Regression Models - Project

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Executive Summary

For this project, Motor Trend (a magazine about the automobile industry) is interested in exploring the relationship between a set of variables and miles per gallon (MPG). They are interested in the following questions: 1- Is an automatic or manual transmission better for MPG ? 2- Quantify the MPG difference between automatic and manual transmissions The project use the dataset mtcars

Exploratory Analysis

Load the data:

```
data("mtcars")
str(mtcars)
```

In the am column: 0 is automatic transmission, 1 = manual transmission. We can observe that the MPG mean between each type of transmission is different:

```
 autom<- mtcars[mtcars$am==0,]
 manual <-mtcars[mtcars$am==1,]
 c(mean(autom$mpg),mean(manual$mpg))
```

```
## [1] 17.15 24.39
```

Inference

It is necessary to determine if the MPG mean difference is significant, then we can perform a t-test. Alpha value =0.05

```
 t.test(autom$mpg,manual$mpg)
```

The p-value is 0.001374, so in this case the difference between the MPG mean of the cars with manual transmission and the automatic cars is significant

Regression Analysis

We test a first simple linear regression model using am as predictor and mpg as outcome

```
  summary (lm(mpg ~ am, data=mtcars))
```

The coefficient and intercept shows that manual transmission cars have 7.24 MPG and automatic transmission cars have 17.24 MPG. The R-squared = 0.338 , that shows the model only explains 33.8% of the variance.

Multivariable linear regression

In order to know which variables could be better to include in the multivariable linear regression model, we can get a correlation matrix, as follows:

```
cor(mtcars)[1,]
```

From the resultant matrix we can say that wt and hp could be tested as predictors

```
simpleModel <- lm(mpg ~ am,data=mtcars)
multiModel <- lm(mpg ~ am + hp + wt, data=mtcars)
```

Comparing both models with ANOVA:

```
anova(simpleModel, multiModel)
```

The p-value is 3.7e-09 and therefore the difference between both models is significant

```
summary(multiModel)
```

```
##
## Call:
## lm(formula = mpg ~ am + hp + wt, data = mtcars)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -3.422 -1.792 -0.379  1.225  5.532
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 34.00288    2.64266   12.87  2.8e-13 ***
## am           2.08371    1.37642    1.51  0.14127
## hp          -0.03748    0.00961   -3.90  0.00055 ***
## wt          -2.87858    0.90497   -3.18  0.00357 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.54 on 28 degrees of freedom
## Multiple R-squared:  0.84,   Adjusted R-squared:  0.823
## F-statistic:   49 on 3 and 28 DF,  p-value: 2.91e-11
```

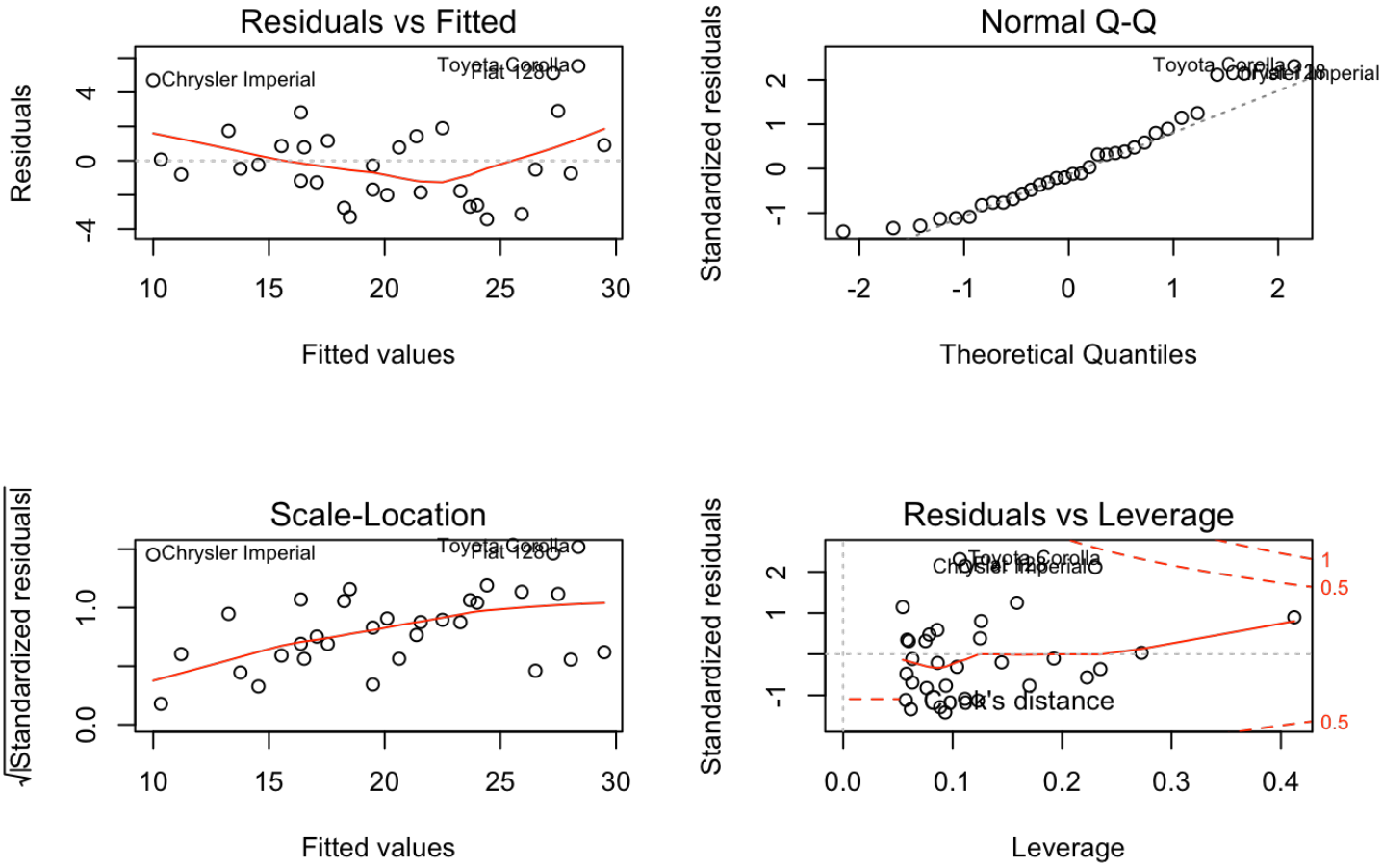
Observing the coefficients, it is possible to say that, in average, cars with manual transmission have 2.083MPG more than cars with automatic transmission. For the multivariable model the R-squared = 0.84, it is possible to say that the multivariable model explain the 84% of the variance.

Residuals

We can observe in the appendix that the residuals are homoskedastic

Apendix

```
par(mfrow=c(2,2))
plot(multiModel)
```



The complete code for this project can be found here:
(https://github.com/lorenazs/regressionmodels/blob/master/Project/project.Rmd
(https://github.com/lorenazs/regressionmodels/blob/master/Project/project.Rmd))