

Homework 5

Group 1

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1 Introduction

The wine industry was valued at \$257.5 billion in 2012 and is predicted to be valued at \$303.6 billion by 2016.¹ As wine is a consumer product, accommodating consumer preference is critical to maintaining a competitive advantage. By understanding the factors involved in wine sales we can better understand consumer behavior and adjust our strategies accordingly.

2 Statement of the Problem

The purpose of this report is to develop statistical models to make inference into the factors associated with the number of cases of wine sold.

3 Data Exploration

3.1 Variables Explained

The variables provided in the Wine Training Data Set are explained below:

Variable Code	Definition
INDEX	Identification Variable (do not use)
TARGET	Number of Cases Purchased
AcidIndex	Proprietary method of testing total acidity of wine by using a weighted average
Alcohol	Alcohol Content
Chlorides	Chloride content of wine
CitricAcid	Citric Acid Content
Density	Density of Wine
FixedAcidity	Fixed Acidity of Wine
FreeSulfurDioxide	Sulfur Dioxide content of wine
LabelAppeal	Marketing Score indicating the appeal of label design for consumers. High numbers suggest customers like the label design. Negative numbers suggest customers don't like the design.
ResidualSugar	Residual Sugar of wine
STARS	Wine rating by a team of experts. 4 Stars = Excellent, 1 Star = Poor
Sulphates	Sulfate content of wine
TotalSulfurDioxide	Total Sulfur Dioxide of Wine
VolatileAcidity	Volatile Acid content of wine
pH	pH of wine

¹"Research and Markets: Wine: 2012 Global Industry Almanac - The Global Wine Market Grew by 3.1% in 2011 to Reach a Value of \$257.5 Billion." Research and Markets: Wine: 2012 Global Industry Almanac - The Global Wine Market Grew by 3.1% in 2011 to Reach a Value of \$257.5 Billion | Business Wire. N.p., 21 May 2012. Web. 20 Nov. 2016.

3.2 Variables Summary Statistics

3.2.1 Discrete Variables

Interestingly, we can see some general sense of the make up of our data set. In this set, most wines sell between 3 and 5 cases, have no label appeal, and very few received 4 stars with most wines receiving 2 or 1 stars. Additionally, we should note that 21.4% of our wines had no case sales.

Table 2: Wine Training Data Table of Discrete Variables

Variable	Levels	n	%	$\sum\%$
TARGET	0	2734	21.4	21.4
	1	244	1.9	23.3
	2	1091	8.5	31.8
	3	2611	20.4	52.2
	4	3177	24.8	77.0
	5	2014	15.7	92.8
	6	765	6.0	98.8
	7	142	1.1	99.9
	8	17	0.1	100.0
all		12795	100.0	
LabelAppeal	-2	504	3.9	3.9
	-1	3136	24.5	28.5
	0	5617	43.9	72.3
	1	3048	23.8	96.2
	2	490	3.8	100.0
	all		12795	100.0
STARS	1	3042	32.2	32.2
	2	3570	37.8	70.1
	3	2212	23.4	93.5
	4	612	6.5	100.0
	all		9436	100.0

3.2.2 Continous Variables

We see that Density is a very narrow measurement, the minimum value is 0.9 and the maximum is 1.1. The remaining continuous variables appear to have a larger range of variability, with the largest being TotalSulfurDioxide which has a range from -823 to 1057. In our models, this variability will provide some insights to our coefficients and the impact to the dependent variable.

Table 3: Wine Training Data Table of Continuous Variables

Variable	n	Min	q ₁	\tilde{x}	\bar{x}	q ₃	Max	s	IQR	#NA
FixedAcidity	12795	-18.1	5.2	6.9	7.1	9.5	34.4	6.3	4.3	0
VolatileAcidity	12795	-2.8	0.1	0.3	0.3	0.6	3.7	0.8	0.5	0
CitricAcid	12795	-3.2	0.0	0.3	0.3	0.6	3.9	0.9	0.5	0
ResidualSugar	12179	-127.8	-2.0	3.9	5.4	15.9	141.2	33.7	17.9	616
Chlorides	12157	-1.2	0.0	0.0	0.1	0.2	1.4	0.3	0.2	638
FreeSulfurDioxide	12148	-555.0	0.0	30.0	30.8	70.0	623.0	148.7	70.0	647
TotalSulfurDioxide	12113	-823.0	27.0	123.0	120.7	208.0	1057.0	231.9	181.0	682
Density	12795	0.9	1.0	1.0	1.0	1.0	1.1	0.0	0.0	0
pH	12400	0.5	3.0	3.2	3.2	3.5	6.1	0.7	0.5	395
Sulphates	11585	-3.1	0.3	0.5	0.5	0.9	4.2	0.9	0.6	1210
Alcohol	12142	-4.7	9.0	10.4	10.5	12.4	26.5	3.7	3.4	653

3.3 Imputing Missing Values

In order to address the missing values in our variables we used a non-parametric imputation method (Random Forest) using the `missForest` package. The function is particularly useful in that it can handle any type of input data and it will make as few assumptions about the structure of the data as possible.²

**Table 4 : Imputed Descriptive Statistics
13 Variables 12795 Observations**

FixedAcidity

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	470	1	7	7	-4	-1	5	7	10	16	18
lowest : -18.1 -18.0 -17.7 -17.5 -17.4, highest: 32.4 32.5 32.6 34.1 34.4												

VolatileAcidity

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	815	1	0.3	0.8	-1.0	-0.7	0.1	0.3	0.6	1.4	1.6
lowest : -2.790 -2.750 -2.745 -2.730 -2.720, highest: 3.500 3.550 3.565 3.590 3.680												

CitricAcid

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	602	1	0.3	0.9	-1.16	-0.84	0.03	0.31	0.58	1.43	1.79
lowest : -3.24 -3.16 -3.10 -3.08 -3.06, highest: 3.63 3.68 3.70 3.77 3.86												

ResidualSugar

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	2685	1	5	34	-52.0	-38.4	-0.5	4.1	15.0	48.9	62.1
lowest : -127.80 -127.10 -126.20 -126.10 -125.70 highest: 136.50 137.60 138.00 140.65 141.15												

Chlorides

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	2285	1	0.05	0.3	-0.48	-0.36	-0.01	0.05	0.13	0.47	0.59
lowest : -1.171 -1.170 -1.158 -1.156 -1.155, highest: 1.260 1.261 1.270 1.275 1.351												

FreeSulfurDioxide

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	1626	1	31	150	-220	-165	3	30	66	223	281
lowest : -555 -546 -536 -535 -532, highest: 613 617 618 622 623												

TotalSulfurDioxide

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	2039	1	121	238	-266	-175	33	123	200	412	507
lowest : -823 -816 -793 -781 -779, highest: 1032 1041 1048 1054 1057												

Density

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	5933	1	1	0.03	0.9	1.0	1.0	1.0	1.0	1.0	1.0
lowest : 0.88809 0.88949 0.88978 0.88983 0.89167 highest: 1.09658 1.09679 1.09695 1.09791 1.09924												

pH

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	863	1	3	0.7	2	2	3	3	3	4	4
lowest : 0.48 0.53 0.54 0.58 0.59, highest: 5.91 5.94 6.02 6.05 6.13												

²Stekhoven, Daniel J., and Peter B?hlmann. "MissForest-non-parametric missing value imputation for mixed-type data." Bioinformatics 28.1 (2012): 112-118.

Sulphates

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
12795	0	1695	1	0.5	0.9	-1.0	-0.6	0.3	0.5	0.8	1.7	2.1

lowest : -3.13 -3.12 -3.10 -3.07 -3.03, highest: 4.11 4.16 4.19 4.21 4.24

Alcohol

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95	
12795	0	1036	1	10	4	.05	.4	.6	.9	.10	.12	.15	.17

lowest : -4.7 -4.5 -4.4 -4.3 -4.1, highest: 25.4 25.6 26.0 26.1 26.5

LabelAppeal

n	missing	distinct	Info	Mean	Gmd
12795	0	5	0.887	-0.009	1

lowest : -2 -1 0 1 2, highest: -2 -1 0 1 2

-2 (504, 0.039), -1 (3136, 0.245), 0 (5617, 0.439), 1 (3048, 0.238), 2 (490, 0.038)

STARS

n	missing	distinct
12795	0	4

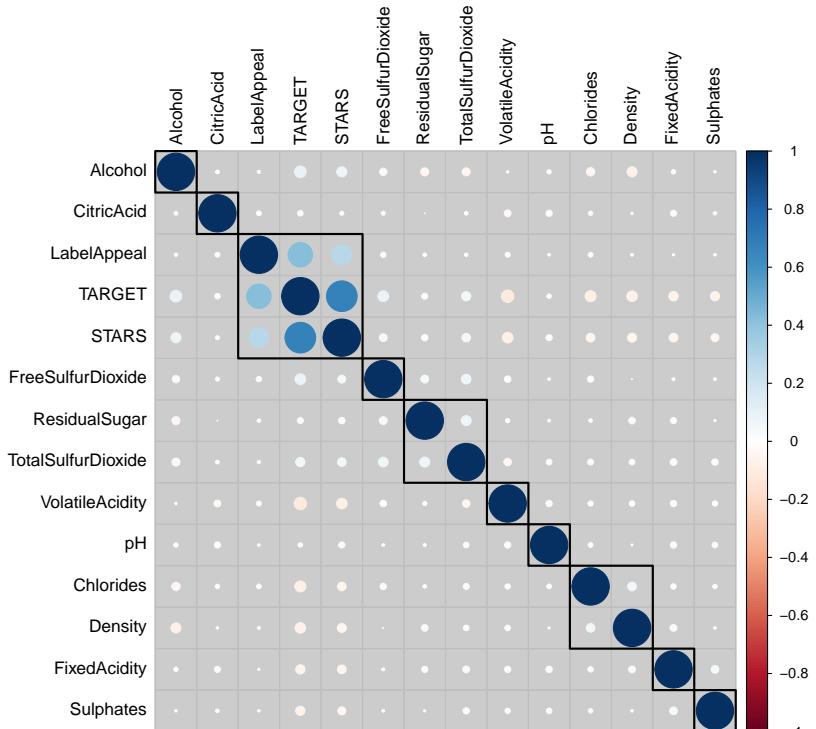
1 (5305, 0.415), 2 (4569, 0.357), 3 (2309, 0.180), 4 (612, 0.048)

3.4 Correlation of Variables

3.4.1 Correlation Matrix

If we modify our data frame to a matrix in our evaluation data set we can further plot a correlation matrix. There are surprisingly few interesting correlations in the data, but the lack of correlation in the data set is in itself interesting.

- STARS has the most positive correlation and strongest correlation with our dependent variable TARGET. It is intuitive that the greater the STARS value the more cases our wine would sell.
- LabelAppeal is the second most correlated with our dependent variable to our dependent variable. It is interesting that the two most correlated variables have less to do with wine quality and more to do with the appearance of a sophisticated wine.
- The lack of strong correlations is interesting in itself. It is concerning that most variables have nearly no correlation with our dependent variable but represent the actual quality of the wine. We see that public perception of wine is more important than the actual quality of the wine as measured by these variables.

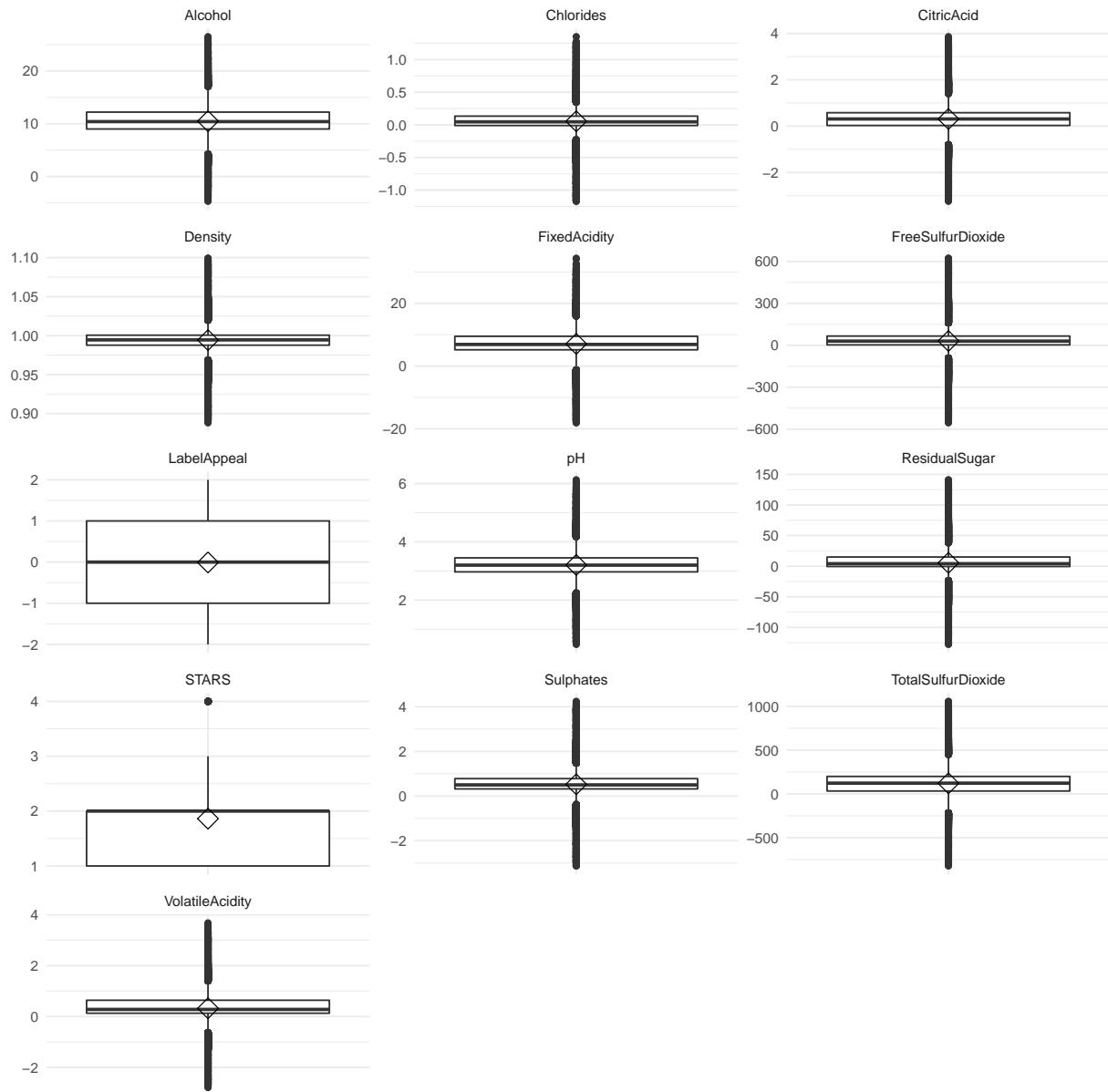


4 Data Transformation

4.1 Outliers Treatment

4.1.1 Box Plots of Variables for Winsorizing

Box Plots provide a visualization of the quartiles and outliers of our data set.³ Using the box plots, we can conclude that the variables to be winsorized are Free Sulfur Dioxide, Residual Sugar, and Total Sulfur Dioxide.



³"Box Plot." Wikipedia. Wikimedia Foundation, n.d. Web. 24 Nov. 2016.

4.1.2 Winsorizing

We chose winsorizing as the method to address outliers. Instead of trimming values, winsorizing uses the interquartile range to replace values that are above or below the interquartile range multiplied by a factor. Those values above or below the range multiplied by the factor are then replaced with max and min value of the interquartile range. Using the factor 2.2 for winsorizing outliers is a method developed by Hoaglin and Iglewicz and published Journal of American Statistical Association in 1987⁴.

The below table is the summary results of the winsorizing of the data.

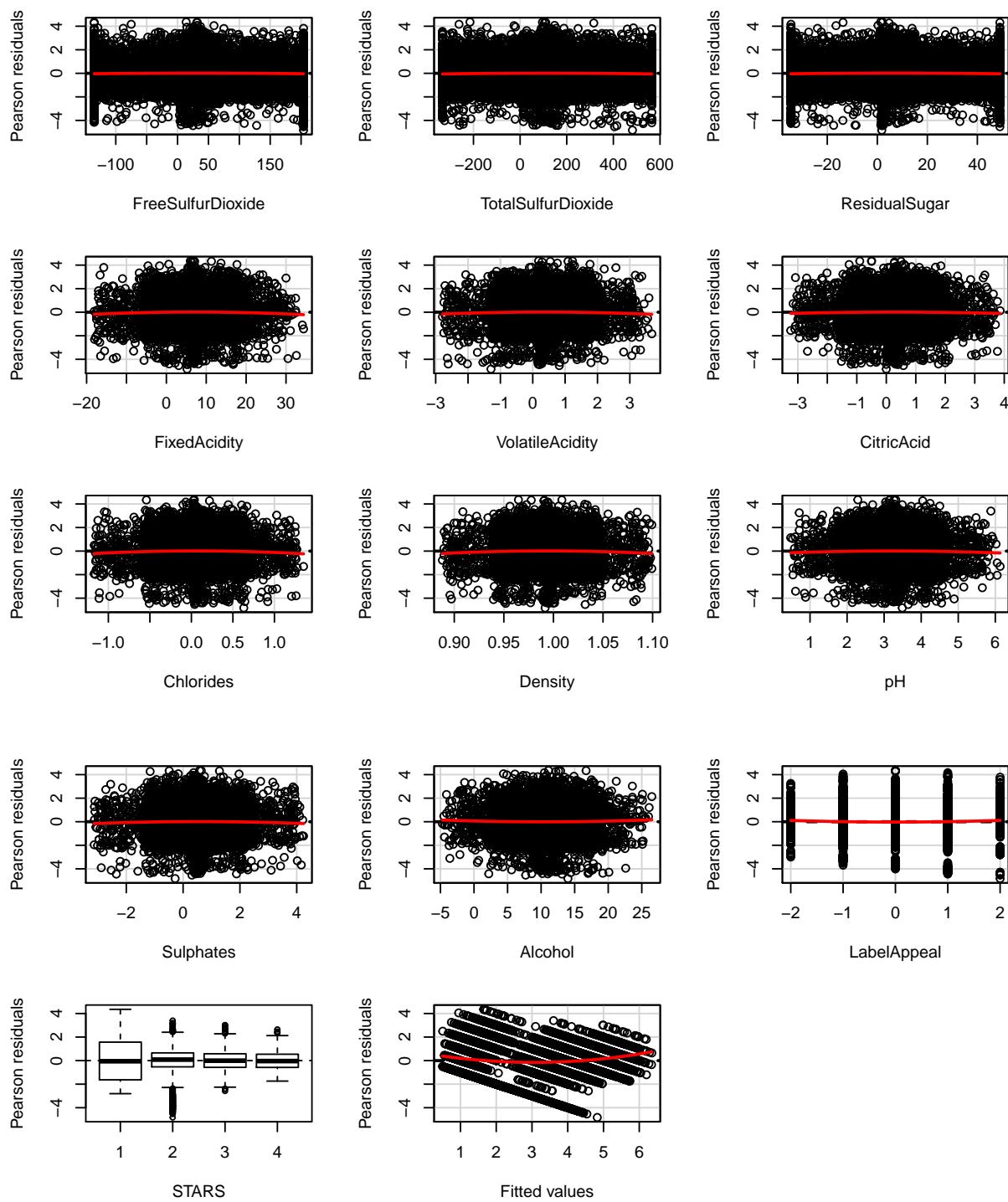
Table 4:

Statistic	N	Mean	St. Dev.	Min	Max
FreeSulfurDioxide	12,796	31.978	99.033	-135.000	204.000
TotalSulfurDioxide	12,796	120.521	203.181	-333.000	565.000
ResidualSugar	12,796	5.927	23.816	-34.600	49.100
TARGET	12,796	3.029	1.926	0	8
FixedAcidity	12,796	7.075	6.317	-18.100	34.400
VolatileAcidity	12,796	0.324	0.784	-2.790	3.680
CitricAcid	12,796	0.308	0.862	-3.240	3.860
Chlorides	12,796	0.055	0.313	-1.171	4.000
Density	12,796	0.994	0.032	0.888	3.000
pH	12,796	3.208	0.670	0.480	6.130
Sulphates	12,796	0.527	0.888	-3.130	4.240
Alcohol	12,796	10.489	3.636	-4.700	26.500
LabelAppeal	12,796	-0.009	0.891	-2	3

⁴Hoaglin, D. C., and Iglewicz, B. (1987), Fine tuning some resistant rules for outlier labeling, Journal of American Statistical Association, 82, 1147-1149.

4.2 BoxCox Transformations

Even after Winsorization we see non-constant variance in the Pearson Residuals for `FreeSulferDioxide`, `TotalSulfurDioxide`, and `ResidualSugar`. The Box-Cox evaluation was completed on these variables, based on the residual plots. In the residual plots, these three variables showed a great deal of non-constant variance because the plots were hyperbolic-shaped.



```
##          Test stat Pr(>|t|)  
## FreeSulfurDioxide     -1.892   0.058  
## TotalSulfurDioxide    -1.751   0.080  
## ResidualSugar        -2.101   0.036  
## FixedAcidity         -1.881   0.060  
## VolatileAcidity      -1.694   0.090  
## CitricAcid           -1.092   0.275  
## Chlorides             -2.370   0.018  
## Density               -2.286   0.022  
## pH                   -1.500   0.134  
## Sulphates            -1.616   0.106  
## Alcohol               1.408   0.159  
## LabelAppeal          3.071   0.002  
## STARS                 NA      NA  
## Tukey test            17.998  0.000
```

4.2.1 Determining BoxCox Transformations

Using the `BoxCox.lambda` function from the `forecast` package we are able to determine our necessary transformations to our independent variables.

λ	Variables
1.22449234379866	Free Sulfur Dioxide
1.0182875042235	Total Sulfur Dioxide
1.18389893233879	Residual Sugar

Utilizing transformations based on the lambda value of the BoxCox and rounding to the nearest tenth we further transform our independent variables for our regression models. We see that the `TotalSulfurDioxide` variable does not require further transformation

Box-Cox Transformations ⁵	
λ	Y'
0	$\log(Y)$
.25	$\sqrt[4]{Y}$
0.5	$Y^{0.5} = \sqrt{(Y)}$
1	$Y^1 = Y$
1.25	$Y^{1.25}$

variable	variable transformation
ResidualSugar	$ResidualSugar^{1.25}$
FreeSulfurDioxide	$FreeSulfurDioxide^{1.25}$

⁵Osborne, Jason W. "Improving your data transformations: Applying the Box-Cox transformation." Practical Assessment, Research & Evaluation 15.12 (2010): 1-9.

5 Models Built

5.1 Poisson Regression Models

First, we investigate the unconditional variance is slightly > unconditional mean. Which we do see in the below table so there may be some over-dispersion.

mean	var
3.029074	3.710895

5.1.1 Poisson Regression Model 1

We build out first Poisson Regression model but we need to verify the confidence levels are appropriate. After producing the Confidence level for ResidualSugar we see it runs through 1 and its P(z) value is clearly not significant. Based on both items we can remove ResidualSugar from the model.

Table 7: Poisson Regression Model 1

<i>Dependent variable:</i>	
	TARGET
Constant	0.406*** (0.018)
STARS2	0.825*** (0.013)
STARS3	1.064*** (0.015)
STARS4	1.229*** (0.021)
Alcohol	0.005*** (0.001)
ResidualSugar	0.00005 (0.0002)
Observations	12,795
Log Likelihood	-23,658.340
Akaike Inf. Crit.	47,328.690
Residual Deviance	15,374.670 (df = 12789)
Null Deviance	22,860.890 (df = 12794)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 8: Confidence intervals

	2.5%	97.5%
(Intercept)	1.5	1.447
STARS2	2.283	2.224
STARS3	2.898	2.816
STARS4	3.419	3.284
Alcohol	1.005	1.002
ResidualSugar	1	0.9997

We removed ResidualSugar and Model with the independent variables STARS and Alcohol. We can see how great the STARS variable has on our model, 2 STARS is 2.28 times wine case sales when compared to one STAR. Furthermore, 3 Stars will have wine case sales of 2.90 times more than one STAR, and four STARS will be 3.42 times more than one STAR. Alcohol = For one unit increase in Alcohol, Wine sales will be 1.004 times more

Table 9: Poisson Regression Model 1 without ResidualSugar

Dependent variable:	
	TARGET
Constant	0.406*** (0.018)
STARS2	0.825*** (0.013)
STARS3	1.064*** (0.015)
STARS4	1.229*** (0.021)
Alcohol	0.005*** (0.001)
Observations	12,795
Log Likelihood	-23,658.390
Akaike Inf. Crit.	47,326.790
Residual Deviance	15,374.760 (df = 12790)
Null Deviance	22,860.890 (df = 12794)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 10: Confidence intervals

	Exponentiated Coefficient	Exponentiated 2.5%	Exponentiated 97.5%
(Intercept)	1.501	1.448	1.555
STARS2	2.283	2.224	2.344
STARS3	2.898	2.816	2.983
STARS4	3.419	3.284	3.559
Alcohol	1.005	1.002	1.008

5.1.1.1 Poisson Regression Model 1 Metrics

5.1.1.1.1 Dispersion

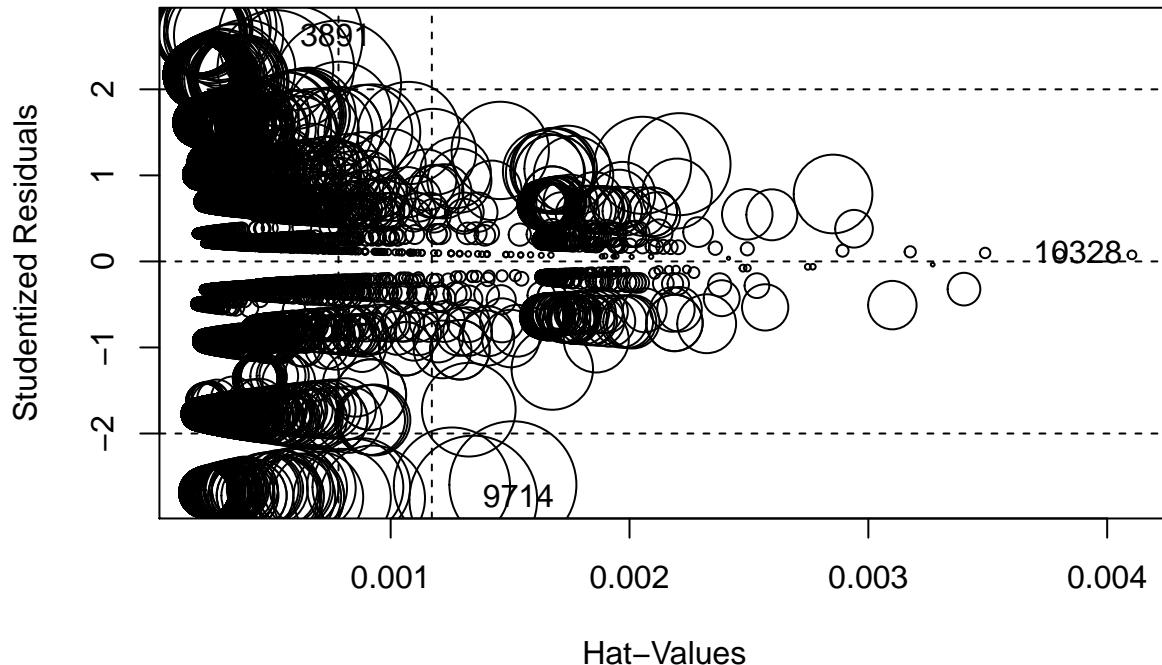
dispersion 0.9730167

Our dispersion results are very close to 1. So, we can say it is not over or under dispersed. However, we can further test for over dispersion by dividing the deviance of our model by the residuals. The result of this test is 1.2020925 and since this result is not greater than 1.5, we can claim that the data is not over-dispersed.⁶

⁶“Multiple Logistic Regression.” R Companion: Multiple Logistic Regression. N.p., n.d. Web. 04 Dec. 2016.

5.1.1.2 Influential Points

We further test for influential points in the data set. This test indicates that rows 10328, 9714, and 3891, have great influence on our model. It would be important to discuss these rows with the appropriate data steward to understand if these are accurate measurements and should be included in the analysis. Due to time limitations, we are not able to verify these rows and they have been included in this analysis.



```
##           StudRes      Hat      CookD
## 3891    2.59248567 0.0005804453 1.31210e-03
## 9714   -2.76735034 0.0013458546 1.03277e-03
## 10328   0.07597296 0.0041037245 4.80641e-06
```

5.1.1.3 Verifying Predictions

We also verify predicted values for the training data set, in order to verify the output of our model against the training data set.

TARGET	STARS	Alcohol	Fitted
3	2	9.9	3.596
3	3	10.07	4.569
5	3	22	4.844
3	1	6.2	1.547
4	2	13.7	3.663
0	1	15.4	1.618

The predictions are close in value, we can further see the prediction quality of the model by reviewing the frequency table for observed vs predicted values.

Target	Obs	Predicted
0	2734	0
1	244	51
2	1091	5254
3	2611	262
4	3177	4574
5	2014	2553
6	765	101
7	142	0
8	17	0

Goodness of Fit Test

Goodness of Fit Test using Pearson Chi square test gives us the result of 0 shows that our model is good.

5.1.2 Poisson Regression Model 2

As in our first Poisson model, we build our second Poisson Regression model and we need to verify the confidence levels are appropriate. After producing the Confidence level for Confidence level for CitricAcid and pH, we see that they run through 1 and and their P(z) values are clearly not significant. Based on both info we can remove CitricAcid and pH from the model.

Table 13: Poisson Regression Model 2

	<i>Dependent variable:</i>
	TARGET
Constant	0.461*** (0.044)
LabelAppeal-1	0.383*** (0.038)
LabelAppeal0	0.685*** (0.037)
LabelAppeal1	0.909*** (0.037)
LabelAppeal2	1.092*** (0.042)
CitricAcid	0.004 (0.006)
pH	-0.011 (0.008)
Observations	12,795
Log Likelihood	-26,380.660
Akaike Inf. Crit.	52,775.320
Residual Deviance	20,819.300 (df = 12788)
Null Deviance	22,860.890 (df = 12794)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 14: Confidence intervals

	2.5 %	97.5 %
(Intercept)	1.585	1.455
LabelAppeal-1	1.467	1.363
LabelAppeal0	1.983	1.846
LabelAppeal1	2.481	2.309
LabelAppeal2	2.98	2.747
CitricAcid	1.004	0.9926
pH	0.9894	0.9747

We removed CitricAcid and pH then created a new Model with only LabelAppeal. The impact of LabelAppeal is very significant since this variable is explaining a great deal of variation in our dependent variable. A neutral LabelAppeal of 0 will have wine sales 1.98 times greater than a very negative LabelAppeal of -2. Also, a great LabelAppeal of 2 will have 2.98 times greater wine sales than a than a very negative LabelAppeal of -2.

Table 15: Poisson Regression Model 2 with LabelAppeal

<i>Dependent variable:</i>	
	TARGET
Constant	0.428*** (0.036)
LabelAppeal-1	0.383*** (0.038)
LabelAppeal0	0.685*** (0.037)
LabelAppeal1	0.909*** (0.037)
LabelAppeal2	1.092*** (0.042)
Observations	12,795
Log Likelihood	-26,381.890
Akaike Inf. Crit.	52,773.780
Residual Deviance	20,821.760 (df = 12790)
Null Deviance	22,860.890 (df = 12794)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 16: Confidence intervals

	Exponentiated Coefficient	Exponentiated 2.5%	Exponentiated 97.5%
(Intercept)	1.534	1.428	1.644
LabelAppeal-1	1.467	1.363	1.582
LabelAppeal0	1.983	1.847	2.133
LabelAppeal1	2.482	2.31	2.672
LabelAppeal2	2.979	2.747	3.235

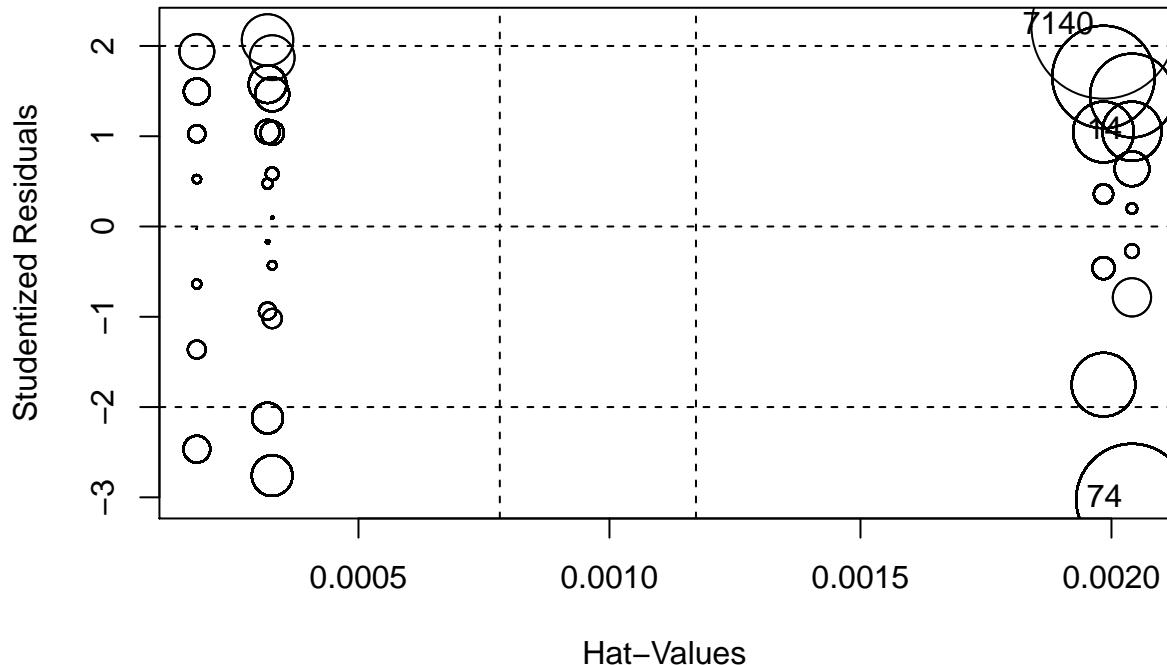
5.1.2.1 Poisson Regression Model 2 Metrics

dispersion 1.035287

Our dispersion results are very close to 1. So, we can say it is not over or under dispersed. However, we can further test for over dispersion by dividing the deviance of our model by the residuals. The result of this test is 1.6279715 and since this result is greater than 1.5, we can claim that the data is over-dispersed.

5.1.2.1.1 Influential points

We further test for influential points in the data set. This test indicates that rows 7140, 14, and 74, have great influence on our model. It would be important to discuss these rows with the appropriate data steward to understand if these are accurate measurements and should be included in the analysis. Due to time limitations, we are not able to verify these rows and they have been included in this analysis.



```
##          StudRes      Hat      CookD
## 14     1.054918 0.002040816 0.0005298851
## 74    -3.024586 0.002040816 0.0018726921
## 7140   2.213682 0.001984127 0.0031210472
```

5.1.2.1.2 Verifying Predictions

We also verify predicted values for the training data set, in order to verify the output of our model against the training data set.

TARGET	LabelAppeal	Alcohol	Fitted
3	0	9.9	3.042
3	-1	10.07	2.25
5	-1	22	2.25
3	-1	6.2	2.25
4	0	13.7	3.042
0	0	15.4	3.042

The predictions are close in value, we can further see the prediction quality of the model by reviewing the frequency table for observed vs predicted values.

Target	Obs	Predicted
0	2734	0
1	244	0
2	1091	3640
3	2611	5617
4	3177	3048
5	2014	490
6	765	0
7	142	0
8	17	0

Goodness of fit test

The goodness of fit test using Pearson Chi-square test results are 0 which shows that our model is good and statistically significant.

5.2 Negative Binomial Regression Models

5.2.1 Negative Binomial Regression Model 1

In the first negative binomial regression model, all of the coefficients are positive. The variable that had to be removed was wine rating, due to the fact that it led to an error in the model, stating that the iteration limit was reached. Even though this categorical variable guarantees high significance and also higher coefficients (0.4 for STARS = 2, 0.6 for STARS = 3, and 0.7 for STARS = 4), this variable would not be appropriate to use for negative binomial regression. The alcohol content is also an equally significant variable but does not have a coefficient as high as those of the wine rating. However, this variable and residual sugar can be used for negative binomial regression because the resulting over dispersion is not so high.

Table 19: Negative Binomial Regression Model 1

	<i>Dependent variable:</i> TARGET	
	(1)	(2)
Constant	0.405*** (0.018)	0.987*** (0.019)
STARS2	0.825*** (0.013)	
STARS3	1.064*** (0.015)	
STARS4	1.229*** (0.021)	
Alcohol	0.005*** (0.001)	0.011*** (0.002)
ResidualSugar	0.0002 (0.0002)	0.001** (0.0003)
Observations	12,795	12,796
Log Likelihood	-23,659.120	-27,142.350
θ	39,834.370 (37,787.650) ($p = 0.292$)	7.521*** (0.435) ($p = 0.000$)
Akaike Inf. Crit.	47,330.240	54,290.700
Residual Deviance	15,373.240 (df = 12789)	18,163.620 (df = 12793)
Null Deviance	22,859.700 (df = 12794)	18,214.010 (df = 12795)

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

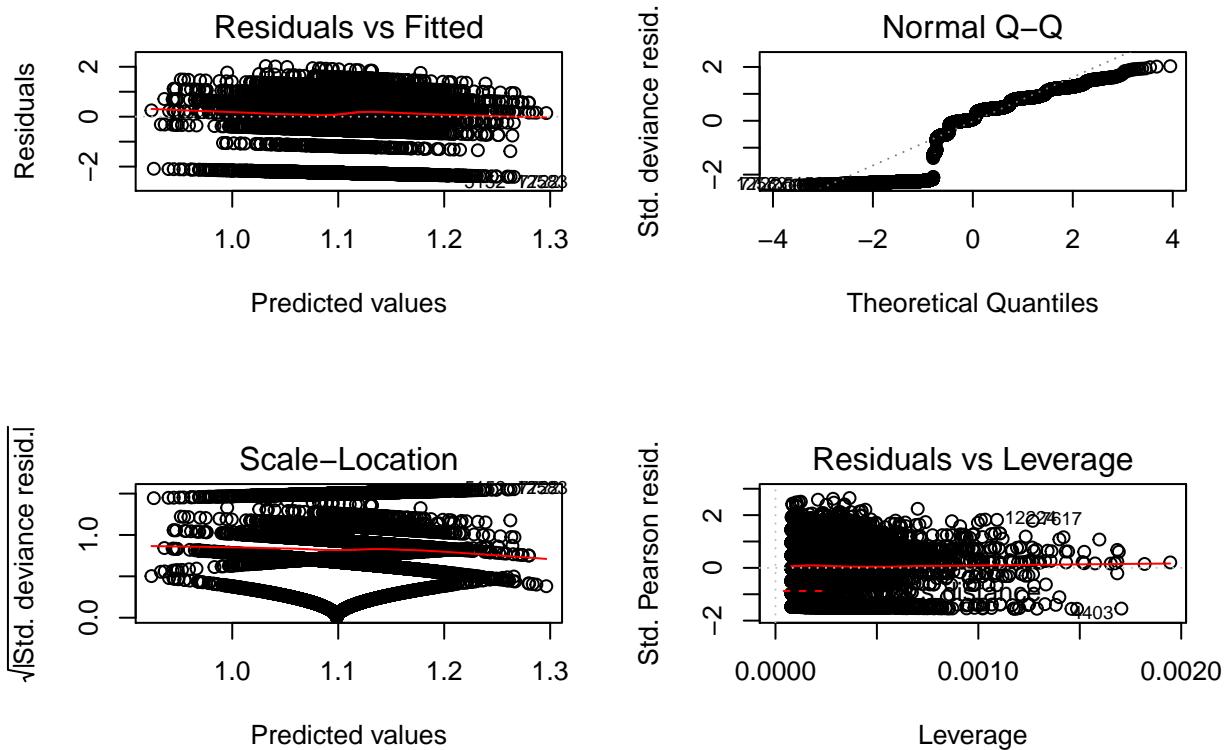
5.2.1.1 Negative Binomial Regression Model 1 Evaluation

In the model-fitting criterion, the chi-squared p-value is close to 0. This implies that the model is valid.

residual.deviance	residual.degrees.of.freedom	chisq.p.value
18164	12793	3.968e-195

5.2.1.1.1 Diagnostic Plots for Negative Binomial Regression Model 1

The normal q-q plot shows a non-linear relationship.



5.2.2 Negative Binomial Regression Model 2

In the second negative binomial regression model, all of the coefficients are positive except for that of pH. The only significant variable is the label appeal. Except for the score of 3, all of the other scores for label appeal, yield significant results. Most of the coefficients for label appeal are close to 1 or slightly greater than 1 (0.7 for Label Appeal = 0, 0.9 for Label Appeal = 1, 1.09 for Label Appeal = 2, and 0.7 for Label Appeal = 3). The only score that yields a coefficient that is less than 1 is -1. The coefficient for this is 0.4. The standard error is 3.5. The theta value is 23.46, guaranteeing a lower level of over dispersion.

Table 21: Negative Binomial Regression Model 2

	<i>Dependent variable:</i>	
	TARGET	
	(1)	(2)
Constant	0.462*** (0.045)	0.428*** (0.037)
CitricAcid	0.004 (0.006)	
pH	-0.011 (0.008)	
LabelAppeal1	0.383*** (0.039)	0.383*** (0.039)
LabelAppeal0	0.685*** (0.038)	0.685*** (0.038)
LabelAppeal1	0.909*** (0.038)	0.909*** (0.038)
LabelAppeal2	1.092*** (0.044)	1.092*** (0.044)
LabelAppeal3	0.703 (0.615)	0.671 (0.614)
Observations	12,796	12,796
Log Likelihood	-26,356.870	-26,358.000
θ	23.465*** (3.501) ($p = 0.000$)	23.422*** (3.489) ($p = 0.000$)
Akaike Inf. Crit.	52,729.730	52,728.000
Residual Deviance	19,237.720 (df = 12788)	19,237.400 (df = 12790)
Null Deviance (df = 12795)	21,051.280	21,048.310

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

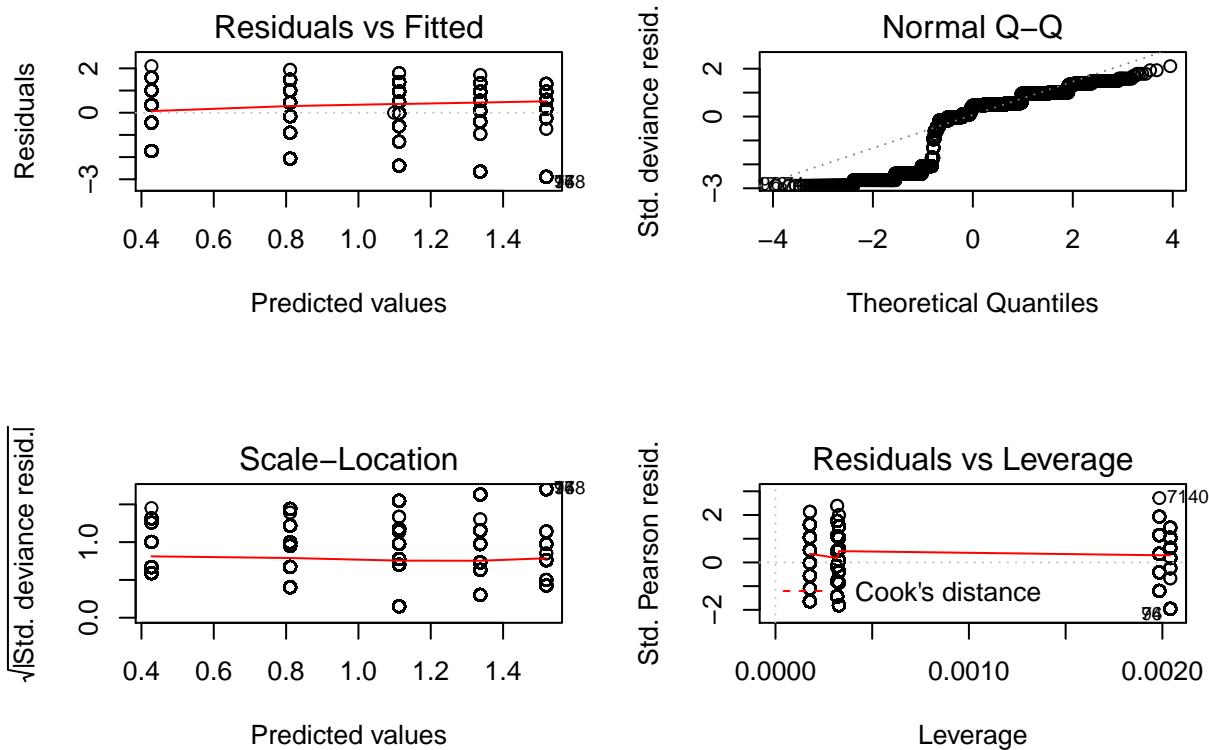
5.2.2.1 Negative Binomial Regression Model 2 Evaluation

Like the previous model, the chi-squared p-value for this model is close to 0. This model is also valid.

residual.deviance	residual.degrees.of.freedom	chisq.p.value
19237	12790	4.356e-269

5.2.2.1.1 Diagnostic Plots for Negative Binomial Regression Model 2

Like the previous model, the normal q-q plot shows a non-linear relationship.



5.3 Multiple Linear Regression

5.3.1 Linear Regression with All Variables

The first linear regression we generate includes all variables from our data set. The intercept is at 3.139 cases and Density shows a large negative impact on cases sold but with its narrow range its difficult to tell how meaningful this variable is in cases sold. The STARS variable shows an expected impact on cases sold, the difference between 1 Star and 4 Stars is an added 3.36 cases in sales.

Table 23: Linear Model with all variables

	<i>Dependent variable:</i>
	TARGET
Constant	3.139*** (0.606)
FixedAcidity	−0.008*** (0.003)
VolatileAcidity	−0.125*** (0.020)
CitricAcid	0.013 (0.019)
I(ResidualSugar^1.25)	−0.001** (0.0002)
Chlorides	−0.234*** (0.052)
I(FreeSulfurDioxide^1.25)	0.0001*** (0.00003)
TotalSulfurDioxide	0.0002** (0.0001)
Density	−1.480** (0.602)
pH	−0.003 (0.024)
Sulphates	−0.046** (0.018)
Alcohol	0.016*** (0.004)
LabelAppeal	0.427*** (0.019)
STARS2	1.905*** (0.037)
STARS3	2.697*** (0.046)
STARS4	3.355*** (0.080)
Observations	7,256
R ²	0.501
Adjusted R ²	0.500
Residual Std. Error	1.356 (df = 7240)
F Statistic	485.267*** (df = 15; 7240) (p = 0.000)

Note: *p<0.1; **p<0.05; ***p<0.01

5.3.1.1 Linear Model Metrics with all Variables

5.3.1.1.1 Multicollinearity

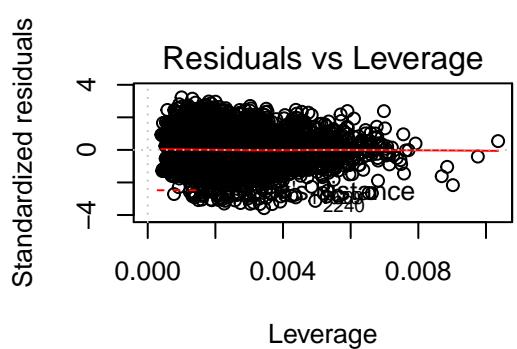
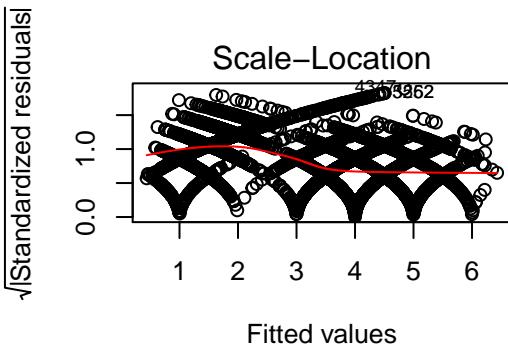
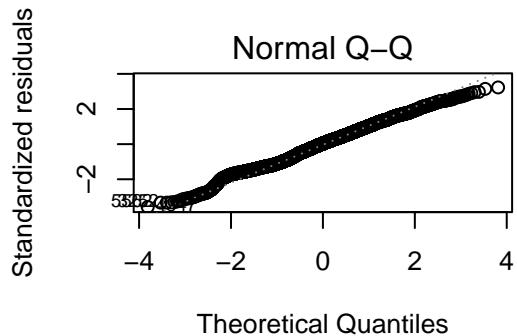
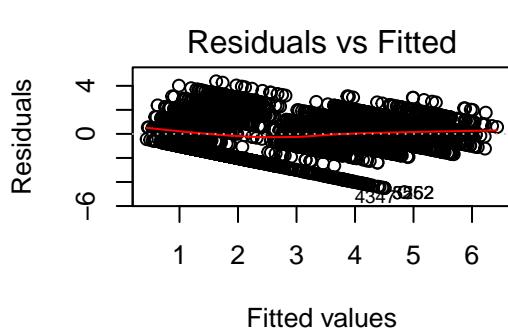
We square $GVIF^{(1/(2*Df))}$ ⁷ in order to use the VIF threshold of 5 for multicollinearity. Fortunately, we find that no variable exceeds our pre-established threshold of 5 for multicollinearity.

rn	GVIF	Df	$GVIF^{(1/(2*Df))}$	Adjusted_GVIF
FixedAcidity	1.003005	1	1.001501	1.003005
VolatileAcidity	1.004193	1	1.002095	1.004193
CitricAcid	1.003311	1	1.001654	1.003311
I(ResidualSugar^1.25)	1.001823	1	1.000911	1.001823
Chlorides	1.002043	1	1.001021	1.002043
I(FreeSulfurDioxide^1.25)	1.003812	1	1.001904	1.003812
TotalSulfurDioxide	1.005073	1	1.002533	1.005073
Density	1.002075	1	1.001037	1.002075
pH	1.002538	1	1.001268	1.002538
Sulphates	1.003861	1	1.001929	1.003861
Alcohol	1.006806	1	1.003397	1.006806
LabelAppeal	1.106042	1	1.051685	1.106042
STARS	1.121941	3	1.019362	1.039098

⁷"Which Variance Inflation Factor Should I Be Using: $GVIF$ or $GVIF^{1/(2*Df)}$?" R. N.p., n.d. Web. 13 Nov. 2016.

5.3.1.1.2 Diagnostic Plots

The Normal Q-Q plots show a linear relationship which suggests that the data is normally distributed.



5.3.2 Linear Regression Selection using AIC

5.3.2.1 Variable Selection

Using the R package MASS we can utilize the `stepAIC` function with the parameter of `direction` set to `both` to select our best subset of variables for a new model.

The method effectively removed pH and CitricAcid which were both shown to be not significant in the previous linear model using all variables.

```
## Stepwise Model Path
## Analysis of Deviance Table
##
## Initial Model:
## TARGET ~ FixedAcidity + VolatileAcidity + CitricAcid + I(ResidualSugar^1.25) +
##          Chlorides + I(FreeSulfurDioxide^1.25) + TotalSulfurDioxide +
##          Density + pH + Sulphates + Alcohol + LabelAppeal + STARS
##
## Final Model:
## TARGET ~ FixedAcidity + VolatileAcidity + I(ResidualSugar^1.25) +
##          Chlorides + I(FreeSulfurDioxide^1.25) + TotalSulfurDioxide +
##          Density + Sulphates + Alcohol + LabelAppeal + STARS
##
##           Step Df   Deviance Resid. Df Resid. Dev      AIC
## 1                   7240    13311.93 4435.174
## 2 - pH            1  0.03552113    7241    13311.97 4433.193
## 3 - CitricAcid   1  0.94340380    7242    13312.91 4431.707
```

5.3.2.2 Model using Variable Selection

We see slight variation in our intercept and some variable coefficients which is expected with the reduced number of variables. However, we don't see any large changes, one benefit with the reduced variables is our model interpretability is improved and our F Statistic has increased with the reduced degrees of freedom.

Additionally, we see that the adjusted R^2 has not changed which is expected since we removed variables that were not considered significant.

Table 25: Linear Model with select variables

	<i>Dependent variable:</i>
	TARGET
Constant	3.134*** (0.601)
FixedAcidity	−0.008*** (0.003)
VolatileAcidity	−0.126*** (0.020)
I(ResidualSugar^1.25)	−0.001** (0.0002)
Chlorides	−0.235*** (0.052)
I(FreeSulfurDioxide^1.25)	0.0001*** (0.00003)
TotalSulfurDioxide	0.0002** (0.0001)
Density	−1.482** (0.602)
Sulphates	−0.046** (0.018)
Alcohol	0.016*** (0.004)
LabelAppeal	0.427*** (0.019)
STARS2	1.906*** (0.037)
STARS3	2.697*** (0.046)
STARS4	3.355*** (0.080)
Observations	7,256
R ²	0.501
Adjusted R ²	0.500
Residual Std. Error	1.356 (df = 7242)
F Statistic	559.996*** (df = 13; 7242) (p = 0.000)

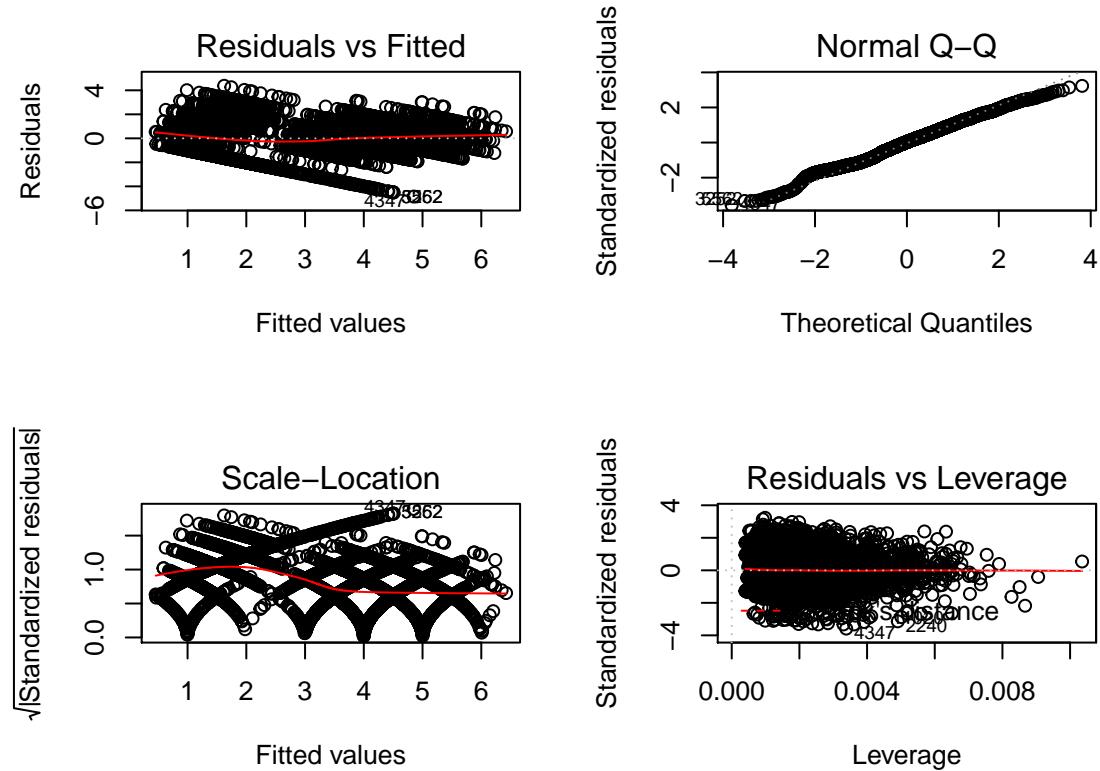
Note:

*p<0.1; **p<0.05; ***p<0.01

5.3.2.3 Linear Model Metrics with select Variables

5.3.2.3.1 Diagnostic Plots

The Normal Q-Q plots show a linear relationship which suggests that the data is normally distributed.



5.3.2.3.2 Multicollinearity

We square $GVIF^{(1/(2*Df))}$ in order to use the VIF threshold of 5 for multicollinearity. Fortunately, we find that no variable exceeds our pre-established threshold of 5 for multicollinearity.

rn	GVIF	Df	$GVIF^{(1/(2*Df))}$	Adjusted_GVIF
FixedAcidity	1.002826	1	1.001412	1.002826
VolatileAcidity	1.004095	1	1.002045	1.004095
I(ResidualSugar^1.25)	1.001601	1	1.000800	1.001601
Chlorides	1.001750	1	1.000875	1.001750
I(FreeSulfurDioxide^1.25)	1.003762	1	1.001879	1.003762
TotalSulfurDioxide	1.004725	1	1.002360	1.004725
Density	1.002057	1	1.001028	1.002057
Sulphates	1.003403	1	1.001700	1.003403
Alcohol	1.006586	1	1.003288	1.006586
LabelAppeal	1.105763	1	1.051553	1.105763
STARS	1.118645	3	1.018862	1.038080

6 Selected Model

In order to select our most appropriate model we will use the AIC as our selection criteria. This method was outlined by Snipes & Taylor for their similar research in selecting models from wine ratings and prices.⁸ As per Snipes & Taylor - "The best model is then the model with the lowest AICc (or AIC) score". Therefore, based on the results of our AIC table below, Linear Regression 2 is our best model. However, for deployment we will need to use one of the count regressions. Therefore, the count regression with the lowest AIC is Poisson Regression 1 which we will use for our predictions.

model	AIC
Poisson Regression 1	47326.78
Poisson Regression 2	52773.78
Negative binomial Regression 1	54290.7
Negative binomial Regression 2	52728
Linear Regression 1	25028.81
Linear Regression 2	25025.34

Model for Deployment - Poisson Model 1:

$$TARGET = 1.50 * 2.28 * (STARS = "2") * 2.9 * (STARS = "3") * 3.42 * (STARS = "4") * 1.004 * Alcohol$$

⁸Snipes, & Taylor. (2014). Model selection and Akaike Information Criteria: An example from wine ratings and prices. *Wine Economics and Policy*, 3(1), 3-9.

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS
4	12183	9.8	0.61	0	2.2	-0.16	48	59	0.9807	3.61	0.7925	12.9	0	7	2
4	12188	0.9	-0.96	-0.59	26.8	-0.561	176	19	0.9636	3.31	0.5077	12.6	0	8	2
5	12189	6.4	-0.13	0.06	1.8	-0.046	43	477	1.006	3.42	0.69	11	0	7	3
4	12192	1.5	0.28	1.08	1.6	0.045	36	431	0.9953	3.11	0.5356	6.2	0	10	2
4	12201	5.9	0.17	0.02	-48.9	0.03	32	311	0.9891	0.96	-1.19	8.1	-1	6	2
2	12204	12.7	0.23	0.6	2.2	0.565	7	18	0.9379	3.04	0.25	16.3	-1	12	1
2	12207	9.3	0.005	1.87	-27.2	0.07	27	39	1.017	3.12	0.59	9.9	-1	10	1
2	12208	8.9	0.48	0.97	3.5	-1.012	10	40	0.9944	3.1	0.36	9.8	-1	10	1
4	12209	7.3	2.695	0.33	1.1	0.044	14	-325	0.9901	3.1	0.6751	12.4	0	8	2
5	12210	7.6	0.42	-0.82	1.9	0.047	-165	432	0.9937	3.2	0.53	13.9	2	8	4
4	12217	7.1	0.05	0.25	1.3	-0.055	-100	524	0.9936	3.27	0.55	8	-1	8	2
4	12227	8.6	0.29	1.96	32.5	0.427	288	120	1.014	3.06	1.04	12.1	0	7	2
5	12231	6.2	0.25	1.01	-30	-0.278	272	71.15	1.053	4.09	0.34	12.8	-1	7	3
4	12232	7.6	0.17	1.1	7.1	0.05	227	228	0.9942	1.88	-1.11	9.5	0	8	2
5	12239	3.9	0.275	1.45	5.4	0.118	-119	245	0.9926	2.96	-0.79	10.8	1	6	3
2	12240	7.3	-0.96	1.02	7.4	0.061	-23	-380	0.9963	3.31	0.05	13	-1	8	1
4	12251	14	0.19	0.3	31.9	-0.245	33	-275	0.989	4.08	1.44	12.8	-1	7	2
4	12256	6.3	1.12	0.32	4.2	0.021	179	117	0.9918	3.93	0.43	12.8	1	7	2
2	12261	10.2	0.05	1.84	2.4	0.075	287	80.15	0.9862	2.36	2.19	24	0	11	1
4	12263	8.4	0.23	0.32	13.4	0.124	35	363	0.9881	3.12	0.47	8.8	-2	9	2
2	12266	8.6	0.55	0.35	15.55	0.102	35.5	248.5	0.9799	3.91	0.15	11	-1	10	1
2	12267	6.7	1.33	-1.12	1.35	-0.532	30.5	544	0.9939	3.54	0.53	9.5	0	7	1
4	12268	4.2	0.34	0.27	-30.8	0.047	21	144	0.9874	2.34	0.76	14.7	0	8	2
4	12279	-4.1	-0.21	0.29	64.7	0.051	25	86.14	1.087	4.27	1.62	6.3	1	8	3
4	12280	10.7	0.6	0.49	34	0.1	5	-381	0.9695	3.25	0.5025	11.9	1	14	2
2	12283	8	-0.83	0.44	-13.9	0.284	-18	111	0.9916	3.09	0.32	11.2	0	9	1
5	12284	13	-0.65	0.57	0.6	0.373	6	20	0.9965	3.4	0.48	13.3	1	10	3
5	12285	7.1	0.15	0.44	6	0.033	8	135	0.9893	3.19	0.3623	13.9	1	7	4
5	12286	6.3	0.79	0.3	2.8	0.239	33	125	1.031	3.03	0	14.7	1	7	3
4	12292	14.3	-1.1	1.04	14	0.032	47	365	0.98	4.44	0.5	10.53	1	7	2
2	12295	16	0.29	-2.88	2.3	-0.129	20	509	1.034	2.71	0.41	12.7	0	7	1
4	12301	11.8	0.52	0.17	-32.8	0.047	5	26	0.9932	3.26	0.8713	16.5	0	7	2
2	12314	1.6	0.19	0.32	18.75	0.356	106	517	1	2.06	1.69	6.5	-1	8	1
2	12315	10.3	-0.81	0.24	17.2	0.072	15	-176	0.9956	3.22	0.66	12.8	0	11	1
4	12318	8	0.32	0.16	-60	0.4	3	115.5	0.9945	3.22	0.58	11.2	0	9	2
5	12323	1.5	-1.1	1.31	-15.6	0.063	125	164	0.9657	3.17	-0.41	9.927	1	8	3
4	12334	6.9	-0.18	-1.15	1.5	0.224	19	-142	0.9958	3.91	0.78	14.4	0	7	2
4	12337	7.4	1.08	-0.08	8.8	0.027	23	341	0.9931	4.76	1.58	11.4	0	8	2
4	12338	7.1	1.15	1.16	30.7	0.109	30	124	0.9728	3.77	0.43	5.5	1	8	3
5	12349	7.5	0.47	-0.55	-55.6	0.048	275	89	0.9918	3.54	2.29	13.57	0	6	3
5	12350	-5.9	-0.29	0.3	12.4	-0.142	-98	168	0.9973	4.15	0.47	9.5	-1	7	3
5	12359	7	1.94	-0.52	-46.2	-0.555	28	181	0.9983	3.18	-1.03	9.3	1	8	4
5	12360	6.8	0.3	0.22	38.9	-0.523	41	521	0.9615	3.58	1.39	9.2	1	7	3
4	12373	-2.3	0.21	0.4	7.3	0.041	20.74	95.19	1.007	2.64	0.43	6.5	1	7	2
4	12374	6.7	-1.07	1.41	9.081	0.037	-1	310	1.02	3.06	1.83	9.1	-1	7	2
4	12380	8.1	0.26	-0.94	10.1	0.05	-183	375	0.9972	3.69	2.06	9	1	9	2
4	12382	6.2	0.44	-1.43	7.7	0.096	292	242	1.019	3.56	0.72	11.1	-1	7	2
3	12383	17.9	0.4	0.21	45.5	-0.372	44	182	1.048	3.35	0.54	3.6	-1	7	2
4	12390	7.4	0.44	0.17	-1	0.045	44	157	0.998	3.82	0.44	9.63	1	8	2
4	12398	6.5	0.27	1.12	-49.2	0.142	-104	175	0.9936	3.61	1.58	10.1	1	7	2
4	12405	6.4	0.18	0.77	-18.1	-0.059	24	90	0.9963	3.35	-2.82	9.4	0	7	2
2	12407	-0.4	1.41	1.64	-2.6	-0.266	-75	-31	0.9984	3.51	-0.15	15.8	0	7	1
5	12410	9.2	0.095	0.19	1.6	0.039	526	-170	1.065	4.17	0.41	6	1	6	4
5	12418	16.4	0.3	0.29	6.2	0.172	-200	95	0.9907	3.03	1.86	12.9	2	7	3
5	12421	7.4	0.42	0.47	14.15	0.667	6	185	1.015	2.8	0.4237	9.3	1	9	3
2	12422	11.9	0.39	0.41	-11.7	0.062	19	503	0.9963	3.04	0.95	9.4	1	8	1
2	12439	-4.2	0.695	-0.64	6.8	0.05969	-172	-59	0.9943	3.44	-1.89	3.6	0	6	1
4	12444	6.1	-1	0.38	-21.1	0.111	-118	106	0.9432	3.03	0.41	12.1	0	7	2
6	12463	5.8	0.32	0.28	4.3	0.032	286	115	0.9895	3.16	1.35	15.3	0	6	4
2	12465	11.9	-0.95	0.01	4.9	0.119	31	153	0.9966	3.27	0.51	3.4	-1	9	1
5	12470	14.9	0.15	0.34	61.5	0.035	31	-15	0.991	3.14	0.5398	9.7	0	8	3
3	12471	-5.1	0.21	-0.82	7.3	0.081	34	126	0.9962	2.86	0.46	3	0	7	2
5	12480	8.5	-1.16	0.48	10	0.058	146	275	1.036	3.25	0.37	11.9	0	9	3
4	12482	2.4	-0.22	0.4	-35.45	0.041	35	-346	0.9892	3.11	1.93	6.7	0	7	3
4	12484	8.6	0.32	0.29	9.4	0.038	-175	282	1.006	3.35	0.55	10.8	-1	8	2
5	12487	-2.4	0.52	0.11	2.9	0.605	13	38	0.9573	3.34	2.47	9.3	0	7	3
3	12491	7.4	0.64	0.76	31.15	0.1157	42	163	0.9984	2.9	0.49	-3.1	0	9	2
5	12503	8.8	1.32	0.44	33.4	0.042	138	-235	1.001	3.02	0.6751	13.2	0	10	4
2	12507	6.8	0.36	-2.81	5.1	0.227	67	122	0.9761	3.13	2.36	12.6	0	7	1
2	12526	12.5	0.39	-0.44	3.3	-0.046	109	81	1.036	3.27	0.56	12.2	-1	7	1
2	12533	3.9	-1.04	0.46	42.5	0.477	44	177	0.9969	3.36	0.24	9.4	0	7	1
4	12540	-1	0.785	-0.15	2.1	0.459	6	168	0.9966	3.59	0.62	7.7	0	7	2
2	12543	2.6	1.27	-0.8	12.5	0.602	38	3	0.9527	3.33	1.45	4.9	-1	6	1
5	12552	13.4	0.695	-0.05	19.4	0.118	12	127.6	0.9898	2.23	0.67	8.8	0	7	3
5	12555	6.4	0.29	0.18	15	0.588	-191	321	0.9472	0.9	0.5	9.2	2	7	3
5	12556	8	1.64	0.13	17.2	0.036	49	-238	0.9996	1.78	-0.43	9.7	0	8	3
4	12570	-6	1.26	-0.93	30.6	-0.34	218	61	0.9914	4.47	2.23	5.3	0	7	3
4	12579	11.7	1.5	0.38	77.4	0.054	32	445	1	3.22	1.56	9.7	0	9	2
2	12588	6	0.89	1.46	9.4	0.042	87	-253	0.9895	1.65	0.41	18.4	-1	7	1
4	12600	-0.1	0.3	-0.99	35.7	0.04	24	29	0.9939	3.324	0.5926	5.5	1	7	3
5	12615	5.6	0.34	0.02	6.9	0.038	192	89	0.9927	4.85	-1.14	16	1	6	3
4															

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS
4	12782	7.6	-0.16	1.56	104.9	0.506	52	151	0.9056	3.18	-0.4	7.3	-1	8	2
5	12787	13.2	0.35	-0.84	-28.2	0.368	62.41	87	1.023	2.92	0.6868	12.2	0	9	3
2	12799	8.8	0.24	0.39	1.2	-0.433	32	85	1.006	3.16	0.5	10.5	-1	8	1
4	12804	12.8	0.18	0.26	-33.6	0.023	10	276	0.9893	3.07	0.54	12.3	1	6	2
4	12809	7.2	2.52	0.27	2.4	-0.535	-504	149	0.964	3.1	0.51	9.2	-1	8	2
4	12813	7.8	0.25	-0.5	-38.2	0.04	46	133	1.041	3.14	0.6	15.7	-1	8	2
4	12816	9.8	1.78	0.49	15.4	0.046	103	101	1	2.41	0.75	2.8	-1	11	3
4	12821	6	0.17	0.22	46.8	0.039	-177	104	0.9836	2.91	0.617	17.2	0	6	2
4	12826	6.4	-0.07	0.49	7.5	0.073	-66	151	1.025	2.18	1.73	8.3	-2	7	2
4	12831	-1.4	0.13	0.61	-52.6	0.054	124	104	0.9806	3.24	2.66	16.2	0	8	2
2	12832	5.8	0.39	-0.01	-29.8	0.042	36	138	0.9938	3.95	-1.22	23	1	6	1
4	12833	6.7	0.28	-0.45	-23.8	-0.451	-130	111	0.9946	3.25	-1.19	4.7	-1	7	2
4	12835	6.5	0.27	0.31	33.8	0.036	-188	179	0.9979	3.39	1.9	13.2	0	7	2
2	12842	4.9	0.425	2.53	37	-0.492	318	396	1.016	2.73	0.57	9	-1	7	1
3	12844	6.8	0.18	0.28	5.04	0.047	52	521	1.096	3.22	0.53	4.3	0	7	2
4	12847	8.6	0.34	1.49	-0.1	0.471	11	119	0.9541	3.17	0.47	9.4	-1	9	2
2	12852	10.4	0.21	0.7	64.2	0.596	261	142	1.025	3.37	-0.87	10.1	0	7	1
4	12856	7.4	0.08	0.58	48.9	0.022	295	-191	0.9928	3.13	0.01	11.5	0	8	2
4	12857	0.4	0.2	0.31	6.85	0.053	-198	211	0.9959	3.31	0.59	10.4	-1	8	2
5	12858	5.1	0.25	1.71	7.7	0.0198	46	182.6	0.9698	3.35	0.43	10.3	1	6	4
2	12861	7.4	0.16	1.49	52.9	0.056	-185	168	0.9982	2.9	-1.33	8.7	0	8	1
4	12869	18.2	-1.27	0.59	22.6	0.147	38	132	0.9933	3.37	-0.27	9.1	0	8	2
2	12876	4.7	1.09	-0.66	20.4	-0.541	17	-11	0.9462	4.58	0.6	11.8	2	5	1
3	12877	5.7	-0.15	0.15	11.82	0.05	20	360	0.9618	3.31	0.6709	2.4	0	6	2
2	12879	1.1	0.34	0.6	1.4	0.032	228	392	0.9921	3.07	0.52	9.8	1	8	1
3	12882	12.5	-0.52	0.34	1.3	0.469	-61	108	0.991	3.36	0.45	14	1	8	2
6	12883	-1.1	0.32	0.41	0.9	0.04448	213	159	0.9752	3.09	1.54	16.37	-1	7	4
2	12887	9.5	0.49	0.36	2	-0.537	146.5	314.5	0.9924	3.24	-0.9	11	-1	8	1
4	12889	-10.9	0.22	0.34	-54	0.06435	-73	-127	0.9799	2.96	0.5183	4.8	0	8	2
5	12891	6.8	0.17	1.31	2.078	0.039	3	530	0.9924	3.28	1.44	10	1	6	3
5	12894	6.5	0.18	-1.02	1.7	-0.213	30	-182	1.02	3.49	0.3	10.2	-1	7	3
2	12895	16.6	0.68	0.37	1.6	0.049	7.25	193	1.026	3.16	0.48	13.8	0	8	1
5	12899	-14.1	0.24	0.89	-106.9	-0.12	218	467	0.9537	3.24	-2.46	9	1	7	3
5	12905	6.5	0.94	0.06	17.1	0.128	29	44	0.9949	3.31	1.46	14	2	7	4
2	12913	4.4	0.84	0.18	5.8	0.1001	32	443	1.043	3.52	0.66	12.3	0	7	1
4	12916	6	1.01	1.92	50.6	0.408	171	149	0.9937	3.652	0.82	11	0	7	2
2	12917	6.6	0.76	-0.04	1.4	0.656	34	421	0.9572	3.17	0.38	10	0	7	1
5	12925	6.2	1.49	-0.22	-31.5	0.036	-185	-147	0.9894	3.71	3.43	12.8	-1	7	3
5	12934	6	-0.77	2.89	6.3	-0.545	143	174	0.9713	3.69	1.21	9.8	1	7	3
5	12939	8	0.44	1.1	12.4	0.308	-142	-35	0.9991	3.61	0.64	9.2	1	9	3
4	12943	1.7	0.3	0.2	1.1	0.077	48	166	0.9944	4.31	0.54	8.7	1	6	2
5	12950	7.7	0.57	0.03	16.8	0.474	-11	211	0.9755	2.954	0.58	14.5	1	8	3
2	12961	-11.4	1.29	1.97	24.9	0.066	10	126	1	3.12	1.18	14.5	-1	13	1
2	12963	4.4	1.555	0.78	-38.9	0.075	226	415	1.041	3.49	1.09	9.3	0	8	1
6	12973	5.2	-0.99	0	1.8	0.05	-228	51	0.9728	3.68	0.79	18.1	1	6	4
4	12979	5.8	1.28	0.27	1.6	0.062	-185	-150	0.9918	2.28	0.81	6.7	0	6	2
4	12980	8.3	0.95	0.96	2.6	0.675	235	192	0.9627	3.4	0.53	13.8	-1	9	2
4	12981	7.4	1.7	0.36	53.6	0.821	-113	178.9	0.9968	1.71	-0.13	9.1	-1	8	2
2	12982	9.2	1.14	0.39	0.9	-0.226	15	-390	1.029	2.96	0.28	10.4	1	10	1
2	12992	9.3	0.49	0.36	1.7	-0.125	3	305	0.9191	2.21	1.12	4.4	1	10	1
2	12994	-5.2	-0.435	0.18	2.1	-0.174	5	30	0.9967	3.4	0.37	9.8	0	9	1
4	12999	7.8	0.6	-0.6	-39.4	0.069	32	73	0.9737	2.49	0.57	10	-1	10	2
4	13002	5.7	0.24	0.24	40	0.498	190	121	0.9579	3.13	0.36	10	0	7	2
4	13004	3.7	-0.485	1.5	-51	0.044	-233	-76	0.9971	4.44	-1.13	9	0	8	2
2	13010	6.4	-0.66	0.07	6.7	0.254	10	-121	1.029	2.97	0.3507	10.56	1	7	1
4	13013	8	1.25	-0.75	9.7	0.357	15	323	0.9941	2.08	0.36	10	0	9	2
4	13015	6.6	0.27	0.29	23.6	-0.344	73	-226	0.968	3.89	1.92	9.8	1	7	2
4	13019	6.3	0.34	1.33	14.7	-0.414	49	-156	1.004	3.23	0.46	9.992	2	7	2
2	13030	20.6	1.29	0.03	28.5	0.076	21	143.7	1.028	3.215	0.68	11.04	-2	8	1
5	13031	6.7	0.11	0.34	39.2	-0.134	41	-80	0.9962	3.42	0.5997	10.8	1	7	3
2	13036	7	0	0.8	36.3	0.036	44	132	1.042	3.34	0.11	9.4	1	7	1
4	13037	11.4	0.26	0.38	1.5	0.061	-190	120	0.9919	2.44	2.12	4.1	1	8	3
5	13042	7.8	0.68	1.91	1.7	-0.19	104	283	1.033	2.54	0.64	8.5	2	8	3
2	13054	-1.5	1.16	-0.83	-36	-0.544	115	110	0.9525	2.26	-0.63	13.33	-1	7	1
5	13060	5.3	0.32	-1.47	3.7	0.043	22	-60	0.9937	2.15	1.99	10.4	1	6	3
4	13072	10.3	1.54	3.37	4.5	0.113	22	-132	0.998	3.28	0.9148	11.5	0	11	2
2	13073	14.8	0.59	1.11	32.5	-0.174	4.475	334	1.04	5.11	0.4786	16.2	0	7	1
5	13079	4.9	0.15	1.94	-41.8	-0.383	-109	253	1.008	2.98	0.39	17.7	1	7	3
4	13081	8.4	-0.25	1.26	1.2	-0.342	-92	467	0.9455	2.07	-1.41	9.5	-1	8	2
2	13086	6.8	0.51	-0.07	54.7	0.074	9	-16	1.031	3.68	0.5722	9.5	0	7	1
4	13087	-0.6	1.02	0.27	2.4	-0.397	199	-249	1.045	2.65	-0.18	9.2	0	8	2
2	13090	6.6	1.36	-0.67	-60.8	0.07	287	467	0.99	1.86	0.82	8.1	0	7	2
2	13098	4.8	0.27	0.25	59.4	0.053	54	202	1.008	3.22	0.56	9.3	0	7	1
2	13100	7.3	-1.06	0.27	-47.6	0.047	16	79	0.9917	3.07	0.46	5.2	0	8	1
2	13105	8.3	0.42	0.62	19.25	0.04	41	-146	1.012	2.98	0.67	9.7	0	9	1
2	13106	6.4	0.25	0.3	5.5	0.208	15	388	0.9966	3.14	-2.4	5	0	7	1
4	13107	6.2	0.06	0.25	-33.3	0.24	35	-313	1.032	2.35	0.44	11.8	0	7	2
5	13113	12.8	1.46	0.28	27.2	0.038	85	153	0.9909	3.33	-0.21	12	2	7	4
5	13115	5.9	0.12	0.27	-24.5	-0.469	40	507	0.9923	3.15	0.68	12.1	0	6	3
2	13117	-5.5	0.58	1.67	-55.85	0.058	8	22	1.036	5.37	0.49	15	-1	8	1
4	13118	19.4	0.22	0.27	87.6	0.057	45	586	0.993	3.305	0.44	9.9	-1	8	2

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS
4	13240	6.6	0.72	0.89	0.8	0.462	-55	-306	0.9776	2.65	0.37	7.8	1	7	2
5	13249	5.9	0.5	0.49	-1.871	0.054	187	-39	0.9948	3.43	0.5	9.2	1	6	3
4	13250	10.7	0.59	-0.76	2.3	0.082	-111	712	0.9974	4.29	1.09	10.2	-1	8	2
4	13256	-1.8	-1.725	0.34	50.5	0.157	97.5	-5	0.9934	3.18	1.49	10.9	0	8	2
2	13261	27.4	0.185	0.14	-6.2	0.544	47	421	0.984	3.55	0.44	14.25	0	6	1
2	13263	9.6	-0.78	0.61	1	0.028	190	24	0.9926	2.91	0.04	15.8	0	10	1
4	13268	2.4	0.05	0.19	4.9	0.055	267	127	1.017	4.26	0.41	6.3	1	7	2
4	13275	3.3	-0.23	-0.55	-23.5	0.077	221	-445	1.038	3.36	1.06	9.1	1	8	2
5	13277	-2.2	0.53	0.33	13.7	0.395	-10.21	-93	0.9902	2.56	-1.16	12.8	1	8	3
4	13283	6.8	0.63	1.27	1.9	0.215	87	108	0.9438	4.06	0.45	14.6	0	7	2
2	13284	7.1	1.13	-0.05	2	0.047	400.5	307.5	1.032	3.24	0.08	10.7	0	8	1
2	13285	15.2	1.06	0.3	-0.3	0.037	29	159	1.039	5.21	0.42	11.74	0	8	1
5	13286	12	0.36	1.98	-11.8	1.161	-3	63.54	1.02	3.4	0.43	11	0	8	3
2	13287	6.6	-0.07	-0.02	66	-0.333	-109	-94	0.9693	2.54	0.55	2.7	-1	7	1
2	13290	-1	0.35	0.35	6	-0.088	31	344	1.039	3.1	0.47	9.4	0	7	1
2	13291	7.5	-0.68	-1.37	-24.1	0.117	-235	255	0.9963	3.38	0.4538	9.2	1	8	1
5	13294	-2.2	-0.39	1.11	-1.1	-0.043	175	-274	1.003	2.09	1.46	18.4	1	8	3
4	13295	7.7	0.3	0.34	42.2	-0.332	-232	-182	1.024	3.18	0.34	6.7	-1	8	2
4	13303	12.4	-0.34	0.17	17.75	0.335	-122	553	0.9992	3.87	1.55	8.8	-1	7	2
2	13306	7.8	1.34	1.85	3.2	0.027	28	786	0.9475	2.96	-0.01	11.3	-2	9	1
4	13311	5.8	0.29	0.05	0.8	0.272	11	363	0.9924	3.36	0.35	14.8	1	6	2
2	13322	13.1	0.71	-1.55	-46.6	0.094	178	-299	1.031	3.47	2.27	9.4	0	8	1
2	13331	19	1	0	2.6	1.106	25	55	0.9968	4.93	0.68	9.82	0	9	1
4	13337	13.4	-1.82	1.79	-26.6	0.385	40	199	1.007	3.2	0.26	20.9	1	6	2
2	13344	7.3	-0.13	0.43	95.7	0.048	52	409	0.9698	4.5	-1.33	9.606	0	8	1
4	13362	5.6	-0.73	-0.83	20.3	0.027	37	150	0.991	3.3	-1.15	13.9	1	6	2
2	13364	6.8	0.28	0.43	7.6	-0.653	-257	129	1.053	3.08	1.37	12.5	-1	8	1
4	13366	6.8	0.33	0.31	64.6	0.045	25.73	-279	1	3.06	0.55	15.1	0	7	2
4	13368	18.3	0.41	-0.92	4.7	0.023	82	110	1.007	2.21	-1.14	12.5	-1	7	2
2	13370	8.5	0.44	0.5	52.2	0.369	-63	311	0.9963	1.05	1.1	13.5	-1	9	1
5	13377	-6.4	0.34	0.28	-11.7	0.166	-26	457	0.9968	2.89	0.49	11.7	1	8	3
2	13378	8.9	0.29	0.34	-14	0.037	10	557	0.9962	1.93	-0.23	14.2	-1	9	1
2	13388	11.1	0.32	-0.54	2.2	0.415	159	-347	1.003	2.89	1.44	11.1	0	11	1
4	13392	6.3	1.28	0.3	5.741	0.463	23	120	1.016	3.24	0.47	14.5	1	7	2
4	13398	6.4	1.07	0.32	1.9	0.04	234	-215	0.9703	3.68	-0.52	11.8	1	7	2
4	13403	-2.7	0.21	-1.2	-44.1	0.033	55.42	684	0.954	2.63	0.35	10.5	1	8	2
4	13404	15.3	1.04	0.38	16.05	0.058	16	19	0.9648	3.38	2.01	9.2	1	7	2
4	13409	7.4	-0.38	-2.95	-37.4	0.561	264	458	0.9991	3.06	0.57	9.9	0	8	2
5	13416	12	0.4	1.94	1.3	-0.388	162	149	1.052	4.18	0.96	8.7	2	8	3
2	13422	22.1	0.17	1.22	58	-0.133	11	-453	1.023	3.32	-0.78	15.7	0	11	1
4	13427	-2.1	0.93	0.25	-32.9	0.048	152	-23	0.9966	1.48	0	9.5	0	8	2
5	13433	2.4	-1	0.28	2.5	-0.554	-239	109	0.9921	4.04	-1.29	11.6	1	7	3
4	13438	8.8	1.28	0.33	30.3	0.456	16	-292	1.001	3.14	1.36	14.7	-1	9	2
5	13441	7	0.28	-0.56	-51.5	0.05708	32	141	1.082	3.38	0.53	0.3	1	8	4
5	13449	12.4	0.89	0.28	73.95	0.041	29	199	0.9942	2.06	-1.31	14.4	1	7	3
2	13450	6.7	-0.1	0	5.788	0.471	148	75	0.9955	3.15	1.83	9.739	1	7	1
2	13453	13.3	0.21	0.24	6	0.042	-117	123	0.993	3.14	-1.29	12.3	-1	8	1
2	13460	-2.9	0.41	0.63	26.7	0.039	185	179	0.9979	3.08	0.44	9.845	1	9	1
4	13461	6.4	-0.44	0.45	3.5	-0.041	118	180	0.9942	1.88	-0.68	7.8	1	7	2
4	13465	20	0.83	0.42	-30.2	-0.097	10	-188	0.9679	3.32	0.46	9.5	0	8	2
4	13468	13.8	0.75	-0.96	6.8	-0.435	44.5	234	0.9972	5.44	-2.33	10.2	1	8	2
4	13481	7	0.36	0.21	64.7	0.378	20	371	0.9708	4.39	1.49	5.2	0	8	2
2	13485	7	0.29	3.76	3.8	-0.094	37	-109	1.015	3.47	1.65	9.4	-1	8	1
5	13487	5.9	-0.1	0.56	-38.3	0.06674	258	102	0.9923	3.24	-1.94	10.5	1	8	3
4	13490	10.1	-0.46	0.92	1.2	0.06	19	464	0.99	3.25	0.4462	7.9	0	7	2
2	13493	15.5	-0.14	0.44	-20.8	0.034	113	-10	0.9502	2.22	2.03	10.54	0	7	1
2	13497	-14.6	0.7	-0.64	-29.5	0.081	38	430	0.9882	3.08	1.89	10.3	-1	7	1
4	13508	6.5	0.22	0.19	7.6	-0.422	16	115	0.9937	4.04	0.44	10.3	1	7	2
2	13516	18.5	0.91	0.11	81	0.172	12	31	0.9979	3.4	0.7613	9.9	0	10	1
4	13525	17.9	-1.31	0.01	2.3	-0.438	197	19	0.996	4.17	0.87	9.1	0	11	2
5	13533	7.3	1.08	1.39	23.1	0.03804	-185	424	0.9938	4.05	0.58	4.5	0	8	4
4	13535	15.7	-0.5	0.53	4.9	-0.475	-130	101	0.9768	3.19	0.503	10.2	0	7	2
4	13538	14	0.2	0.3	15	0.546	23	166	0.9948	3.62	2.18	13.6	0	8	2
2	13545	-0.3	0.27	0.19	14.2	0.085	21	561	0.9447	2.24	0.7926	9.5	1	7	1
5	13566	7.7	0.25	0.43	57.3	0.231	306	115	1.043	4.14	-0.91	8.6	-1	8	3
2	13581	13	0.24	0.36	5.2	0.524	49	-253	0.9942	2.89	0.37	10.8	0	8	1
2	13584	-4.7	0.72	1.7	0.8	0.029	26	77	1.025	5.66	0.51	14.2	-1	6	1
2	13588	5.6	0.27	-0.18	0.9	0.025	-215	49	0.9512	3.402	0.95	13.1	-1	6	1
2	13596	16	1.66	-0.6	6.2	0.059	-70	136	1.036	3.3	0.49	12	0	7	1
4	13600	6.3	-0.635	2.53	-3.7	0.04	37	288	1.007	3.8	-0.1	6.3	2	7	3
4	13604	6.4	1.53	-1.36	27.3	0.463	17	-137	0.9987	3.23	0.44	12.2	0	7	2
2	13608	6.6	0.46	0.23	-50.4	0.222	19	184	1.021	3.11	0.38	9	1	8	1
1	13611	-11.5	0.4	1.23	12.9	0.033	-64	186	1.02	3.08	0.49	-3.6	0	7	1
2	13612	6.4	0.85	0.98	2	-0.358	21	191	0.9923	4.03	1.63	9.6	0	7	1
4	13615	6.1	-0.285	-0.16	60.5	0.056	77	172	0.9954	3.64	0.73	5.4	0	8	2
4	13616	14.5	1.63	1.19	6.7	0.037	15	60	1.044	3.95	-0.17	2.2	0	8	3
4	13618	-0.8	1.77	1.69	-27.9	-0.621	177	65	0.976	5.27	-0.51	12.7	0	8	2
4	13625	21.1	0.65	3.59	64.6	0.05	26	203.9	0.9478	3.33	0.53	9.1	1	8	2
5	13628	7.1	0.44	0.62	11.8	0.493	52	276	1.049	3.62	0.46	8.7	-1	8	3
2	13629	8.9	1.1	1.22	1.9	0.494	-212	16	0.9948	3.35	0.7	9	0	10	1
5	13630	-2	0.2	0.38	-47.2	0.034	105	104	0.9887	2.07	0.52	15.9	1	7	3

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS
2	13770	11.4	0.35	0.36	1.6	0.038	163	-288	1.018	3.25	2.24	5.3	0	9	1
4	13774	8.8	0.56	0.28	7.7	0.053	37	551	0.9949	3.06	0.5	2	1	7	3
2	13787	29.3	0.04	0.26	21.35	-0.019	52	495	0.9904	2.33	1.77	11.5	0	9	1
2	13791	7.5	0.36	0.59	2.2	0.152	-563	18	0.9601	3.04	1.05	0	1	12	1
2	13802	1.1	1.51	0.57	2.3	0.201	-250	-176	1.063	3.36	0.55	11	-1	8	1
2	13807	7.3	0.365	0.49	65.8	0.163	-18	42	1.033	2.5	0.78	11	0	8	1
2	13808	7	0.24	2.06	6.6	0.029	17	227	0.9965	3.03	0.61	9.5	-2	8	1
4	13809	8.5	0.23	-0.31	-34.7	0.035	321	110	1.007	3.07	-0.69	6.4	1	9	3
4	13810	3.4	0.38	1.84	59.3	-0.048	5	12	1.033	3.36	0.7267	12.4	0	8	2
4	13822	16.7	0.615	1.35	5.8	0.315	7	28.62	0.9646	3.74	0.09	3.2	1	14	3
4	13823	-2.9	0.28	-0.35	16.9	0.044	231	-227	1.004	3.35	2.15	10.7	-1	6	2
4	13825	7.7	-0.06	-0.63	-43.6	-0.209	29	131	1.038	3.68	0.44	11	0	8	2
5	13826	3.2	0.16	0.35	-7.3	0.635	-109	147	0.9935	2.96	0.36	10	1	9	3
4	13833	17.1	1.45	-0.93	1.1	0.034	36	84	0.9914	3.05	0.55	11.6	0	10	2
4	13837	8.2	0.3	1.78	12.4	0.043	52	154	0.9945	3.04	2.11	12	-1	9	2
4	13842	17	0.66	-0.49	-5.1	0.031	-47	122	0.9932	3.03	0.52	10.3	0	9	2
4	13846	13	0.47	0.49	4.3	0.085	6	-7	0.9828	2.61	-0.76	15	0	14	2
5	13852	1.4	0.78	0.45	-24.8	0.16	370	124	0.9953	2.93	-0.09	10.8	1	11	3
2	13853	11.8	-1.09	1.29	2.1	0.102	304	-42	0.99	2.61	0.57	12.9	-2	10	1
4	13858	9.7	0.36	0.26	56.7	0.081	236	79	0.9706	2.84	0.78	11.4	-1	9	2
4	13860	1.5	0.21	0.83	1.8	0.254	-101	222	1.04	3.46	0.44	11.2	0	7	2
2	13866	5.7	0.22	1.52	3.5	0.04	27	211	0.961	3.9	0.36	13.3	0	6	1
2	13886	7.6	1.73	0.29	2.1	0.075	272	-124	0.9576	3.46	0.6263	4.8	0	8	1
5	13887	4.8	0.61	0.4	4	0.073	235	69	0.9979	3.22	-0.4	9.5	1	10	3
2	13890	-1.1	1.76	0.34	-63.5	-0.198	30	133	0.9954	2.78	0.44	9.8	2	7	1
4	13891	-9.1	-1.9	0.32	-1.867	0.549	257	117	1.027	2.3	0.54	15.7	-1	7	2
2	13893	7.6	1.71	0.34	21.3	-0.131	18	427	0.9908	3.06	1.53	12.4	-1	8	1
5	13902	9.2	-0.59	-1.25	37.7	0.053	-10	175	1.008	3.2	1.05	11	2	8	3
3	13903	12	0.15	0.44	12.6	0.499	65	875	0.9969	3.26	0.6377	3.8	0	7	2
4	13908	-2	0.54	1.95	2.4	0.581	265	301	1.001	4	0.71	8.9	1	11	2
2	13912	18.7	0.27	1.04	3.6	0.036	44	340	1.019	2.15	-0.11	9.6	-2	7	1
4	13924	5.9	1.2	0.1	21.4	-0.42	-98	-61	0.9745	2.84	0.92	6.5	1	7	3
2	13928	7.8	0.34	0.12	-51.7	0.024	-238	231	0.9908	3.11	0.41	12.1	0	8	1
2	13929	9.8	-0.4	0.3	-6.2	0.054	108	152	1.024	3.1	-1.97	9.5	1	7	1
4	13938	1	1.32	-0.49	-7	-0.459	200	189	0.9986	2.94	0.99	9.4	1	7	2
2	13939	7.7	-0.2	0.34	6.5	0.23	-265	192	0.9908	2.75	0.7089	7.7	-1	8	1
5	13941	8.5	-0.53	1.27	9.2	0.032	-193	61	1.004	3.06	-0.46	11.5	1	9	3
2	13951	10.2	0.44	0.88	6.2	-0.166	-210	505	0.9677	3.03	0.51	9	1	12	1
4	13962	-4.8	0.17	-0.35	-104	0.578	109	-253	0.9485	3.4	0.1	11	-2	8	2
2	13964	6.2	1.6	-0.23	1.2	0.539	147	95	0.9869	3.24	0.89	11.8	-1	7	1
4	13967	3	0.31	0.27	11.1	-0.018	23	-304	0.994	3.41	0.54	11.7	-1	8	2
5	13971	4.3	1.37	0.4	1.5	0.037	143	107	0.9804	3.46	1.12	18.2	-1	7	3
4	13972	-0.2	0.3	-1.12	27.6	0.025	37	107	0.9916	3.31	1.23	5.7	0	7	3
5	13975	12	-0.11	0.76	-40.2	-0.141	-249	-2	0.9526	1.93	-0.34	13	2	13	3
2	13977	-4.6	0.24	-0.81	56.8	0.034	95	-140	0.9977	3.2	1.07	9	0	8	1
5	13979	5.1	0.26	0.05	1.1	0.915	46	-209	0.9552	3.35	0.43	11.2	0	6	3
2	13983	6.6	0.37	1.72	-28.4	0.613	-4	210	1.023	3.15	0.01	11.13	-1	7	1
4	13984	7.6	0.4	0.09	-38.7	-1.011	6	19	0.9788	3.99	0.82	11.7	0	11	2
2	13987	8.1	0.02	-0.84	7.9	0.034	17	-241	1.014	4.08	0.31	7.3	0	7	1
5	13994	6.1	-0.48	1.04	9.8	0.644	33	152	0.9809	3.31	0.3922	18.8	0	7	3
2	13999	10	0.22	1.28	17.6	0.054	178	-200	0.9948	3.83	-1.14	10.1	0	7	1
4	14003	6.8	-1.7	0.22	6.2	-1.089	41	190	1.016	3.18	0.51	9.2	2	7	2
4	14008	9	-0.26	0.03	65.2	-0.482	-234	157	0.995	4.46	1.78	10.1	1	6	2
4	14011	17.7	0.19	0.59	13.6	0.18	60	-57	0.9989	3.17	0.4851	8.7	2	9	2
2	14012	9.3	-0.92	0.35	1.7	0.05	257	178	1.001	3.16	-1.05	10.2	0	10	1
4	14016	-4.2	0.35	1.58	13.8	0.048	-183	103	0.9679	3.28	-0.36	5.7	-1	7	2
2	14017	7	-0.38	1.87	21.9	0.066	-24.98	10	1.023	3.33	0.77	11	0	8	1
4	14020	16	0.41	-0.02	-96.7	-0.369	-169	118.2	0.9618	3.244	0.64	10.1	0	8	2
5	14027	12.4	-1.04	0.49	-13.8	0.046	87	-38	1.038	3.244	-0.12	13.9	1	8	3
4	14038	6.4	1.49	0.49	7.5	0.054	-238	-139	1.046	4.07	3.38	15.4	0	7	2
5	14040	-17.2	0.3	1.94	-35.2	-0.078	114	531	0.9945	3.21	-1.24	9.9	1	8	3
2	14042	-0.6	0.59	0.24	7.4	0.044	142	308	1.03	3.97	2.08	4.8	-1	6	1
4	14055	18.4	-0.58	0.33	-42.6	0.059	-207	84.52	0.9969	2.69	2.22	10.1	1	7	2
4	14057	6.6	0.26	-0.69	126.5	0.239	56	-28	0.9906	4.51	0.3	18.2	1	7	2
5	14060	7.3	0.18	1.38	-22.3	0.046	28	-262	1.042	3.59	-0.06	9.4	1	8	3
4	14081	7.2	0.23	0.25	18.8	0.177	219	161.3	1.056	3.11	-0.17	11.6	-1	8	2
4	14091	5.3	0.34	-0.43	27	0.041	43	542	0.9928	3.91	0.68	6.8	0	7	2
4	14111	6.6	0.56	-0.37	-1.8	-0.071	183	107	0.9457	2.51	0.51	11.3	-1	7	2
5	14117	-2.3	0.16	-0.08	-14.1	0.037	18	102	0.9923	3.62	-0.24	11.27	1	7	3
4	14121	11.2	0.2	0.39	16.5	0.304	-225	149.2	1.036	4.19	0.44	10.25	0	8	2
5	14122	8.3	0.4	1.29	16.3	0.1137	28.5	190	0.9964	1.92	1.86	12.3	1	7	3
4	14125	18.6	0.01	1.69	30.6	0.07	25	402	0.9745	3.05	-0.25	9.2	0	7	2
2	14129	7.8	0.43	0.32	29.7	0.08	29	161	0.9974	2.02	0.64	14.5	0	9	1
2	14135	8.8	0.61	0.3	2.8	0	78	-321	0.9976	3.26	0.51	9.3	-1	10	1
5	14148	8.3	-0.14	1	13	0.045	11	160.3	0.9286	4.2	0.55	10.9	2	9	3
4	14157	6.9	0.13	0.86	6.596	0.035	157	138	1.044	2.88	0.76	10.33	0	7	2
2	14161	7.3	1.71	0.09	-0.5555	0.39	10	505	0.9565	3.3	0.67	16.4	0	8	1
5	14163	7.1	0.685	0.35	119.3	-0.364	9	638	0.9963	2.39	0.2624	3.1	0	8	1
5	14172	6	-1.4	-1	12.2	-0.242	25	97	1.003	1.93	0.6049	11.3	-1	7	3
5	14180	6.1	0.51	0.16	-32.7	0.069	313	-158	0.9902	2.83	0.74	16.7	1	7	3
4	14182	-1.6	1.03	0.3	-19.5	0.025	47.7	128.3	0.991	3.11	1.25	11	1	7	2
4															

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS
4	14316	17.6	-0.47	-0.27	32.1	0.03	32	150	0.9936	2.51	0.31	12	0	7	2
5	14319	0.9	0.08	0.44	14.1	0.053	-500	185.4	1.001	2.75	-0.07	9.1	1	9	4
2	14322	7.8	0.46	0.26	-43	0.1036	-231	53	0.9981	3.43	1.42	9.2	1	9	1
4	14323	7.9	-2.36	-0.26	-114.3	0.027	316	92	1.025	5.26	0.4046	15.8	-1	9	2
5	14325	-10	0.3	1.24	60.1	0.237	52	-44	1.024	3.3	0.33	14.4	2	9	3
4	14327	-3.6	0.78	-1.12	41.9	0.036	28	-77	1.039	3.24	0.77	6.1	0	8	3
5	14329	6.9	1.34	-0.7	-19.3	0.23	40	461	1.065	2.98	0.47	11.8	0	8	3
2	14341	0.1	-0.98	1.12	-50.6	0.046	193	208	0.9749	3.23	-0.28	9.8	0	8	1
5	14342	19.6	0.22	0.28	14	0.583	83	197	0.9981	3.14	0.98	16.3	1	9	3
5	14346	6.2	1.78	0.24	6.1	0.032	260	86	0.9545	1.9	1.87	12.7	1	7	4
4	14351	7.6	0.1	-1.13	1.2	0.481	33	-258	0.9909	3.06	0.68	16	0	8	2
2	14354	7.3	0.27	0.32	-119.6	0.859	23	72	0.9964	2.14	-0.72	10.5	0	8	1
4	14355	7.4	0.59	-0.89	4.4	-0.127	6	-121	0.9974	3.38	0.5	6.8	0	8	2
5	14358	7.1	0.28	1.94	8.5	0.03	359	223	1.042	4.48	0.46	10.01	2	8	3
2	14359	8.7	0.45	0.4	55.6	0.067	-75	100	0.9499	3.05	0.6099	14.5	-1	10	1
4	14364	7.5	0.32	-0.46	-112.1	-0.502	111	-165	0.9861	3.15	-0.23	12.8	0	8	2
2	14374	6.6	-0.715	0.24	-16.4	0.412	-222	140	1.019	3.36	1.07	10.46	-2	7	1
2	14376	8.5	0.585	0.18	2.1	-0.42	-0.37	30	0.9967	3.2	1.45	12.9	-1	9	1
2	14382	-3.4	0.39	1.53	26.7	0.02	38	312	1.02	3.18	2.1	12	0	8	1
2	14384	-1.6	-0.58	0.3	-33.1	0.051	366	552	0.9976	4.2	0.62	9.621	0	8	1
4	14393	-17.5	0.24	-0.57	7.3	0.19	-61.13	-1	1	3.12	0.5	5.8	0	7	2
2	14398	10.9	0.27	-0.98	6.7	-0.317	61	230	0.9661	2.82	0.4	9.4	0	7	1
5	14403	2.6	1.43	0.75	-34.6	0.042	183	61	0.9914	3.22	0.54	10.8	0	7	3
2	14406	10	-0.33	0.14	4.402	0.071	83.62	373	1.032	3.16	-0.61	7.9	0	11	1
4	14408	6.3	0.31	0.3	35.9	0.03822	345	212	0.9962	4.16	0.55	16	0	7	2
5	14411	-3.2	-0.68	1.76	-41.1	0.025	43	117	0.9928	3.46	1.23	9.7	1	7	3
4	14414	5.8	0.23	0.2	2	-1.15	39	426	0.9923	2.22	-0.13	16.2	0	6	2
2	14418	6.8	-0.64	0.36	1.4	0.08236	-122	105	0.9912	3.23	0.6	8.9	-1	7	1
4	14423	-10.2	-0.5	1.79	-41.4	0.098	13	110.3	0.9966	3.03	0.22	15	0	8	2
4	14442	7	0.36	-0.16	104.5	-0.006	67	-101	0.9915	2.84	0.55	6.3	0	8	3
4	14443	-0.9	0.25	3.45	69.45	0.492	52	161	0.9986	3.88	0.44	14.7	0	7	2
4	14444	16.1	1.65	0.22	6.2	0.025	36	30	1.027	2.29	0.6	13.8	-1	7	2
5	14446	13.3	-1.06	0.29	-44.6	0.132	39	118	1.066	3.05	0.7594	9.1	-1	7	3
2	14455	5.8	1.56	0.68	7.3	-0.118	-62	145	0.9944	3.15	-0.61	10	0	6	1
5	14456	-4.2	0.225	0.46	-52.4	-0.423	188	118	0.989	3.57	0.4	12.8	0	5	3
4	14458	7.7	0.11	0.81	14.05	0.369	-325	-208	0.9963	3.67	0.59	11	0	8	2
3	14464	7.1	0.68	1.33	5.904	0.324	-211	104.8	1.034	2.43	0.38	0.2	1	8	2
5	14466	8	0.71	0.36	-9.5	0.608	50	151	0.9632	2.97	0.63	10.3	1	9	3
2	14467	7.9	0.24	1.49	-100.6	0.046	-186	-54	0.9908	2.65	1.08	11.4	0	7	1
4	14469	25.9	-0.15	-0.91	21.1	-0.07	31	257	0.9585	4.39	1.14	6.7	-1	9	3
5	14483	9.7	0.815	0.15	2.6	-0.356	80	210	1.036	4.46	0.62	17.3	1	9	3
2	14484	0.5	0.475	1.35	14.4	0.055	146	131	0.9932	2.97	0.29	5	0	7	1
2	14490	7	1.53	0.32	53.8	-0.21	-7	-98	0.9958	3.21	0.34	10	0	7	1
4	14491	6.8	1.51	2.79	1.8	0.118	13	20	0.9761	3.42	-0.29	11.3	-2	8	2
2	14494	6.8	0.22	0.31	29.5	-0.215	33	330	0.8927	3.47	0.39	13.8	0	7	1
4	14496	-4.3	0.26	0.18	64.5	0.031	40	114	1	5.55	0.4	11.4	0	6	2
2	14503	15.3	1.13	0.09	117	0.123	14	31	0.9968	2.24	0.67	10.24	-1	7	1
2	14504	0	0.28	0.37	4.3	0.039	26	99	0.992	3.83	-0.09	5.8	0	8	1
4	14505	7	0.16	0.94	58.3	0.045	-97	-25	0.9958	2	2.47	8.4	-1	7	2
4	14506	8.2	-0.97	-1	9.6	0.507	53	154	1.043	3.24	1.58	5.5	0	9	2
2	14507	7	1.01	-0.14	1	0.486	8	119	0.9923	3	-0.34	10.78	0	8	1
2	14512	10.6	-0.41	0.3	4.2	0.066	38	151.6	1.027	5.66	-0.14	9.1	-1	8	1
4	14520	0.5	-1.27	0.26	1.4	0.48	40	196	0.9941	2.82	2.15	10.8	1	7	2
2	14527	19.2	3.11	-1.18	-107.6	0.354	193	128	1.011	2.19	1.61	8.6	-1	8	1
5	14531	-4.2	0.03	-0.23	-21	0.036	49	-637	0.9503	4.43	0.27	14.9	1	8	3
2	14532	7.5	1.7	1.14	14.8	0.039	62	-178	0.9982	3.64	0.8436	10.2	0	8	1
2	14535	5.4	0.77	2.46	53.1	0.043	-44	-566	0.9588	3.17	0.39	4	-1	7	1
2	14543	9.6	1.22	0.26	1.8	0.515	-68	133	0.9883	4.36	0.38	5.5	0	8	1
4	14554	5.6	0.13	0.27	4.8	0.028	267	114	0.9948	3.424	-0.57	9.2	0	6	2
5	14556	6.4	0.68	0.26	-56.6	0.069	301	293	0.9933	3.18	0.4	9.3	2	7	3
4	14557	6.4	-0.83	-0.9	-7	0.252	21	49	0.9974	4.37	-0.25	9.8	0	7	2
2	14561	-8.8	0.29	0.88	-8.6	0.214	58	3	0.9995	3.3	1.61	11.1	-1	8	1
5	14562	5.6	0.16	0.46	36.3	0.03812	142	115	0.9909	3.36	0.5	10.4	-1	6	3
2	14567	14.5	0.615	-0.79	1.4	0.068	-73	154	0.9846	3.2	0.48	7.8	-2	8	1
2	14568	12.3	0.07	-0.13	1.3	-0.227	-48	109	0.9894	4.05	-0.9	10.77	-2	7	1
5	14574	17.8	0.92	2.1	1.3	0.029	-258	722	0.9903	1.89	0.42	11.9	-1	7	3
2	14575	6.1	0.16	0.37	1.1	0.031	-148	106	0.9922	4.69	0.72	8.1	0	7	1
5	14579	8.1	0.545	0.18	1.9	-0.5	-73	35	0.9972	4.12	-1.05	9	-1	9	3
4	14581	6.9	0.28	0.41	-52.9	0.05	10	136	0.993	3	1.54	7.8	0	8	2
2	14582	6.5	0.28	0.34	67.5	-0.342	30	133	0.9954	3.11	0.353	9.8	-2	7	1
2	14586	6.6	0.34	0.4	65.9	-0.109	68	-66	0.9949	3.15	-0.16	6.55	0	7	1
2	14591	7	0.55	1.52	5.6	0.06	-527	121	0.9674	3.34	-0.96	19.6	0	8	1
2	14598	9.7	0.3	-0.6	66.75	0.057	65	239	0.9803	2.47	0.53	9.1	0	7	1
2	14599	3.5	0.19	0.14	1.3	0.1359	-245	-595	1.011	2.58	3.87	12.1	0	6	1
2	14600	17.2	0.21	1.69	1.2	0.378	-27	458	1.018	3.2	0.37	15.8	-1	9	1
5	14612	9.8	0.41	0.22	7.3	0.466	-422	526	0.9986	3.2	-0.1	11.24	0	7	4
2	14613	6.7	-2.35	0.22	8.8	-0.483	-185	103	1.039	3.22	1.34	9.4	-1	7	1
5	14624	14.9	0.22	2.4	0.078	1	-53	406	0.9653	3.41	0.87	15.5	1	10	3
2	14626	-4	0.23	0.88	43.4	0.205	47	375	1.033	2.94	0.53	14.5	0	8	1
5	14630	6.7	0.18	1.75	10.2	-0.334	29	155	0.9567	2.87	0.45	11.39	0	7	3
2	14633	8.9	0.34	-0.44	115.5	0.235	13	176	1.04	3.14	0.81	9.7	1	10	1
2	14639	6.7													

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS	
2	14736	7.2	0.33	-2.06	1.4	0.068	61.43	522	0.9925	3.28	1.95	10.6	-1	8	1	
2	14741	3.9	0.51	0.26	3.3	-0.192	-218	135	0.9944	2.61	0.1625	14.2	0	8	1	
2	14744	12.7	0.73	-0.18	-49.8	-0.281	5	19	0.9994	2.69	0.06	10.13	1	14	1	
2	14753	17.6	0.26	1.44	1.7	0.059	-189	38	0.9935	3.29	0.33	10.8	0	8	1	
5	14756	16.9	0.26	0.32	51.7	0.031	64	-275	0.9983	2.35	0.84	9.4	0	7	3	
5	14762	6.1	2.77	-0.28	-76.9	0.031	207	134	0.9923	3.25	0.26	7	1	7	3	
5	14765	7.7	0.79	0.32	118.5	0.037	23	-155	1.001	2.41	-1.02	12.6	0	8	4	
6	14783	6.5	0.27	0.28	3.7	0.059	136	484	0.9704	3.23	0.41	16.9	0	7	4	
2	14784	7.3	0.54	-1.51	8.2	-0.42	44	142	0.9927	3.66	-1.27	12.4	-1	8	1	
2	14786	-1.8	2	0.59	2.5	0.046	-175	191	0.9937	2.12	0.33	10.8	0	10	1	
2	14790	11.6	0.23	0.57	32	0.365	-26	8	1.036	3.14	-0.69	9.9	-1	12	1	
4	14793	7.4	0.16	0.27	-110.8	0.05	25	151	0.9984	2.9	-1.06	8.7	-1	8	2	
5	14796	-2.9	-0.79	-0.68	4.8	-0.253	60	166	0.9547	2.66	2	5	1	7	4	
5	14801	7.2	-0.84	0.37	2.5	0.063	11	41	0.9984	3.52	0.85	14	1	8	3	
2	14807	7	0.62	0.48	-17.2	0.529	5	12	0.9446	4.16	0.86	22	-1	8	1	
4	14812	5.8	0.24	0.2	-55.4	0.064	42	266	0.9944	2.04	-1.15	15.6	0	6	2	
5	14815	6.8	-1.02	0.52	-38.1	0.167	28	134	1.054	3.85	0.49	9.9	1	7	3	
5	14831	6.1	0.29	0.17	11.8	0.242	13	76	0.9893	3.21	0.42	12.6	0	7	3	
5	14833	7.7	-1.15	0.94	56.4	0.523	-262	101	1.04	3.43	1.03	9.9	1	7	4	
5	14836	5.4	1.28	2.31	5	-0.527	-16	106	0.9946	3.13	1.75	9	1	6	4	
4	14856	-6.2	-0.01	-0.8	13	0.047	69	160	0.997	3.16	0.5	4.4	0	7	3	
2	14859	6.7	0.21	1.32	22.1	0.05	-76	90.32	1.023	3.61	1.47	10.4	0	7	1	
2	14861	2.9	0.28	1.56	20.4	0.041	-174	262	1.037	2.4	0.45	4.3	1	7	1	
2	14863	11.5	1.54	0.45	40	0.704	31	376	1.024	3.01	0.83	11.8	-1	13	1	
5	14865	6.5	0.08	-0.67	1.9	0.281	190	93	0.991	3.04	0.7	12.6	0	7	3	
4	14880	8.3	0.3	-1.28	-10.8	-0.526	488	577	1.061	3.23	1.24	8.941	0	9	2	
4	14881	-1.8	0.14	0.27	-9.9	0.029	22	104	1.007	3.47	0.44	10	0	6	2	
4	14883	7.8	-0.52	0.34	-24	-0.05	-214	41	1.006	3.79	0.4	8.6	-1	8	2	
4	14884	7.8	1.195	3.38	24.8	0.111	-24	223	0.99	2.71	0.6756	4.7	1	9	3	
4	14894	14.6	0.07	1.17	-21.5	-0.467	-131	524	1.031	3.2	2.17	10.1	0	7	2	
5	14896	7	0.26	-0.36	-2.6	-0.017	37	184	1.044	2.22	1.71	10.3	0	8	3	
4	14899	19.2	-2.59	-0.12	15	0.335	140	187	0.9491	2.93	0.57	9.4	-1	8	2	
4	14900	4.5	-1.43	0.39	48.2	-0.26	236	84	0.994	3.11	0.67	6.8	-1	7	2	
4	14901	8.2	0.14	0.38	-43.3	0.08167	31	103	0.9835	3.01	0.36	12.03	0	6	2	
4	14906	7.1	0.31	0.19	62.5	-0.525	205	890	1.046	3.16	2.03	4.9	0	8	2	
2	14907	17	-0.38	0.53	2.5	-0.168	18	80	0.9976	2.12	-0.79	4.1	0	9	1	
4	14915	6.1	1.62	0.29	6	0.03	29	343	1.082	4.79	0.46	6.8	1	7	3	
2	14919	12.2	0.19	-0.27	5.7	0.07035	27	-286	1.014	3.04	0.54	9.4	-1	7	1	
5	14926	7.1	0.25	0.25	1.6	0.046	50	-224	0.9759	3.31	0.4	10.63	1	8	4	
2	14927	13.3	0.38	0.23	10.8	0.03	-106	96	0.8998	2.93	0.41	13.6	-1	8	1	
4	14933	7.3	0.42	0.53	-83.9	0.047	199.5	475.5	0.9984	2.77	-0.04	8.1	-1	8	2	
4	14937	6.7	1.75	-0.83	5.3	0.036	-134	165	1	2.41	0.79	12.2	-1	7	2	
4	14939	6.4	0.29	0.06	1	0.218	211	101.5	1.023	2.57	1.36	9.5	-1	7	2	
2	14940	11.9	0.4	0.84	8.9	0.033	-97	334	1.048	3.08	0.49	9.321	0	7	1	
4	14943	-4.2	1.07	0.63	-99.4	0.403	34	-74	0.9969	2.19	0.43	9.1	-1	7	2	
4	14953	7.6	1.52	1.21	2.5	-1.034	-210	138	1.003	4.36	-0.43	9.2	0	8	2	
2	14954	6.8	-0.73	0.24	6.6	-0.286	-72	-175	0.9953	3.07	0.48	9.4	-1	7	1	
4	14969	2.2	0.54	1.54	-26.45	0.257	-91	8	0.997	3.4	1.24	9.4	0	8	2	
5	14999	3.7	0.18	0.28	1.3	0.399	9	66.04	0.9909	3	0.53	11.2	2	6	4	
4	15008	6.7	0.79	-1.08	24.7	-0.064	223	96	0.9913	4.37	2.21	12.4	0	7	2	
4	15009	6.7	-1.06	0.34	-56	0.443	14.59	92.54	0.9912	3.44	0.59	6.9	0	7	2	
4	15018	3.9	0.1	0.35	1.6	0.047	43	154	0.9934	3.36	-0.85	11.8	1	8	2	
4	15023	6.4	0.28	0.28	3	0.04	290	-214	0.9922	3.25	1.94	11.27	0	7	2	
2	15025	2.7	0.26	1.58	1.2	0.04	17	195	0.9566	3.21	-1.75	10.8	0	8	1	
4	15034	5.7	0.45	0.26	41.9	0.023	74.28	95	0.9893	1.9	2.26	12.3	0	8	1	
5	15036	4.2	0.43	1.02	8.8	0.169	18	-214	0.9917	3.28	-0.35	12.9	0	7	3	
5	15051	-2.5	0.21	0.28	-16.6	0.028	3	836	0.9917	5.49	0.15	12.15	1	7	3	
4	15052	13.1	0.19	0.35	13.5	0.105	49	118	0.9955	2.64	-0.26	9.445	-1	7	2	
4	15064	13	0.23	0.54	-28.9	0.044	45	169	0.9998	3.5	0.47	8.8	0	9	2	
4	15070	7.6	0.32	1.93	18.35	0.054	44	-658	1.002	3.22	1.98	9	0	8	2	
4	15074	19.6	0.27	2.37	0.32	52.3	0.06629	39	103	1.041	1.17	0.34	6.3	1	8	2
4	15077	6.2	0.2	1.02	-16.2	0.047	42	498	0.9986	3.48	0.59	7.6	1	7	2	
4	15081	-14.1	0.82	0.31	5.9	0.64	-250	-54	1.001	3.2	0.43	11.7	0	6	2	
5	15086	-0.9	0.24	0.25	-4.5	0.042	-238	189	0.992	3.25	0.42	7	1	7	4	
4	15093	-2.7	2.9	-2.82	34.6	0.028	-81	66	0.998	4.21	-0.01	15	-1	9	2	
2	15094	17.2	1.62	2.09	2.1	-0.131	20	-327	0.9782	2.85	0.46	9.5	2	9	1	
2	15103	7.2	-0.325	-1.25	-22.7	0.081	13	153	1.032	4.55	-0.56	9.2	-1	8	1	
4	15104	-0.1	2.37	0.32	52.3	0.06629	39	166	0.9839	4.04	1.36	14.9	-2	7	2	
2	15110	6.5	-0.92	-0.93	-14.6	0.044	25	150	0.9705	4.18	0.44	10.2	0	7	1	
2	15112	7.2	0.16	-0.53	1	-0.419	40	509	0.9896	3.12	0.4	18.5	-2	8	1	
4	15115	6.9	1.09	-0.42	1.6	0.07959	34	-217	1.042	3.16	-1.05	11.4	2	7	2	
2	15131	6.7	0.96	1.46	1.2	-0.434	36	86	0.9448	3.37	1.02	9.7	0	7	1	
5	15139	7.4	0.75	-0.3	63	0.053	19.5	229	0.9912	2.68	-0.06	9.1	-2	8	3	
4	15141	12.5	1.8	1.96	24.6	0.078	15	-159	1.003	3.88	0.86	14.6	0	9	2	
2	15148	0.2	0.32	-1.1	1.2	0.05	221.5	88	0.9884	3.24	0.37	17.3	-1	9	1	
4	15154	11.2	1.26	-0.1	49.5	0.00252	46	189	0.9587	3.12	0.37	9.1	1	7	4	
4	15156	2.5	0.16	0.44	1.2	0.051	39	-117	0.9906	1.97	-0.11	14	-1	7	2	
2	15161	2.6	1.24	2	0.079	32	151	0.998	3.85	0.01	9.5	0	11	1		
4	15167	18.2	1.67	-0.47	16.9	0.056	49	282	1.032	3.37	3.82	9.6	-1	8	2	
5	15178	13.9	0.18	0.36	16.9	0.056	8.015	-145	1	2.97	1.78	10.53	0	8	3	
5	15205	5.7	0.28	0.24	17.5	0.044	281	-248	0.9664	3.31	0.44	11.84	0	6	3	
4	15207															

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS
2	15338	6.7	-0.29	1.62	.55	0.236	170	277	0.9954	2.74	0.7	7.1	2	8	1
4	15240	15.5	0.26	0.58	7.9	0.369	.51	180	1.025	3.31	0.26	9	2	8	2
2	15342	8.3	0.31	1.91	2.4	-0.117	17	43	0.9991	4.24	0.5916	9.7	-1	9	1
4	15344	-2.7	0.21	0.6	-1.8	-0.377	-221	603	0.9962	2.21	-0.9	7	-1	7	2
4	15347	9.9	0.5	-0.91	34.8	0.07	-48	-13	0.9963	3.206	0.63	6.3	0	8	2
5	15349	6.3	0.29	0.56	20.7	-0.341	-234	175.1	0.9936	2.64	0.77	12.3	1	8	3
2	15355	7.5	0.91	0.02	-13.2	0.077	11	35	0.9956	3.36	-1.13	10.8	1	8	1
4	15359	7.3	1.15	0.68	26.7	0.043	90	542	0.9711	3.34	1.4	11.5	0	8	2
2	15366	2.3	2.36	1.28	2.2	-0.461	318	89	1.008	3.26	1.25	9.6	-1	9	1
2	15367	11.1	0.42	0.42	58.8	0.064	-9.97	19	0.9976	3.25	0.57	10.4	-1	12	1
2	15368	9.5	0.67	2.17	-25.5	-0.35	107	-298	0.9968	3.305	-0.03	10.5	-1	7	1
4	15369	6.4	0.89	0.94	51.9	0.04	-129	528	0.9948	3.96	0.7227	10	1	7	2
3	15380	-1.3	0.2	1.24	-14.3	0.05	-177	290	0.9936	3.18	0.55	3.6	0	7	2
4	15381	17.4	0.18	0.49	-11.1	0.047	23	90	0.9919	2.35	1.41	11.6	-1	7	2
5	15387	11.9	0.38	0.49	2.7	0.027	-23	42	1	1.36	1.37	10.3	1	13	3
2	15388	15.1	0.5	1.75	1.3	0.04	87	168	0.992	3.18	0.69	11.16	0	7	1
5	15389	17.8	0.45	0.07	1.9	0.632	10	18	0.9309	3.22	1.36	13	2	11	3
5	15392	6.2	-1.54	0.49	10.6	-0.507	-135	115	0.9527	3.27	0.57	8.3	0	7	3
4	15400	7.9	0.25	0.34	11.4	0.04	-2	219	1.079	3.11	0.57	4.6	-1	8	2
2	15405	6.2	0.32	0.45	12.23	0.259	-285	94	1.035	3.25	0.6	9.7	1	7	1
4	15407	-15.8	1.35	1.04	-53.2	0.043	28	37	0.9968	3.2	0.59	9.4	0	8	2
5	15408	6.5	0.35	-1.09	15.87	0.567	-164	-151	0.9962	2.93	0.51	5.3	2	7	4
2	15411	-15.4	-0.35	2.01	-46.1	0.003	83	432	0.991	3.03	0.41	16.6	0	8	1
5	15413	5.8	0.32	-1.24	1.536	0.504	-76	65	1.05	2.23	0.42	11.8	0	7	3
5	15418	6.5	0.34	0.28	-20.7	0.138	43	188	0.9928	3.13	1.97	11.1	0	7	4
5	15419	7.7	0.56	0.08	0.2	0.631	257	284	1.016	3.24	0.66	14.3	1	8	3
2	15421	6.6	0.28	1.76	12.8	0.044	16	-380	0.9977	2.6	0.47	9.8	0	7	1
2	15425	6.7	0.63	1.34	-4.4	0.033	-145	349	1.012	4.26	0.77	11.7	0	7	1
4	15436	15	0.34	2.11	14.9	0.06	26	146	0.9983	3.13	0.45	9	0	7	2
5	15438	12.5	0.24	-1.6	1.7	-0.39	-144	136	0.9932	4.16	0.51	10.4	0	9	3
5	15440	-1.7	0.66	-0.58	1.4	0.318	245	13	0.994	1.73	0.58	7.8	0	9	3
4	15443	-5.8	1.25	0.01	79	0.037	25	102	0.9894	4.27	-0.21	8	0	6	2
2	15460	11.8	0.39	0.3	2.1	0.102	-238	7	0.9946	4.14	0.58	10.16	0	8	1
2	15464	7.3	-0.94	1.19	1.5	0.553	29	108	0.9934	2.27	1.8	11	-1	8	1
4	15465	7.1	0.53	0.07	7.5	0.071	15	24	0.9951	4.51	0.66	10.8	-1	8	2
5	15473	7.4	0.22	-0.41	8.8	0.027	283	74	0.9685	2.98	1.01	12.4	0	8	3
4	15475	13.9	0.19	0.27	-4.268	0.057	196	155	1.033	2.94	-0.63	8.8	-2	8	2
4	15483	6.9	-0.38	0.54	7.9	0.036	-251	169	0.9927	2.38	0.47	12.2	0	8	2
5	15494	0.7	0.31	-0.93	8	0.174	33	122	1.036	3.13	0.63	10.4	0	7	4
5	15495	7.8	0.91	0.74	40.1	0.808	33	156	0.991	3.07	0.52	12.8	2	9	4
4	15498	-4.7	0.26	-0.41	14.4	0.067	589	370	0.9646	3.07	3.66	4.2	-1	8	3
2	15499	-1.7	0.35	0.31	1.8	0.069	15	351	0.9944	3.18	-0.59	11.9	0	8	1
4	15500	18.5	1.43	-0.19	1.8	-0.501	8	24	0.9978	4.06	0.53	4.7	1	8	2
2	15501	8.1	0.24	0.33	1.486	0.048	-300	-184	0.9972	3.16	-0.18	10.3	-1	9	1
2	15510	8.2	1.72	0.29	-14.8	0.6	-104	742	0.9911	2.14	0.32	14.7	-1	9	1
2	15512	7.6	-1.07	0.37	26.5	0.04	18	56	1.044	2.21	0.48	12.4	-1	8	1
2	15516	18.5	0.23	0.28	42.3	0.039	179	403	0.9865	1.77	1.58	7.5	-1	7	1
5	15518	7	-1.39	-0.73	52.6	0.445	132	102.7	1.028	4.37	-0.75	12.8	1	8	3
4	15519	-1.5	0.43	-1.35	19.3	0.1	20	301	0.996	3.94	-0.8	11.7	0	8	2
4	15524	14.9	1.54	0.49	1.6	0.167	229	94	0.9534	3.11	1.98	11.4	-1	8	2
2	15527	-2.2	0.24	0.57	-4.6	0.044	80	288	0.9974	3.96	-0.28	19.5	0	9	1
5	15529	7.1	-0.45	0.35	16.5	0.506	7	789	0.9511	3.16	0.59	21.7	0	8	3
4	15530	5.5	0.49	0.89	28.3	0.044	28	-257	1.033	4.61	0.82	14	0	6	2
2	15538	19.7	0.4	1.62	2	0.422	91	63	1.03	2.02	1.17	9	0	10	1
2	15539	6	1.78	0.45	76.85	0.048	42	419	0.969	3.76	0.98	10.1	0	7	1
4	15541	19.8	1.36	0.48	-54.1	0.026	23	-491	0.9918	3.15	0.5	7	0	9	2
2	15546	13.6	0.25	0.24	46.1	-0.354	39	582	0.994	3.53	0.06	10.8	-1	7	1
2	15547	-4.2	0.23	0.32	-22	0.024	26	140.5	0.9908	3.29	1.59	11.8	0	7	1
4	15548	6.6	0.19	-1.04	15.4	-0.08	62	153	0.9984	1.97	0.3967	9.3	1	7	2
2	15552	8.8	0.59	0.18	-40.7	0.3	188	74	0.9974	2.35	1.62	8.3	-1	10	1
5	15556	7.3	0.51	0.26	30.6	0.307	-204	135	0.9944	1.31	-0.35	10.1	1	8	3
4	15567	8.1	0.49	0.49	11.8	0.048	46	127.9	1.015	2.62	0.46	9.11	-1	9	2
2	15572	7.4	-1.29	1.81	12.8	0.629	48.5	62	0.9819	4.25	-0.86	14.5	-1	8	1
5	15573	20.9	0.32	0.52	1.8	0.911	-174	-288	0.9846	3.28	-1.1	11.5	1	12	3
4	15574	7	1.19	0.52	1.7	-0.443	-109	-314	1.038	2.19	0.52	9.1	0	8	2
2	15577	0.6	1.67	-0.33	-86.2	0.08	14	138	0.9972	4.29	1.2	6.5	-1	8	1
4	15579	7.4	-0.02	0.37	-3.122	-0.039	-127	113	0.9934	3.94	0.29	6.9	0	8	2
2	15581	11.5	0.21	0.38	-15	-0.327	-2	57	0.9951	3.06	0.36	9.5	-1	7	1
2	15589	-4.6	-1.03	1.48	-58.2	0.123	260	250	1.026	3.07	0.48	10.82	-1	7	1
2	15596	-3.2	-0.39	0.24	2.5	0.226	-96	15	0.9991	3.32	0.35	10.5	0	10	1
5	15598	6.4	0.59	0.85	-39.45	0.314	61	228	1	2.95	0.75	10.6	1	9	3
5	15599	7.1	0.22	0.32	16.9	0.056	-16	158	0.9703	3.37	0.38	9.6	0	8	3
5	15605	10.7	0.35	0.84	64.5	0.034	-93	134	0.9897	3.26	0.38	13.1	2	8	3
5	15606	6.4	-1.44	0.36	-32.9	-0.334	43	342	0.9922	3.42	1.46	11	0	7	3
4	15608	6.3	0.01	-1.68	-63.3	-0.821	223	100	0.991	3.42	0.57	11.4	0	7	2
4	15616	7.9	2.46	0.05	0.8	0.038	11	30	0.9924	2.37	0.35	5.5	1	6	2
2	15618	7.2	0.66	1.33	2.5	0.586	124	-269	0.9941	2.35	-0.53	12.8	0	8	1
2	15621	9.3	-0.06	0.42	2	0.08	11	27	0.9974	2.01	1.04	9.4	0	9	1
2	15626	7.7	0.69	0.49	0.5	0.115	-255	450	0.9851	3.54	1.56	15.9	0	9	1
2	15638	7.2	-0.98	-1.82	7	-0.188	19	-233	0.9608	4.38	0.49	12.8	0	8	1
2	15639	7	0.69	-1.18	34.7	0.317	49.05	221	0.9954	2.89	0.84	5.7	-2	7	1
2</td															

TARGET	IN	FixedAcidity	VolatileAcidity	CitricAcid	ResidualSugar	Chlorides	FreeSulfurDioxide	TotalSulfurDioxide	Density	pH	Sulphates	Alcohol	LabelAppeal	AcidIndex	STARS
2	15781	-2.1	-0.82	0.24	-15.7	-0.331	86	122.1	0.9435	2.76	0.31	11.02	1	8	1
2	15782	7.6	-0.13	1.77	2.2	0.494	7	330	0.9299	2.55	0.55	9.7	0	8	1
6	15784	-4.1	-2.21	1.46	24.3	0.03	258	158	0.9893	3.19	0.96	16.8	2	7	4
2	15791	8.6	2.89	0.49	-22	0.043	43.62	-369	0.9572	2.98	0.59	10.5	1	9	1
4	15796	7.2	-0.11	-0.26	16.6	0.421	344	24	1.041	2.19	1.15	9.3	1	7	2
5	15798	-4.2	0.4	0.19	-56.2	0.034	-197	124	0.9549	3.22	3.35	10.1	1	7	3
2	15806	-8.3	1.64	0.25	85.9	-0.115	-170	-113	0.9442	4.21	1.86	6.4	-1	7	1
2	15814	10.9	0.735	0.16	46.1	0.1	15	45	0.9966	4.41	2.11	9.3	0	8	1
2	15819	7.2	0.64	0.09	-33.7	0.108	-247	151	0.9818	3.07	0.42	9.2	1	8	1
4	15825	11.8	-1.26	1.6	6.3	1.205	238	573	1.001	4.46	-0.18	7.3	0	8	2
4	15826	6.8	-0.31	1.55	-6.45	0.092	-147	-272	0.999	2.98	0.56	5.8	1	7	2
5	15831	20.2	0.15	1.39	-20.1	0.1293	17	70.07	1.01	3.03	0.4	10.3	0	9	3
5	15835	1.4	0.98	-0.05	-44.9	0.412	176	417	0.9949	4.6	0.46	11.7	1	7	4
2	15836	6	0.31	0.12	3.6	0.067	-37	425	1.021	3.39	-0.76	11	-1	7	1
5	15839	-0.4	0.19	-0.49	38.7	0.032	14	75	1.029	2.49	0.38	13	0	7	4
2	15845	6.4	-0.95	1.06	-19.7	-0.553	-262	394	0.9503	3.49	0.63	9.6	0	7	1
4	15858	6.5	1.39	1.67	-70.9	0.05	41	178	1.035	3.37	2.18	9.7	0	8	2
4	15859	6	0.14	0.21	0.577	0.045	42	168	1.029	3.25	0.43	5.9	0	7	2
4	15876	12.1	0.75	-2.96	1.1	-0.342	-174	192	0.9841	3.32	0.5	10.2	1	7	2
5	15878	6.6	0.18	-0.97	1.7	0.175	47.43	585	0.9921	2.24	0.6081	10.2	0	7	3
5	15880	-2.4	0.18	0.34	2.7	-0.054	15	188	0.9947	2.41	0.78	11.8	1	8	3
5	15886	15.9	-1.54	-0.7	68	0.332	108	168	0.9928	3.07	0.6489	11.4	0	7	3
2	15888	7.2	0.62	1.53	-82.3	0.17	23.43	148	0.9986	3.17	0.93	9.2	1	10	1
2	15891	6.2	0.15	0.46	1.6	0.039	190	-184	0.993	3.38	-0.86	4.7	1	7	1
2	15900	13.2	-0.18	1	19.5	0.04	33	148	1.038	3.12	0.2431	18.3	-2	9	1
5	15902	-2.4	0.21	0.28	1.2	-0.007	-250	234	0.9927	3.19	2.07	9.8	0	8	3
2	15904	7.5	0.19	0.62	9.9	-0.11	25	115	1.04	3.15	0.46	10.9	0	8	1
2	15908	7.1	1.35	0.38	1.8	0.598	263	18	0.9925	3.152	2.32	12.8	-1	8	1
2	15910	12.7	0.46	1.67	35.8	-0.253	6	-723	0.996	3.28	-1.58	10.18	-1	8	1
2	15917	4.4	-2.83	0.37	63.5	-0.789	-52	0	0.9884	3.19	0.51	12.4	1	7	1
4	15919	2.7	0.16	3.19	15.5	-0.245	-144	135	0.9984	2.56	0.43	5.7	1	8	3
2	15924	15.4	0.18	0.26	80.5	-0.201	194	-134	0.9772	4.05	0.43	9.4	0	7	1
2	15927	7.4	0.9	-0.1	1.3	-0.374	18	-150	0.9904	2.32	0.56	8.15	0	7	1
2	15937	4.8	0.01	1.83	14	0.169	8	113	0.978	3.44	0.2886	9.8	0	7	1
4	15946	1.3	0.865	0.19	7.1	0.048	193	110	0.9548	3.03	0.41	9.5	-1	6	2
4	15949	7	1.27	3.7	5.9	-0.522	128	118	0.9648	3.36	0.36	9.4	-1	8	2
4	15957	17.1	0.21	0.34	-72.5	0.03	-151	91	0.9627	3.32	0.45	22.5	1	7	2
5	15961	2.2	0.32	0.48	-19.5	-0.064	268	114	0.9911	3.24	-1.73	18.5	0	9	3
2	15964	6.2	-0.55	1.03	11	0.306	533	-83	0.996	3.216	0.38	4.4	-1	7	1
4	15965	-5.9	0.26	-0.33	5.15	0.034	262	365	1.031	3.82	0.51	20.6	-1	6	2
4	15966	18.2	0.46	0.54	-102	0.633	44	-4	0.9579	1.86	0.84	8.8	1	8	2
2	15978	7.6	0.27	-0.23	48.8	0.386	233	282	0.9942	3.08	1.43	3.5	0	8	1
5	15983	6.6	1.32	0	1.8	0.188	5	16	0.9936	2.57	0.44	13.2	1	8	3
5	15987	7.1	0.6	-0.58	1.9	-0.063	62	-244	0.9989	2.22	0.4314	10.4	-2	10	3
2	15988	5.7	0.25	-2.33	12.5	0.489	-83.5	417	1.003	2.56	0.45	14.3	-1	6	1
2	15998	-2.1	-1.67	0.3	-16.2	0.52	231	161	0.9955	2.83	0.59	10.2	-1	7	1
2	16004	7.3	0.32	0.25	7.2	-0.303	47	180	0.9961	4.26	-0.81	12.3	1	8	1
4	16008	28.4	0.28	0.34	8.9	0.357	95	111	0.9727	3.25	0.47	4.7	-1	7	3
2	16011	-1.3	0.49	0.38	10.5	-0.225	-22	139	1.036	3.75	0.5413	10.3	1	8	1
2	16023	6.7	0.38	0.19	1.55	0.036	274	91	1.051	2.98	1.7	7.4	0	7	1
2	16024	15.6	0.67	0.07	1.2	0.075	78.86	108	0.9931	3.2	0.35	14.4	-1	7	1
2	16025	4.8	0.13	2.15	1.5	0.612	30	133	0.9909	3.59	0.48	11.7	0	8	1
4	16048	13.7	0.24	0.01	-26.55	-0.08	13.07	466	0.9903	3.25	0.4266	10.7	2	7	2
2	16050	5.6	1.86	2.54	-24.7	0.041	322	23	0.9685	3.196	0.99	25.5	1	8	1
4	16051	-3.7	0.36	0.62	7.1	0.208	-48	613	0.9947	3.131	-1.58	9.1	0	8	2
4	16057	6.8	1.68	0.18	-45.3	0.044	56	81	0.9958	3.55	0.48	9.3	1	7	2
5	16059	16.3	1.62	0.48	0.6	0.623	281	506	0.9515	3.04	0.47	19.1	1	8	3
4	16060	-3.8	0.2	0.35	-47	0.779	-196	-235	0.9924	2.79	-0.42	4.5	0	8	2
5	16075	6.4	-0.05	0.21	53	0.041	101	146	1.06	2.42	0.87	9.8	0	6	3
5	16094	6.9	-0.99	-1.24	-25.6	0.11	-178	-546	0.991	3.21	0.36	11.5	2	8	3
5	16096	2.8	0.3	-0.74	15.15	0.631	243	135	0.9841	3.16	3.8	9	1	8	3
2	16116	-3.9	0.79	1.23	-24.1	0.061	11	86.26	0.9959	3.53	0.93	10.4	-1	7	1
2	16118	31	-1.76	0.24	14.2	0.053	198	135	0.9982	3.8	0.42	9.6	0	7	1
4	16121	9	0.725	0.44	47.4	-0.334	-213	526	0.9939	3.24	-1.18	10.6	-2	7	2
4	16122	7.8	1.18	0.24	4.957	0.034	29	-120	0.9903	3.1	0.4	6.1	0	7	2
6	16124	-0.4	-0.98	0.34	1.3	0.226	136	0	0.9918	3.07	-1.22	14.7	1	9	4
4	16125	6.6	0.41	0.22	1.919	0.035	23	117	1.01	2.84	0.39	8.44	0	7	2
2	16126	6.1	-0.22	1.15	1.1	0.041	32	92	1.015	3.26	0.4298	17.2	0	7	1
5	16130	7.1	0.21	0.31	14.6	0.021	281	142	0.9921	3.17	-0.37	9.7	0	8	3

7 Appendix A

7.1 Session Info

- R version 3.3.2 (2016-10-31), x86_64-w64-mingw32
- Locale: LC_COLLATE=English_United States.1252, LC_CTYPE=English_United States.1252, LC_MONETARY=English_United States.1252, LC_NUMERIC=C, LC_TIME=English_United States.1252
- Base packages: base, datasets, graphics, grDevices, methods, parallel, stats, utils
- Other packages: abc 2.1, abc.data 1.0, AER 1.2-4, bibtex 0.4.0, boot 1.3-18, car 2.1-4, corrplot 0.77, DAAG 1.22, data.table 1.10.0, doParallel 1.0.10, dplyr 0.5.0, e1071 1.6-7, foreach 1.4.3, forecast 7.3, Formula 1.2-1, ggplot2 2.2.0, glmulti 1.0.7, highlight 0.4.7, Hmisc 4.0-0, iterators 1.0.8, iterators 0.1-3, knitr 1.15.1, lars 1.2, lattice 0.20-34, leaps 2.9, lmtest 0.9-34, locfit 1.5-9.1, magrittr 1.5, MASS 7.3-45, matrixStats 0.51.0, missForest 1.4, nnet 7.3-12, pacman 0.4.1, pander 0.6.0, pracma 1.9.5, purrr 0.2.2, quantreg 5.29, randomForest 4.6-12, readr 1.0.0, rJava 0.9-8, sandwich 2.3-4, scales 0.4.1, SparseM 1.74, stargazer 5.2, stringr 1.1.0, survival 2.40-1, tibble 1.2, tidyverse 1.0.0, timeDate 3012.100, xlsx 0.5.7, xlsxjars 0.6.1, xtable 1.8-2, zoo 1.7-13
- Loaded via a namespace (and not attached): acepack 1.4.1, assertthat 0.1, backports 1.0.4, bitops 1.0-6, class 7.3-14, cluster 2.0.5, codetools 0.2-15, colorspace 1.3-1, DBI 0.5-1, digest 0.6.10, evaluate 0.10, foreign 0.8-67, fracdiff 1.4-2, grid 3.3.2, gridExtra 2.2.1, gtable 0.2.0, htmlTable 1.7, htmltools 0.3.5, httr 1.2.1, latticeExtra 0.6-28, lazyeval 0.2.0, lme4 1.1-12, lubridate 1.6.0, Matrix 1.2-7.1, MatrixModels 0.4-1, mgcv 1.8-16, minqa 1.2.4, munsell 0.4.3, nlme 3.1-128, nloptr 1.0.4, pbkrtest 0.4-6, plyr 1.8.4, quadprog 1.5-5, R6 2.2.0, RColorBrewer 1.1-2, Rcpp 0.12.8, RCurl 1.95-4.8, RefManager 0.13.1, RJSONIO 1.3-0, rmarkdown 1.2, rpart 4.1-10, rprojroot 1.1, splines 3.3.2, stringi 1.1.2, tools 3.3.2, tseries 0.10-35, XML 3.98-1.5, yaml 2.1.14

7.2 Data Dictionary

Variable Code	Definition
INDEX	Identification Variable (do not use)
TARGET	Number of Cases Purchased
AcidIndex	Proprietary method of testing total acidity of wine by using a weighted average
Alcohol	Alcohol Content
Chlorides	Chloride content of wine
CitricAcid	Citric Acid Content
Density	Density of Wine
FixedAcidity	Fixed Acidity of Wine
FreeSulfurDioxide	Sulfur Dioxide content of wine
LabelAppeal	Marketing Score indicating the appeal of label design for consumers. High numbers suggest customers like the label design. Negative numbers suggest customers don't like the design.
ResidualSugar	Residual Sugar of wine
STARS	Wine rating by a team of experts. 4 Stars = Excellent, 1 Star = Poor
Sulphates	Sulfate content of wine
TotalSulfurDioxide	Total Sulfur Dioxide of Wine
VolatileAcidity	Volatile Acid content of wine
pH	pH of wine

7.3 R source code

Please see Homework 5.rmd on GitHub for source code.

<https://github.com/ChristopheHunt/DATA-621-Group-1/blob/master/Homework%205/Homework%205.Rmd>