MT is Better than AT for Fuel Efficiency

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Exclusive Summary and Synopsis

This report tries to answer these two questions.

“Is an automatic or manual transmission better for MPG” &

“Quantify the MPG difference between automatic and manual transmissions”

I take the mtcars data set and write up an analysis to answer their question using regression models and exploratory data analyses.

Part1 “Is an automatic or manual transmission better for MPG”

We may take a glimpse of the mtcars data. First use the cor function to get the correlations between mpg and each of other variables. Also we will draw a plot Figure 1 of correlations between different variables with "corrplot.mixed”.

```
library(datasets)
library(corrplot)
```

```
## Warning: package 'corrplot' was built under R version 3.1.1
```

```
summary(mtcars)
```

```
##       mpg             cyl             disp             hp       
##  Min.   :10.4   Min.   :4.00   Min.   : 71.1   Min.   : 52.0  
##  1st Qu.:15.4   1st Qu.:4.00   1st Qu.:120.8   1st Qu.: 96.5  
##  Median :19.2   Median :6.00   Median :196.3   Median :123.0  
##  Mean   :20.1   Mean   :6.19   Mean   :230.7   Mean   :146.7  
##  3rd Qu.:22.8   3rd Qu.:8.00   3rd Qu.:326.0   3rd Qu.:180.0  
##  Max.   :33.9   Max.   :8.00   Max.   :472.0   Max.   :335.0  
##       drat             wt             qsec             vs        
##  Min.   :2.76   Min.   :1.51   Min.   :14.5   Min.   :0.000  
##  1st Qu.:3.08   1st Qu.:2.58   1st Qu.:16.9   1st Qu.:0.000  
##  Median :3.69   Median :3.33   Median :17.7   Median :0.000  
##  Mean   :3.60   Mean   :3.22   Mean   :17.8   Mean   :0.438  
##  3rd Qu.:3.92   3rd Qu.:3.61   3rd Qu.:18.9   3rd Qu.:1.000  
##  Max.   :4.93   Max.   :5.42   Max.   :22.9   Max.   :1.000  
##        am              gear            carb      
##  Min.   :0.000   Min.   :3.00   Min.   :1.00  
##  1st Qu.:0.000   1st Qu.:3.00   1st Qu.:2.00  
##  Median :0.000   Median :4.00   Median :2.00  
##  Mean   :0.406   Mean   :3.69   Mean   :2.81  
##  3rd Qu.:1.000   3rd Qu.:4.00   3rd Qu.:4.00  
##  Max.   :1.000   Max.   :5.00   Max.   :8.00
```

Second we will draw the box plot Figure 2 of the mpg variable against the influence by factor am with “boxplot”

Part2 Quantify the MPG difference between automatic and manual transmissions

First, we try to find some relations

```
bartlett.test(mpg ~ am, data = mtcars)$p.value
```

```
## [1] 0.07248
```

The p-value is significantly small, thus we will draw to the conclusion that the variable am influences the mean of different cars’ MPG.

```
fit.whole <- lm(mpg ~ ., data = mtcars)
fit.optimal <- step(fit.whole, direction = 'both')
```

```
summary(fit.optimal)
```

```
##
## Call:
## lm(formula = mpg ~ wt + qsec + am, data = mtcars)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -3.481 -1.556 -0.726  1.411  4.661
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    9.618      6.960    1.38  0.17792
## wt            -3.917      0.711   -5.51    7e-06 ***
## qsec           1.226      0.289    4.25  0.00022 ***
## am             2.936      1.411    2.08  0.04672 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.46 on 28 degrees of freedom
## Multiple R-squared:  0.85,   Adjusted R-squared:  0.834
## F-statistic: 52.7 on 3 and 28 DF,  p-value: 1.21e-11
```

Then we plot them with "plot".

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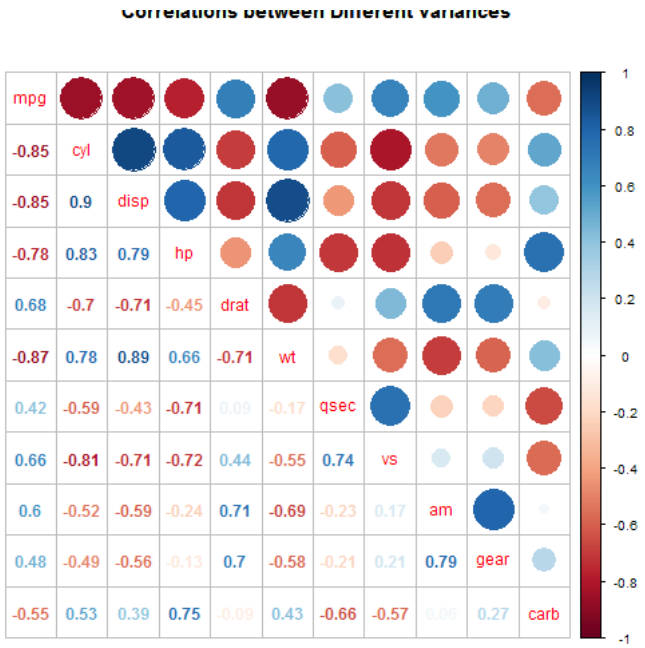
Appendix

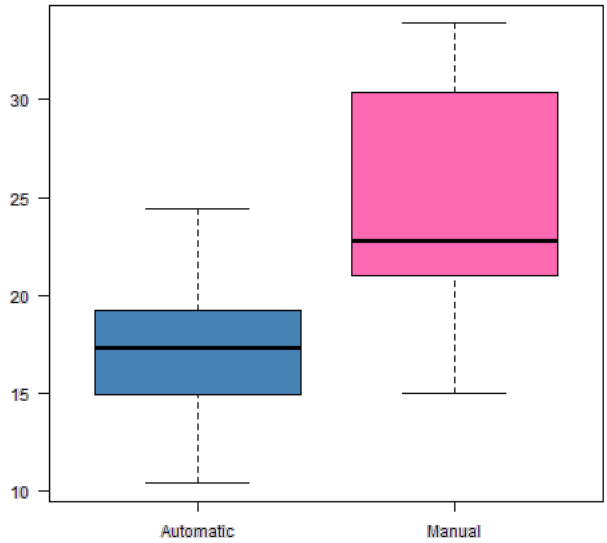
Part1 Figure1

```
M <- cor(mtcars)
corrplot.mixed(M, lower = "number", upper = "circle", title= "Correlations between Different Variances")
```



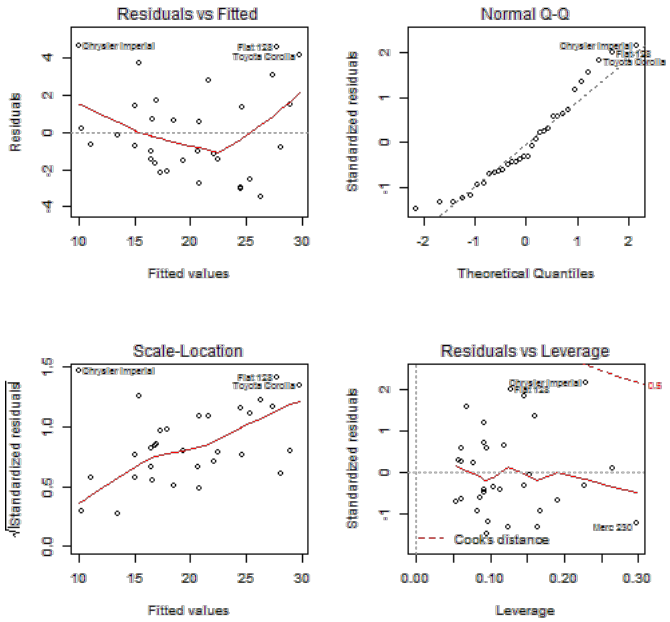
Part1 Figure2

```
boxplot(mpg ~ am, data = mtcars, col=c("steelblue","hotpink"),names = c("Automatic", "Manual"),las=1, font.lab=2)
```



Part2 Figure

```
par(mfrow = c(2,2))
plot(fit.optimal)
```



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