     4.62   138           0        472  51     96        12
## 106     5.55    97           8        398  61    100        11
## 107     0.16   139           0        217  70     33        18
## 108     8.55   108           0        104  60    107        12
## 109     3.47   103           2        488  65     79        16
## 110     8.98    90           0        217  60     65        17
## 111     9.00   116           7        125  43     62        14
## 112     6.62   151          12        272  43    118        14
## 113     6.67   125           5        298  62     99        12
## 114     6.01   127          11        335  33     29        12
## 115     9.31   106           9         17  65     87        13
## 116     8.54   129           0         95  42     35        13
## 117     5.08   128           0        202  80     75        10
## 118     8.80   119           0        507  41     53        12
## 119     7.57    99           2        243  62     88        11
## 120     7.37   128           8        137  64     94        12
```

```
## 121     6.87   131          11        249  63    105         13
## 122    11.67    87          10        380  28     89         10
## 123     6.88   108           5         45  75    100         10
## 124     8.19   155           0        125  29    103         15
## 125     8.87   120           0        181  63    113         14
## 126     9.34    49           0        181  43     78         15
## 127    11.27   133           2         60  59     68         16
## 128     6.52   116           3        192  51     48         14
## 129     4.96   126           3        350  55    100         13
## 130     4.47   147           7        279  40    120         10
## 131     8.41    77          13        497  51     84         12
## 132     6.50    94           3        208  77     69         16
## 133     9.54   136           9        232  72     87         10
## 134     7.62    97           2        265  62     98         12
## 135     3.67   131           0        327  76     31         16
## 136     6.44   120          14        384  36     94         18
## 137     5.17   120           0         10  31     75         18
## 138     6.52   118           0        436  80     42         11
## 139    10.27   109          12        371  44    103         10
## 140    12.30    94          10        310  30     62         13
## 141     6.03   129          10        277  45     60         18
## 142     6.53   131           0        331  28     42         15
## 143     7.44   104           0        300  77     84         15
## 144     0.53   159           7         36  28     88         17
## 145     9.09   123           0        264  34     68         11
## 146     8.77   117          11         27  47     63         17
## 147     3.90   131           0        412  39     83         14
## 148    10.51   119           9        402  41     54         16
## 149     7.56    97           0        384  72    119         14
## 150    11.48    87          13        140  56    120         11
## 151    10.49   114           8        176  57     84         10
## 152    10.77   103          17        407  75     58         17
## 153     7.64   128           0        341  45     78         13
## 154     5.93   150           7        488  25     36         17
## 155     6.89   110          10        289  50     69         16
## 156     7.71    69           0         59  65     72         16
## 157     7.49   157           0        220  51     34         16
## 158    10.21    90           8        249  48     58         13
## 159    12.53   112           1        189  39     90         10
## 160     9.32    70           0        372  30     60         18
## 161     4.67   111           0        486  29     28         12
## 162     2.93   160           5         81  67     21         12
## 163     3.63   149           0        424  51     74         13
## 164     5.68   106           0         40  39     64         17
## 165     8.22   141           0         58  27     64         13
## 166     0.37   191           7        100  27     58         15
## 167     6.71   137          17        151  55     67         11
## 168     6.71    93           0        216  60     73         13
## 169     7.30   117           0        425  45     89         10
## 170    11.48    77          15        492  73     41         18
## 171     8.01   118          12        356  71     39         10
## 172    12.49    55          12        416  75    106         15
## 173     9.03   110          13        123  35    102         16
## 174     6.38   128           5        207  66     91         18
```

```
## 175     0.00   185          0        358  79     24        15
## 176     7.54   122          0         38  25     89        12
## 177     5.61   154          9        480  47    107        11
## 178    10.48    94          0        148  27     72        17
## 179    10.66    81         14         89  25     71        14
## 180     7.78   116          3         70  77     25        18
## 181     4.94   149         15        434  66    112        13
## 182     7.43    91          0         79  68     83        11
## 183     4.74   140          4        230  25     60        13
## 184     5.32   102          6        426  80     74        18
## 185     9.95    97          7         35  60     33        11
## 186    10.07   107         11        449  64    100        10
## 187     8.68    86          0         93  46     51        17
## 188     6.03    96          0        142  62     32        17
## 189     8.07    90          0        426  76     37        15
## 190    12.11   104         18        509  26    117        15
## 191     8.79   101         13        297  37     37        13
## 192     6.67   173         13        170  74     42        14
## 193     7.56    93          0        408  56     26        14
## 194    13.28    96          7         71  61     70        10
## 195     7.23   128         18        481  45     98        11
## 196     4.19   112          4        420  66     93        11
## 197     4.10   133          6        410  72     28        16
## 198     2.52   138          0        333  76     61        16
## 199     3.62   128          5        500  69     80        10
## 200     6.42   126          5        335  64     88        14
## 201     5.56   146          0        349  62     92        12
## 202     5.94   134          0        139  54     83        18
## 203     4.10   130          4        413  46     78        10
## 204     2.05   157          0        132  25     82        14
## 205     8.74   124          0        237  37     80        14
## 206     5.68   132          1        317  28     22        12
## 207     4.97   160          0         27  77     67        17
## 208     8.19    97          0        466  61    105        10
## 209     7.78    64          0        497  33     54        12
## 210     3.02    90         11        326  76     21        11
## 211     4.36   123          2        357  47     41        14
## 212     9.39   120         14        445  32    118        15
## 213    12.04   105         19        501  45     69        11
## 214     8.23   139          5        220  33     84        10
## 215     4.83   107          3         48  73    115        18
## 216     2.34   144         15        170  71     83        11
## 217     5.73   144          0        243  34     33        17
## 218     4.34   111          0        481  70     44        14
## 219     9.70   120         12        156  25     61        14
## 220    10.62   116         19        359  58     79        17
## 221    10.59   124         15        262  30    120        10
## 222     6.43   107          0        125  80     44        11
## 223     7.49   145          6        178  35    119        13
## 224     3.45   125          9        276  62     45        14
## 225     4.10   141          0        464  48     82        13
## 226     6.68    82          0        412  36     25        14
## 227     7.80   122          0        245  56     33        14
## 228     8.69   101         10         68  57     64        16
```

```
## 229     5.40   163          13        381  26     73         11
## 230    11.19    72           0        404  27    104         18
## 231     5.16   114           0        119  38     60         14
## 232     8.09   122           0        123  27     69         11
## 233    13.14   105          10         24  61     80         15
## 234     8.65   120          18        218  29     76         14
## 235     9.43   129          11        289  56     62         16
## 236     5.53   132           8         95  50     32         17
## 237     9.32   108          16        361  69     34         10
## 238     9.62   135           8        499  48     28         10
## 239     7.36   133           0        200  73     24         13
## 240     3.89   118           0        149  62    105         16
## 241    10.31   121           0        362  26     80         18
## 242    12.01    94           0        160  38     63         12
## 243     4.68   135           0        199  52     46         14
## 244     7.82   110          13         87  57     25         10
## 245     8.78   100           0        391  26     30         18
## 246    10.00    88           0        199  57     43         10
## 247     6.90    90          20        266  78     56         18
## 248     5.04   151           0        298  34    114         16
## 249     5.36   101           0         12  61     52         11
## 250     5.05   117           0         86  65     67         11
## 251     9.16   156          10        435  72    105         14
## 252     3.72   132           5        310  62    111         13
## 253     8.31   117           0         70  32     97         16
## 254     5.64   122           5        288  57     24         12
## 255     9.58   129          23        353  37    104         17
## 256     7.71    81           8        198  80     81         15
## 257     4.20   144           0        277  73     40         10
## 258     8.67   112          14        477  80     62         13
## 259     3.47    81           0        251  72     38         14
## 260     5.12   100          10        467  74     36         11
## 261     7.67   101           8        400  36    117         10
## 262     5.71   118           4        188  54     42         15
## 263     6.37   132          15         86  48     77         18
## 264     7.77   115           6        434  25     26         17
## 265     6.95   159           5        324  31     29         15
## 266     5.31   129          10        402  39     35         17
## 267     9.10   112          12        343  73     93         17
## 268     5.83   112           7        473  51     82         12
## 269     6.53   105           0         66  39     57         11
## 270     5.01   166           0        438  46     69         17
## 271    11.99    89           0        284  26     26         10
## 272     4.55   110           0        504  62     56         16
## 273    12.98    63           0         14  38     33         12
## 274    10.04    86           8        244  58    106         12
## 275     7.22   119           2         67  34     93         11
## 276     6.67   132          11        210  53    119         11
## 277     6.93   130          14        296  73     69         15
## 278     7.80   125          12        326  36     48         16
## 279     7.22   151           2        129  40    113         15
## 280     3.42   158          13        376  64     57         18
## 281     2.86   145          10        496  51     86         10
## 282    11.19   105           7        303  45     69         16
```

```
## 283     7.74   154           0         80  61     96         11
## 284     5.36   117           0        112  80    110         16
## 285     6.97    96          11        414  79     46         17
## 286     7.60   131          11        261  39     26         10
## 287     7.53   113          11        429  67    118         18
## 288     6.88    72           4        208  44     44         17
## 289     6.98    97           0         74  76     40         15
## 290     8.75   156          25        448  43     77         17
## 291     9.49   103          14        400  41    111         11
## 292     6.64    89           0        106  39     70         17
## 293    11.82    74          16        322  76     66         15
## 294    11.28    89           0         74  59     84         10
## 295    12.66    99           3        126  60     76         11
## 296     4.21   137          14        502  79     35         10
## 297     8.21   123          13        160  63     44         18
## 298     3.07   104          13        276  75     83         10
## 299    10.98   130           0        312  63     63         15
## 300     9.40    96          17        497  54     40         17
## 301     8.57    99           1        158  45     78         11
## 302     7.41    87           0        198  57     93         16
## 303     5.28   110          13        388  74     77         14
## 304    10.01    99          16        290  43     52         11
## 305    11.93   134          12        408  29     98         10
## 306     8.03   132          26        394  33     29         13
## 307     4.78   133           1         85  48     32         12
## 308     5.90   120           0         13  61     92         12
## 309     9.24   126          19        436  52     80         10
## 310    11.18    80          13         33  68    111         18
## 311     9.53   166          29        419  53     65         12
## 312     6.15   132          12        328  51     68         14
## 313     6.80   135           5        337  38    117         10
## 314     9.33    54           3        491  66     81         13
## 315     7.72   129          10        333  71     33         14
## 316     6.39   171           8        220  29     21         14
## 317    15.63    72           5        369  35     36         10
## 318     6.41   136           0        472  80     30         15
## 319    10.08   130          10        456  41     72         14
## 320     6.97   129          19        459  57     45         11
## 321     5.86   152          12        171  44     70         18
## 322     7.52    98           5        499  34     39         15
## 323     9.16   139          10        300  60     50         15
## 324    10.36   103          18        428  34    105         12
## 325     2.66   150           4        133  53     65         13
## 326    11.70   104          11        131  47     69         11
## 327     4.69   122           0        152  53     30         17
## 328     6.23   104          17        316  80     38         16
## 329     3.15   111           1         65  55     66         11
## 330    11.27    89           9        433  45     54         12
## 331     4.99   112           0        501  32     59         14
## 332    10.10   134          15        213  32     63         10
## 333     5.74   104          20        354  61     33         12
## 334     5.87   147           7        303  41     60         10
## 335     7.63    83           9        489  42    117         13
## 336     6.18   110          15        464  72     70         15
```

```
## 337     5.17   143           6         60  28     35         18
## 338     8.61   102           0        283  80     38         15
## 339     5.97   101           0        164  45     24         11
## 340    11.54   126           4        219  44     44         15
## 341     7.50    91           0        105  43     29         16
## 342     7.38    93           0        268  72    120         10
## 343     7.81   118          13        422  71    102         10
## 344     5.99   121          10        371  26     42         14
## 345     8.43   126           0        108  70     80         13
## 346     4.81   149           0        279  79     68         12
## 347     8.97   125           0        144  33    107         13
## 348     6.88   112           0        161  27     39         14
## 349    12.57   107          20        459  49    102         11
## 350     9.32    96          18        467  49     27         14
## 351     8.64    91          17        266  63    101         17
## 352    10.44   105          16        458  62    115         16
## 353    13.44   122          14        288  61    103         17
## 354     9.45    92          12        430  35     67         12
## 355     5.30   145           1         80  42     31         18
## 356     7.02   146           0        306  42    100         11
## 357     3.58   164           0        111  72    109         12
## 358    13.36    72           3        276  34     73         15
## 359     4.17   118          10         71  69     96         11
## 360     3.13   130          11        396  66     62         14
## 361     8.77   114           7        265  52     86         15
## 362     8.68   104          10        183  56     25         15
## 363     5.25   110           0         26  79     55         12
## 364    10.26   108           1        377  25     75         12
## 365    10.50   131          16        488  30     21         14
## 366     6.53   162           0        122  57     30         17
## 367     5.98   134          11        447  53     56         12
## 368    14.37    53           0        256  52    106         17
## 369    10.71    79          10        348  74     22         14
## 370    10.26   122          22        463  36    100         14
## 371     7.68   119          22        403  42     41         12
## 372     9.08   126           0        191  54     81         16
## 373     7.80    98           0        508  65     50         11
## 374     5.58   116           0        402  78     71         17
## 375     9.44   118           7         90  47     47         12
## 376     7.90   124           4        206  73     46         11
## 377    16.27    92          19        319  44     60         11
## 378     6.81   125           0        263  41     61         12
## 379     6.11   119           3        105  79     88         12
## 380     5.81   107           0        404  54    111         15
## 381     9.64    89          10         17  68     64         17
## 382     3.90   151          21        496  77     65         13
## 383     4.95   121          19        315  66     28         14
## 384     9.35    68           0         76  63    117         10
## 385    12.85   112          15        348  28     37         12
## 386     5.87   132          13        455  62     73         17
## 387     5.32   160           0        170  39    116         16
## 388     8.67   115          14        238  73     73         14
## 389     8.14    78          11        245  79     89         16
## 390     8.44   107           8        328  35     42         12
```

```
## 391     5.47   111           9         61  67     75        12
## 392     6.10   124           0         49  56     63        16
## 393     4.53   130          13        315  34     42        13
## 394     5.57   120          10         26  30     51        17
## 395     5.35   139          19        366  33     58        16
## 396    12.57   128          17        203  33    108        14
## 397     6.14   120           3         37  55     23        11
## 398     7.41   159          12        368  40     26        18
## 399     5.94    95           7        284  50     79        12
## 400     9.71   120           0         27  49     37        16
```

Using the caret function to train a random forest (method='rf')

Create training (70%) and test (30%) sets for the Carseat data.

```
set.seed (123)
RF_split <-createDataPartition(Carseats_Filteredx$ï..Sales,p=0.7, list = FALSE)
RF_train <-Carseats_Filteredx[RF_split]
RF_test <-Carseats_Filteredx[-RF_split]

Model_RF_Caret <- train(ï..Sales~., data= Carseats_Filteredx, method = "rf",
                        trControl = trainControl(method = "oob"))

print(Model_RF_Caret)
```

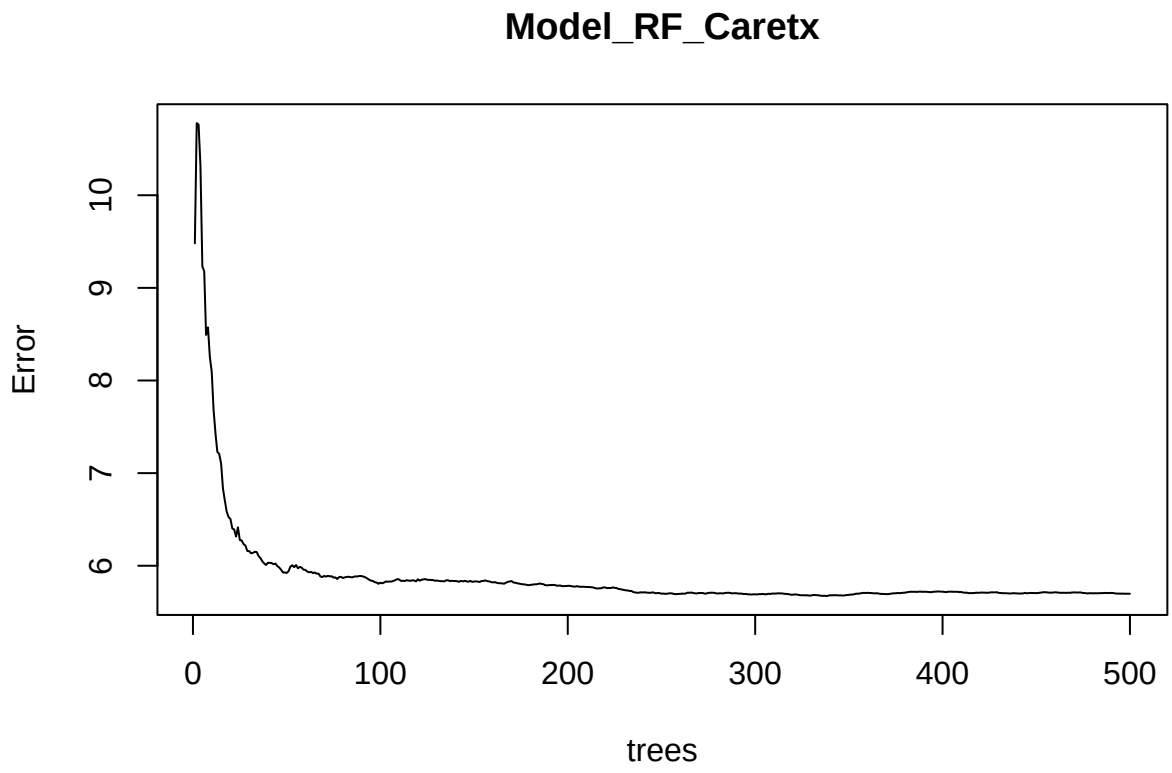
```
## Random Forest
##
## 400 samples
##   6 predictor
##
## No pre-processing
## Resampling results across tuning parameters:
##
##   mtry  RMSE      Rsquared
##   2     2.392782  0.2803378
##   4     2.371022  0.2933679
##   6     2.396132  0.2783211
##
## RMSE was used to select the optimal model using the smallest value.
## The final value used for the model was mtry = 4.
```

for reproducibility

```
set.seed(123)
# default RF model
Model_RF_Caretx <-randomForest(formula =ï..Sales~.,data = Carseats_Filteredx)
Model_RF_Caretx
```

```
##
## Call:
##  randomForest(formula = ï..Sales ~ ., data = Carseats_Filteredx)
##                Type of random forest: regression
##                      Number of trees: 500
## No. of variables tried at each split: 2
##
##           Mean of squared residuals: 5.698216
##                     % Var explained: 28.38
```

```
plot(Model_RF_Caretx)
```



The random forest model has 500 trees, which is the default setting and 2 variables were tried at each split. This is our m parameter. The model seems to have an R squared value of 28.38%.

```
library(caret)
set.seed(123)
RF_control <-trainControl(method = "repeatedcv",number = 5, repeats = 3,
                          search = "grid")
Rf_Model_grid <-train(ï..Sales~ ., data = Carseats_Filteredx, method = "rf",
                        trainControl=control,
                        tuneGrid=expand.grid(mtry=c(2,3,5)))

Rf_Model_grid
```

```
## Random Forest
```

```
##
## 400 samples
##   6 predictor
##
## No pre-processing
## Resampling: Bootstrapped (25 reps)
## Summary of sample sizes: 400, 400, 400, 400, 400, 400, ...
## Resampling results across tuning parameters:
##
##   mtry  RMSE      Rsquared   MAE
##   2     2.405819  0.2852547  1.926801
##   3     2.410040  0.2830573  1.925623
##   5     2.438861  0.2715500  1.947528
##
## RMSE was used to select the optimal model using the smallest value.
## The final value used for the model was mtry = 2.
```