Critical Thinking Group 4 - HW5 - Wine

Sreejaya, Suman, Vuthy

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Overview

The objective of this assignment is to predict the number of cases of wine that will be sold based on the properties of the wine. A count regression model will be used to predict wine sales.

Dataset
Wine - Training data
Wine - Evaluation Data

Data Exploration

```
##     ï..INDEX         TARGET       FixedAcidity     VolatileAcidity
##  Min.   :    1   Min.   :0.000   Min.   :-18.100   Min.   :-2.7900
##  1st Qu.: 4038   1st Qu.:2.000   1st Qu.:  5.200   1st Qu.: 0.1300
##  Median : 8110   Median :3.000   Median :  6.900   Median : 0.2800
##  Mean   : 8070   Mean   :3.029   Mean   :  7.076   Mean   : 0.3241
##  3rd Qu.:12106   3rd Qu.:4.000   3rd Qu.:  9.500   3rd Qu.: 0.6400
##  Max.   :16129   Max.   :8.000   Max.   : 34.400   Max.   : 3.6800
##
##    CitricAcid      ResidualSugar        Chlorides       FreeSulfurDioxide
##  Min.   :-3.2400   Min.   :-127.800   Min.   :-1.1710   Min.   :-555.00
##  1st Qu.: 0.0300   1st Qu.:  -2.000   1st Qu.:-0.0310   1st Qu.:   0.00
##  Median : 0.3100   Median :   3.900   Median : 0.0460   Median :  30.00
##  Mean   : 0.3084   Mean   :   5.419   Mean   : 0.0548   Mean   :  30.85
##  3rd Qu.: 0.5800   3rd Qu.:  15.900   3rd Qu.: 0.1530   3rd Qu.:  70.00
##  Max.   : 3.8600   Max.   : 141.150   Max.   : 1.3510   Max.   : 623.00
##                    NA's   :616        NA's   :638       NA's   :647
##  TotalSulfurDioxide    Density             pH          Sulphates
##  Min.   :-823.0     Min.   :0.8881   Min.   :0.480   Min.   :-3.1300
##  1st Qu.:  27.0     1st Qu.:0.9877   1st Qu.:2.960   1st Qu.: 0.2800
##  Median : 123.0     Median :0.9945   Median :3.200   Median : 0.5000
##  Mean   : 120.7     Mean   :0.9942   Mean   :3.208   Mean   : 0.5271
##  3rd Qu.: 208.0     3rd Qu.:1.0005   3rd Qu.:3.470   3rd Qu.: 0.8600
##  Max.   :1057.0     Max.   :1.0992   Max.   :6.130   Max.   : 4.2400
##  NA's   :682                         NA's   :395     NA's   :1210
##     Alcohol       LabelAppeal          AcidIndex          STARS
##  Min.   :-4.70   Min.   :-2.000000   Min.   : 4.000   Min.   :1.000
##  1st Qu.: 9.00   1st Qu.:-1.000000   1st Qu.: 7.000   1st Qu.:1.000
##  Median :10.40   Median : 0.000000   Median : 8.000   Median :2.000
##  Mean   :10.49   Mean   :-0.009066   Mean   : 7.773   Mean   :2.042
##  3rd Qu.:12.40   3rd Qu.: 1.000000   3rd Qu.: 8.000   3rd Qu.:3.000
##  Max.   :26.50   Max.   : 2.000000   Max.   :17.000   Max.   :4.000
##  NA's   :653                                          NA's   :3359
```

```
## Observations: 12,795
## Variables: 16
```

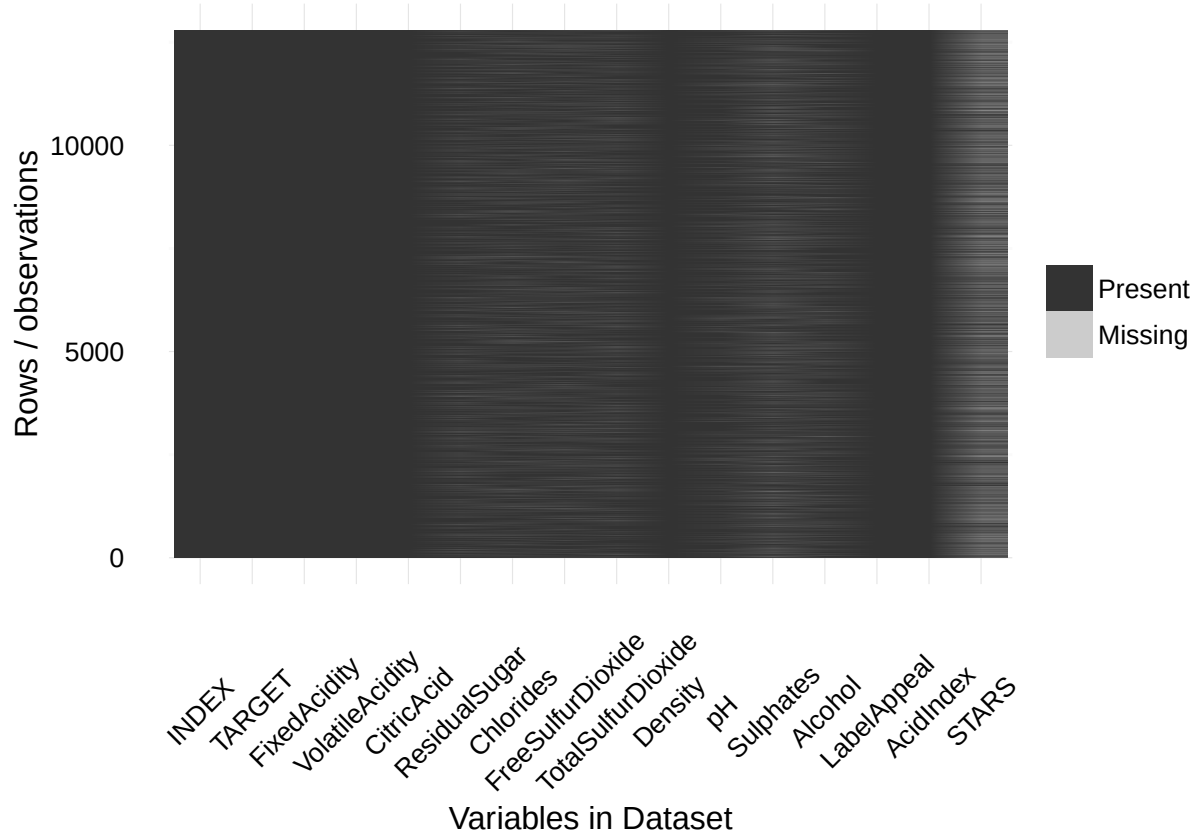
```
## $ ï..INDEX           <int> 1, 2, 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 16...
## $ TARGET             <int> 3, 3, 5, 3, 4, 0, 0, 4, 3, 6, 0, 4, 3, 7, 4...
## $ FixedAcidity       <dbl> 3.2, 4.5, 7.1, 5.7, 8.0, 11.3, 7.7, 6.5, 14...
## $ VolatileAcidity    <dbl> 1.160, 0.160, 2.640, 0.385, 0.330, 0.320, 0...
## $ CitricAcid         <dbl> -0.98, -0.81, -0.88, 0.04, -1.26, 0.59, -0....
## $ ResidualSugar      <dbl> 54.20, 26.10, 14.80, 18.80, 9.40, 2.20, 21....
## $ Chlorides          <dbl> -0.567, -0.425, 0.037, -0.425, NA, 0.556, 0...
## $ FreeSulfurDioxide  <dbl> NA, 15, 214, 22, -167, -37, 287, 523, -213,...
## $ TotalSulfurDioxide <dbl> 268, -327, 142, 115, 108, 15, 156, 551, NA,...
## $ Density            <dbl> 0.99280, 1.02792, 0.99518, 0.99640, 0.99457...
## $ pH                 <dbl> 3.33, 3.38, 3.12, 2.24, 3.12, 3.20, 3.49, 3...
## $ Sulphates          <dbl> -0.59, 0.70, 0.48, 1.83, 1.77, 1.29, 1.21, ...
## $ Alcohol            <dbl> 9.9, NA, 22.0, 6.2, 13.7, 15.4, 10.3, 11.6,...
## $ LabelAppeal        <int> 0, -1, -1, -1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 2...
## $ AcidIndex          <int> 8, 7, 8, 6, 9, 11, 8, 7, 6, 8, 5, 10, 7, 8,...
## $ STARS              <int> 2, 3, 3, 1, 2, NA, NA, 3, NA, 4, 1, 2, 2, 3...
```

Looks like the INDEX column name need to be corrected.

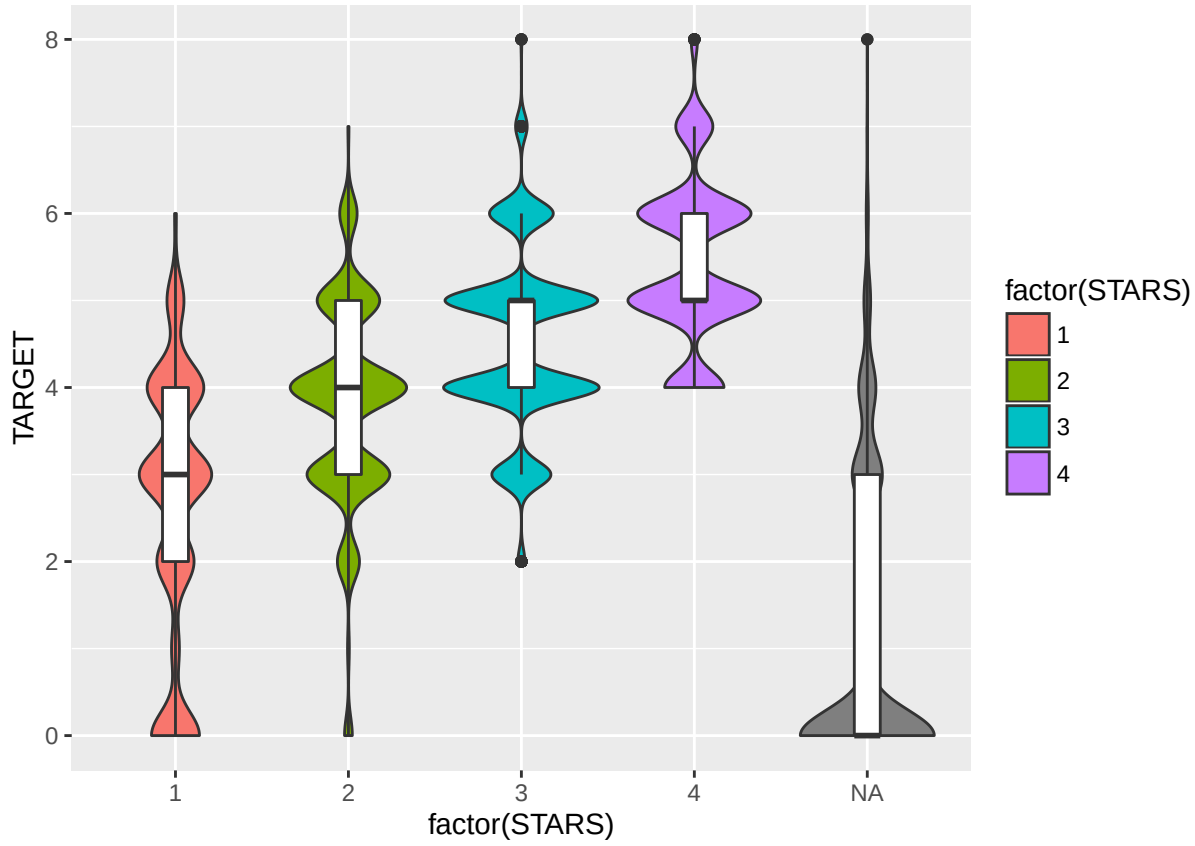
Missing Data

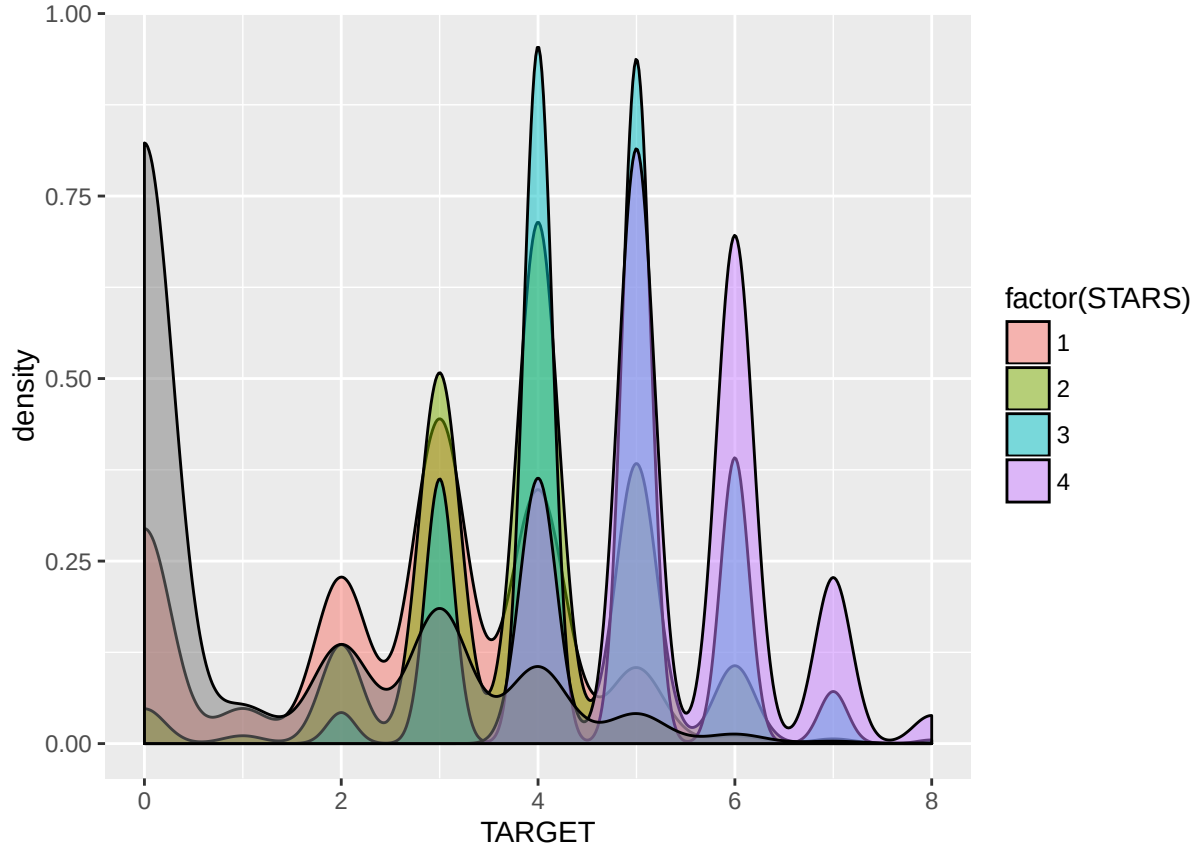
Eight of the variables have missing data.

Lets explore more on the missing values here:



Though there are lot of missing values, we could not see a definite pattern here, but we difinitely notice that there are highest number of missing values for *STARS* variable.

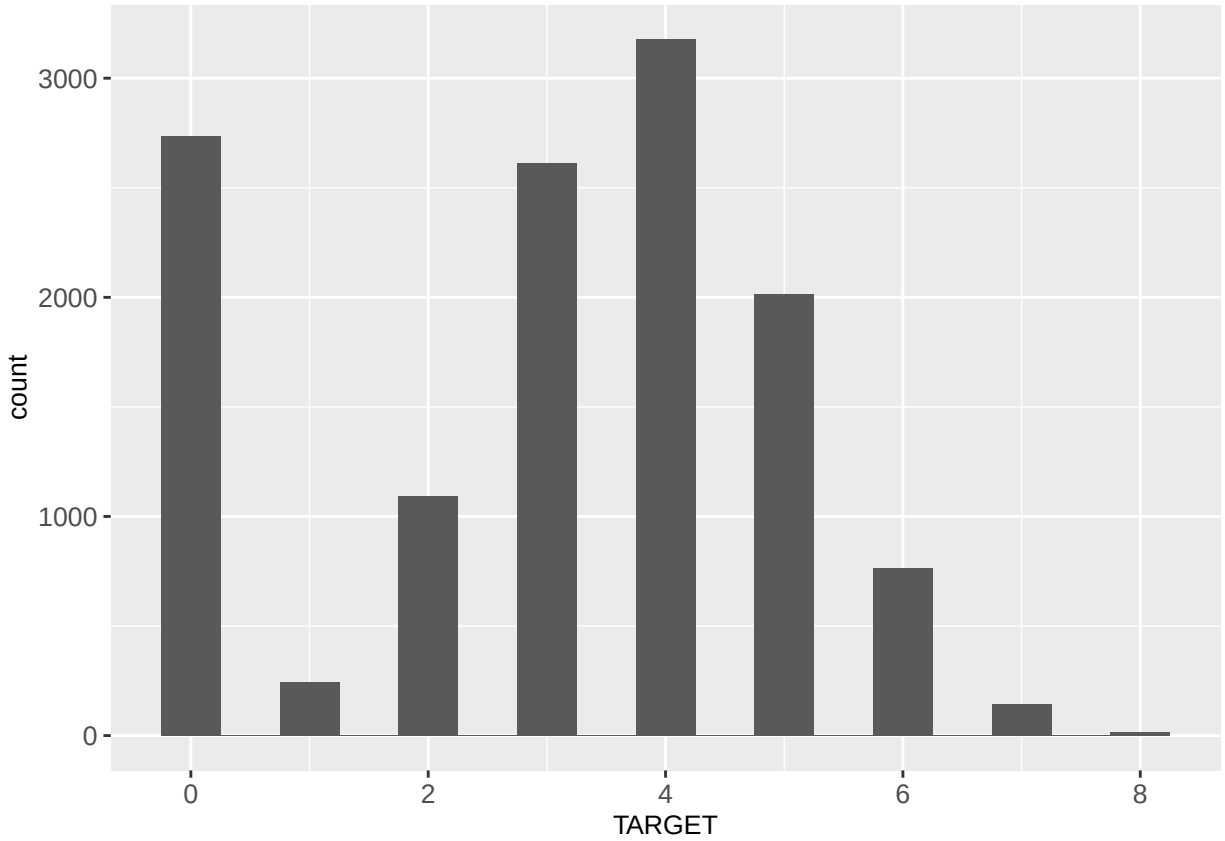

8
6
4
2
0
TARGET
1
2
3
4
NA
factor(STARS)
factor(STARS)
1
2
3
4



From the above diagrams, we notice that the NAs for STARS showing us a different distribution. So, we have to take care of this in the data preparation.

Data Distributions

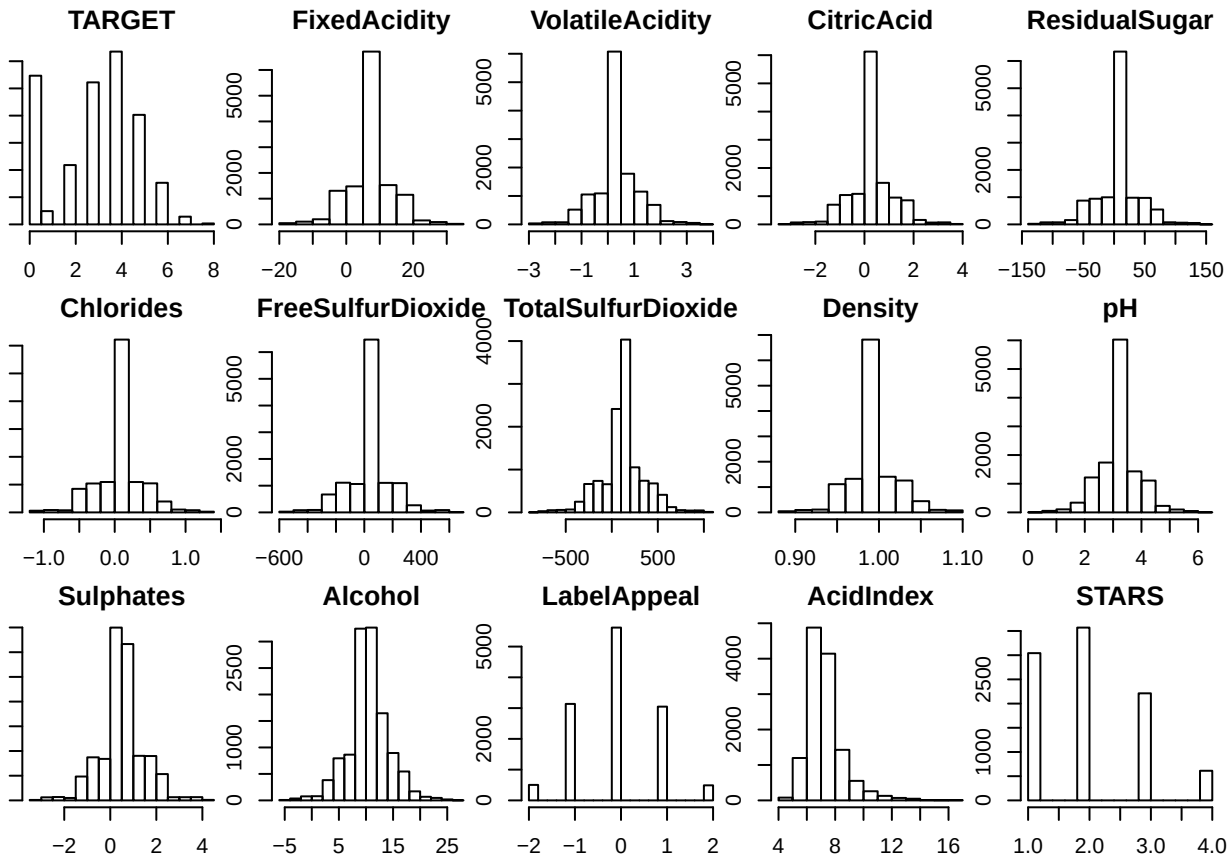
Lets check the overall distribution of the TAGET variable (which is a *count variable* indicating the number of sample cases):

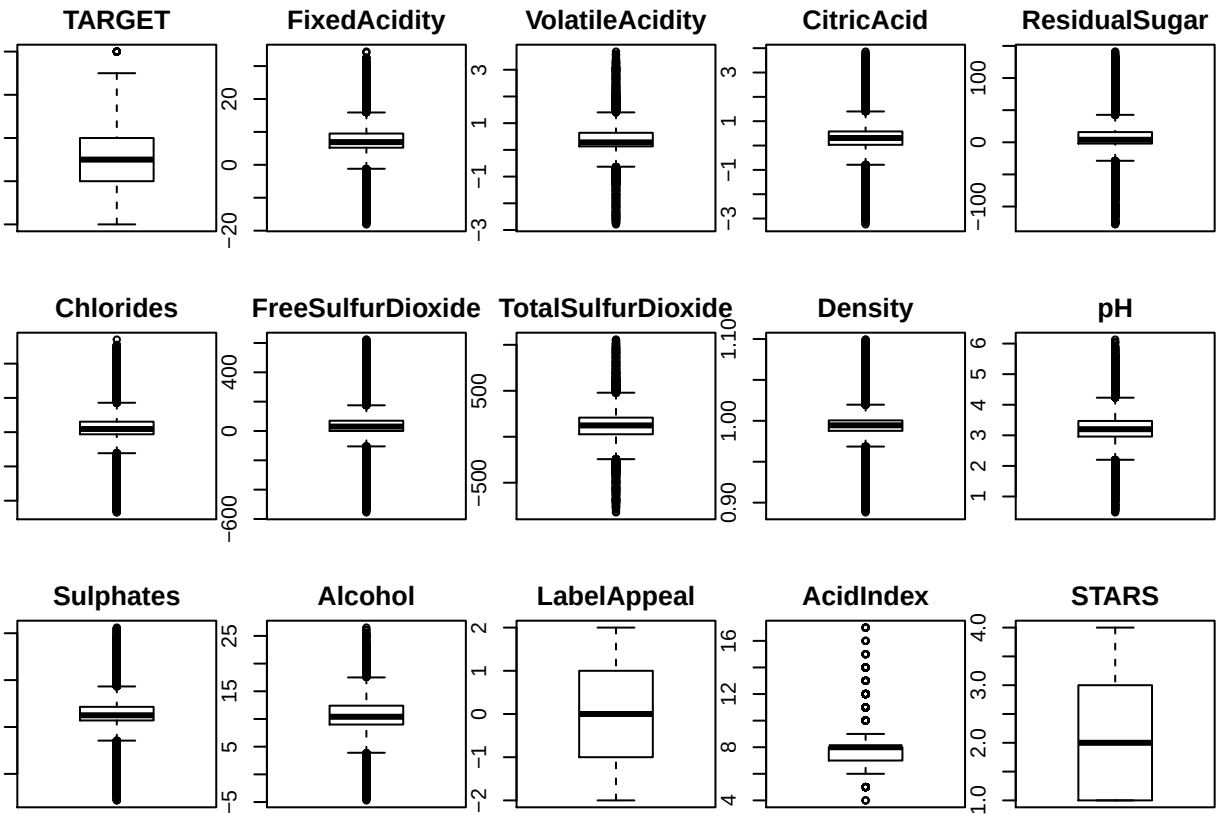


The above *TARGET* distribution has lot of *ZERO* values, which would indicate the *no sample cases purchased*, which could be due to NA values presence Or, some business reasons. But overall this appears close to *Poisson* distribution.

Lets check other variables distributions:

```
##  [1] "INDEX"             "TARGET"             "FixedAcidity"
##  [4] "VolatileAcidity"   "CitricAcid"         "ResidualSugar"
##  [7] "Chlorides"         "FreeSulfurDioxide"  "TotalSulfurDioxide"
## [10] "Density"           "pH"                 "Sulphates"
## [13] "Alcohol"           "LabelAppeal"        "AcidIndex"
## [16] "STARS"
```

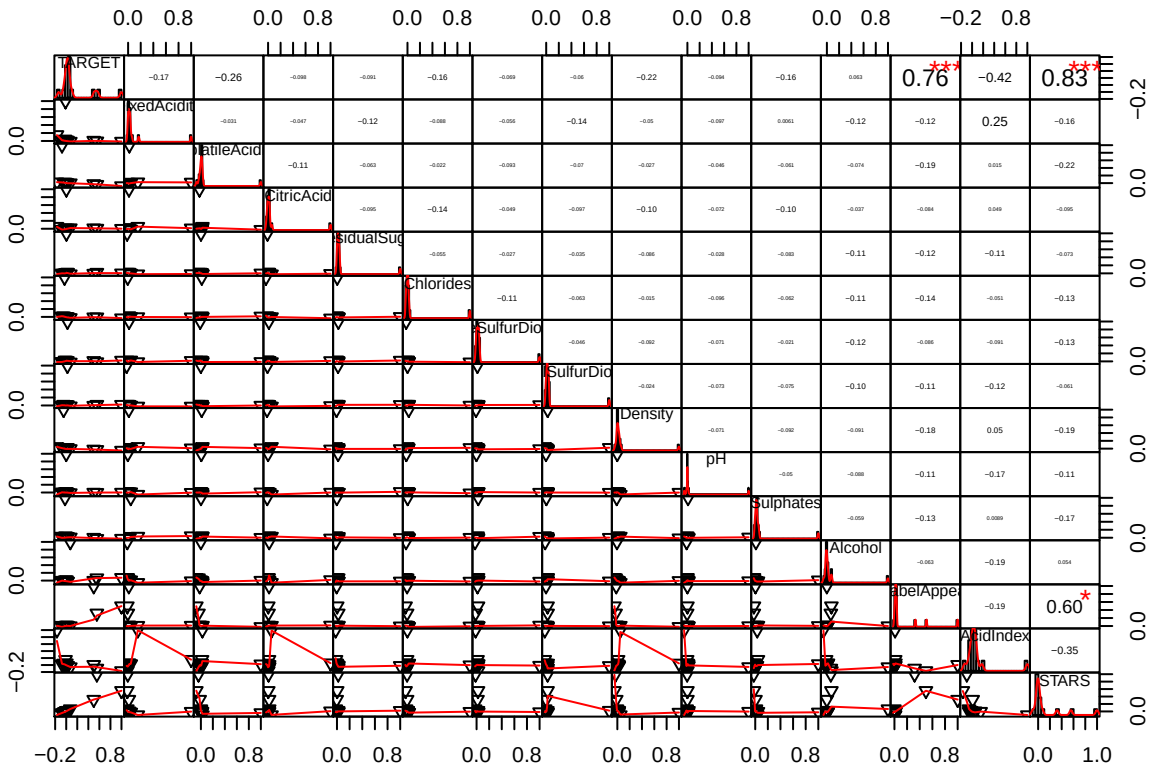

TARGET
FixedAcidity
VolatileAcidity
CitricAcid
ResidualSugar
Chlorides
FreeSulfurDioxide
TotalSulfurDioxide
Density
pH
Sulphates
Alcohol
LabelAppeal
AcidIndex
STARS



Most of the variables appears to be normally distributed.

Correlations

Lets visualize the correlation graph:



The above indicates the *STARS* and *LabelAppeal* are significant variables from correlation perspective.

Data Preparation

```
##      TARGET       FixedAcidity     VolatileAcidity     CitricAcid
##  Min.   :0.000   Min.   :-18.100   Min.   :-2.7900   Min.   :-3.2400
##  1st Qu.:2.000   1st Qu.:  5.200   1st Qu.: 0.1300   1st Qu.: 0.0300
##  Median :3.000   Median :  6.900   Median : 0.2800   Median : 0.3100
##  Mean   :3.029   Mean   :  7.076   Mean   : 0.3241   Mean   : 0.3084
##  3rd Qu.:4.000   3rd Qu.:  9.500   3rd Qu.: 0.6400   3rd Qu.: 0.5800
##  Max.   :8.000   Max.   : 34.400   Max.   : 3.6800   Max.   : 3.8600
##
##  ResidualSugar        Chlorides       FreeSulfurDioxide TotalSulfurDioxide
##  Min.   :-127.800   Min.   :-1.1710   Min.   :-555.00   Min.   :-823.0
##  1st Qu.:  -2.000   1st Qu.:-0.0310   1st Qu.:   0.00   1st Qu.:  27.0
##  Median :   3.900   Median : 0.0460   Median :  30.00   Median : 123.0
##  Mean   :   5.419   Mean   : 0.0548   Mean   :  30.85   Mean   : 120.7
##  3rd Qu.:  15.900   3rd Qu.: 0.1530   3rd Qu.:  70.00   3rd Qu.: 208.0
##  Max.   : 141.150   Max.   : 1.3510   Max.   : 623.00   Max.   :1057.0
##  NA's   :616        NA's   :638       NA's   :647       NA's   :682
##     Density             pH          Sulphates          Alcohol
##  Min.   :0.8881   Min.   :0.480   Min.   :-3.1300   Min.   :-4.700
##  1st Qu.:0.9877   1st Qu.:2.960   1st Qu.: 0.2800   1st Qu.: 8.700
##  Median :0.9945   Median :3.200   Median : 0.5000   Median :10.200
##  Mean   :0.9942   Mean   :3.208   Mean   : 0.5271   Mean   : 9.954
```

```
##  3rd Qu.:1.0005   3rd Qu.:3.470   3rd Qu.: 0.8600   3rd Qu.:12.200
##  Max.   :1.0992   Max.   :6.130   Max.   : 4.2400   Max.   :26.500
##                   NA's   :395     NA's   :1210
##   LabelAppeal          AcidIndex
##  Min.   :-2.000000   Min.   : 4.000
##  1st Qu.:-1.000000   1st Qu.: 7.000
##  Median : 0.000000   Median : 8.000
##  Mean   :-0.009066   Mean   : 7.773
##  3rd Qu.: 1.000000   3rd Qu.: 8.000
##  Max.   : 2.000000   Max.   :17.000
##
##  C:/Users/administrator.BARNETTASSOCIAT/Documents/GitHub/DATA621-HW/HW5/CT4-HW5.Rmd_1
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.0000
##  Mean   :0.2377
##  3rd Qu.:0.0000
##  Max.   :1.0000
##
##  C:/Users/administrator.BARNETTASSOCIAT/Documents/GitHub/DATA621-HW/HW5/CT4-HW5.Rmd_2
##  Min.   :0.000
##  1st Qu.:0.000
##  Median :0.000
##  Mean   :0.279
##  3rd Qu.:1.000
##  Max.   :1.000
##
##  C:/Users/administrator.BARNETTASSOCIAT/Documents/GitHub/DATA621-HW/HW5/CT4-HW5.Rmd_3
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.0000
##  Mean   :0.1729
##  3rd Qu.:0.0000
##  Max.   :1.0000
##
##  C:/Users/administrator.BARNETTASSOCIAT/Documents/GitHub/DATA621-HW/HW5/CT4-HW5.Rmd_4
##  Min.   :0.00000
##  1st Qu.:0.00000
##  Median :0.00000
##  Mean   :0.04783
##  3rd Qu.:0.00000
##  Max.   :1.00000
##
##  C:/Users/administrator.BARNETTASSOCIAT/Documents/GitHub/DATA621-HW/HW5/CT4-HW5.Rmd_NA
##  Min.   :0.0000
##  1st Qu.:0.0000
##  Median :0.0000
##  Mean   :0.2625
##  3rd Qu.:1.0000
##  Max.   :1.0000
##
```

Build Models

Model Selection

Appendix