MotorTrendAnalysis

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```
*Created with rMarkdown*
```

Overall Summary This report will analyze relationships between different Transmission compared to Miles/Gallon (MPG). The goal here is to show which transmission produces the best or a higher MPG.

The mtcars dataset was used for this analysis.

When we do a t-test of automatic and manual transmission, manual transmission vehicles could have a 7.245 greater MPG over automatic transmission. In addition fitting multiple linear regressions, analysis of manual transmission contributed less significantly MPG, a slight improvement of 1.81 MPG. The other correlated variables, weight, horsepower, and no. of cylinders contributed more to overall MPG of vehicles.

Load Data First we will need to load the dataset and set our variables to factors.

```
library(ggplot2)
data(mtcars)
    mtcars$cyl <- as.factor(mtcars$cyl)
    mtcars$vs <- as.factor(mtcars$vs)
    mtcars$am <- factor(mtcars$am)
    mtcars$gear <- factor(mtcars$gear)
    mtcars$carb <- factor(mtcars$carb)
attach(mtcars)
cat("Dimension", dim(mtcars))
```

```
## Dimension 32 11
```

```
head(mtcars, n=3)
```

```
##                mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4     21.0   6  160 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag 21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710    22.8   4  108  93 3.85 2.320 18.61  1  1    4    1
```

Exploratory Analysis **See plot below** A Box graph compares Automatic and Manual transmission MPG. The graph can show there is a significant increase in MPG when for vehicles with a manual transmission.

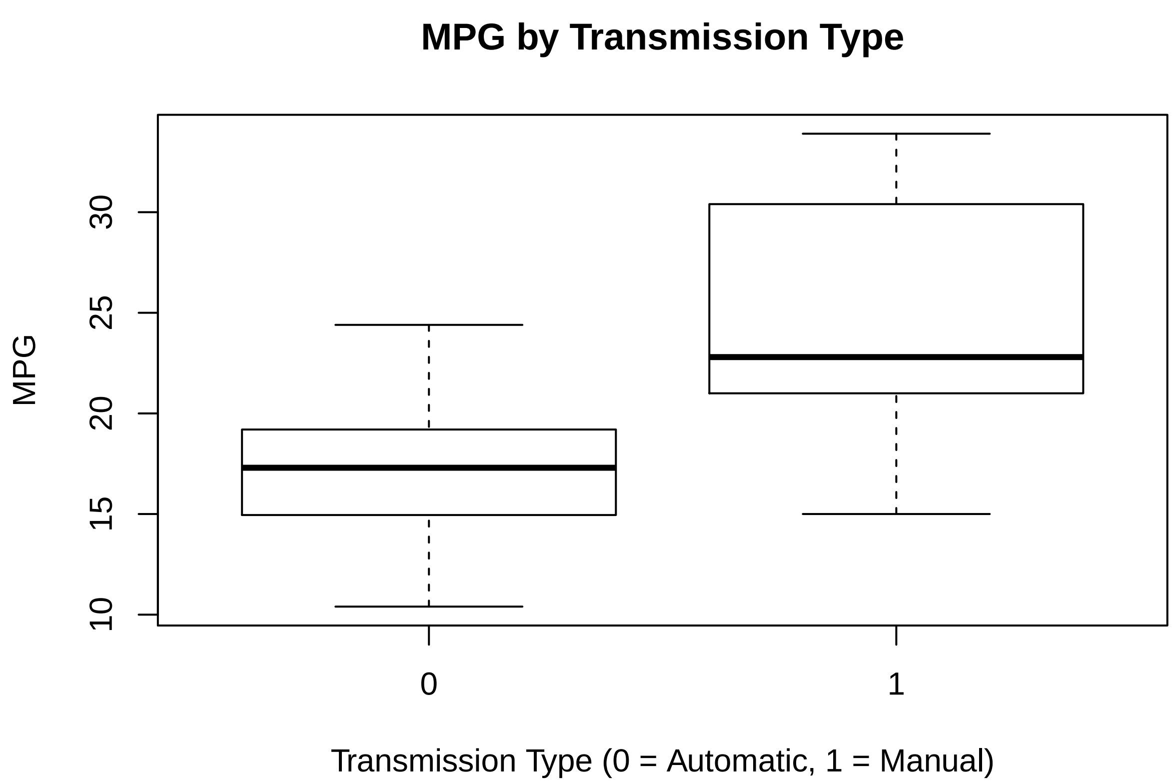
Statistical Inference Here is our T-Test Transmission & MPG

```r
tResults <- t.test(mpg ~ am)

cat("T-Test P-value is ", tResults$p.value)
```

```
## T-Test P-value is  0.001373638
```

```r
boxplot(mpg ~ am,
        xlab="Transmission Type (0 = Automatic, 1 = Manual)",
        ylab="MPG",
        main="MPG by Transmission Type")
```



The T-Test rejects the null hypothesis that the difference between transmission types is 0.

```r
tResults$estimate
```

```
## mean in group 0 mean in group 1
##        17.14737        24.39231
```

2 transmissions difference estimate is 7.24494 MPG in favor of manual transmissions.

Regression Analysis Fit the full model

```
lm.Regression <- lm(mpg ~ ., data = mtcars)
summary(lm.Regression)  # results hidden
summary(lm.Regression)$coeff  # results hidden
```

No coefficient had a p-value less than 0.05 we cannot deduce which variables are more significant.

Now lets try Stepwise Regression to determine which variables are most significant

```
Stepwise <- step(lm.Regression)
summary(Stepwise) # results hidden
summary(Stepwise)$coeff # results hidden
```

Now we have 4 variables (cylinders, horsepower, weight, transmission). The R-squared value of 0.8659. - The p-values are less than 0.05. - The coefficients conclude that increasing the number of cylinders from 4 to 6 with decrease the MPG by 3.03.
- Further increasing the cylinders to 8 with decrease the MPG by 2.16.
- Increasing the horsepower is decreases MPG 3.21 for every 100 horsepower.
- Weight decreases the MPG by 2.5 for each 1000 lbs increase. - A Manual transmission improves the MPG by 1.81.

Residuals & Diagnostics Residual Plot **See plot below**

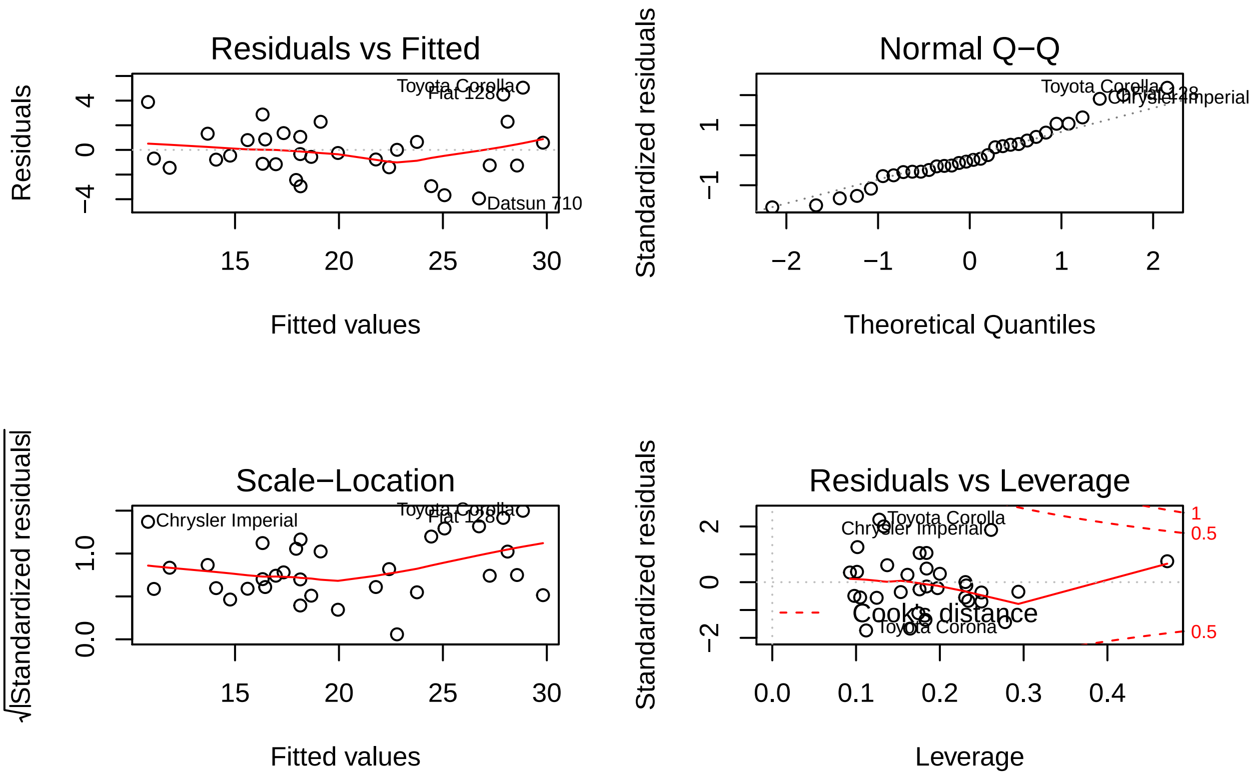
```
Us this plot to deduce:
```

1. Randomness of the Residuals vs. Fitted plot supports the assumption of independence
2. The points of the Normal Q-Q plot following closely to the line conclude that the distribution of residuals is normal
3. The Scale-Location plot random distribution confirms the constant variance assumption
4. Since all points are within the 0.05 lines, the Residuals vs. Leverage concludes that there are no outliers

```
sum((abs(dfbetas(Stepwise)))>1)
```

```
## [1] 0
```

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



Conclusion There is a difference in MPG based on transmission type. A manual transmission will have a slight MPG boost. However, it seems that weight, horsepower, & number of cylinders are more statistically significant when determining MPG.