Motor Trend - MPG & Transmission Analysis

Executive Summary

The objective of this analysis is try to determine what transmission is better for MPG: manual or automatic. Also quantify the MPG difference between both.

Data Set

The data was obtained from the US Magazine "Motor Trend" (1974 edition). It includes 32 observations and 11 different features for each one.

```
 mpg    - Miles/(US) gallon
 cyl  - Number of cylinders
 disp - Displacement (cu.in.)
 hp   - Gross horsepower
 drat - Rear axle ratio
 wt   - Weight (1000 lbs)
 qsec - 1/4 mile time
 vs   - V/S
 am   - Transmission (0 = automatic, 1 = manual)
 gear - Number of forward gears
 carb - Number of carburetors
```

```
data(mtcars)
require(graphics)
```

Exploratory Analysis

Initial exploration show an apparent high visual relation between MPG and the following factors, not only the transmission type:

- Transmission Type (am)
- Number of cylinders (cyl)
- Gross Horsepower (hp)
- Weight (wt)

There is a difference in fuel consumption depending on the type of transmission type. Still, when we check the impact of the Transmission Type in the resulting MPG we notice that it is limited (0.3598 over 1 = 36 %) and other factors are needed.

```
singlevar_am <- lm(mpg ~ am, mtcars)
```

Study Approach and Conclusion

Following the exploratory analysis we could see how other variables had apparent impact in MPG.

Multiple regression combinations were tested and the combination of the Cylinders and Weight parameters offered the best R Squared. Considering the type of transmission as input for the linear model proved to be a far worse predictor. Adding the type of transmission to the best combination of Cylinders and Weight still gave slighly worse results that not including it.

As conclusion we could say that the number of cylinders and the weight of the vehicles together perform better as predictors than transmission type.

Apendix

Testing the fitness of different regression models

Testing different regression models selected from the observation in the exploratory analysis

R Squared Results are as follow:

Transmission Type vs MPG:

```
## [1] 0.3384589
```

Cylinders vs MPG:

```
## [1] 0.7170527
```

Weight vs MPG:

```
## [1] 0.7445939
```

Cylinders and Weight vs MPG:

```
## [1] 0.8185189
```

Displacement vs MPG:

```
## [1] 0.7089548
```

Displacement and Transmission Type vs MPG:

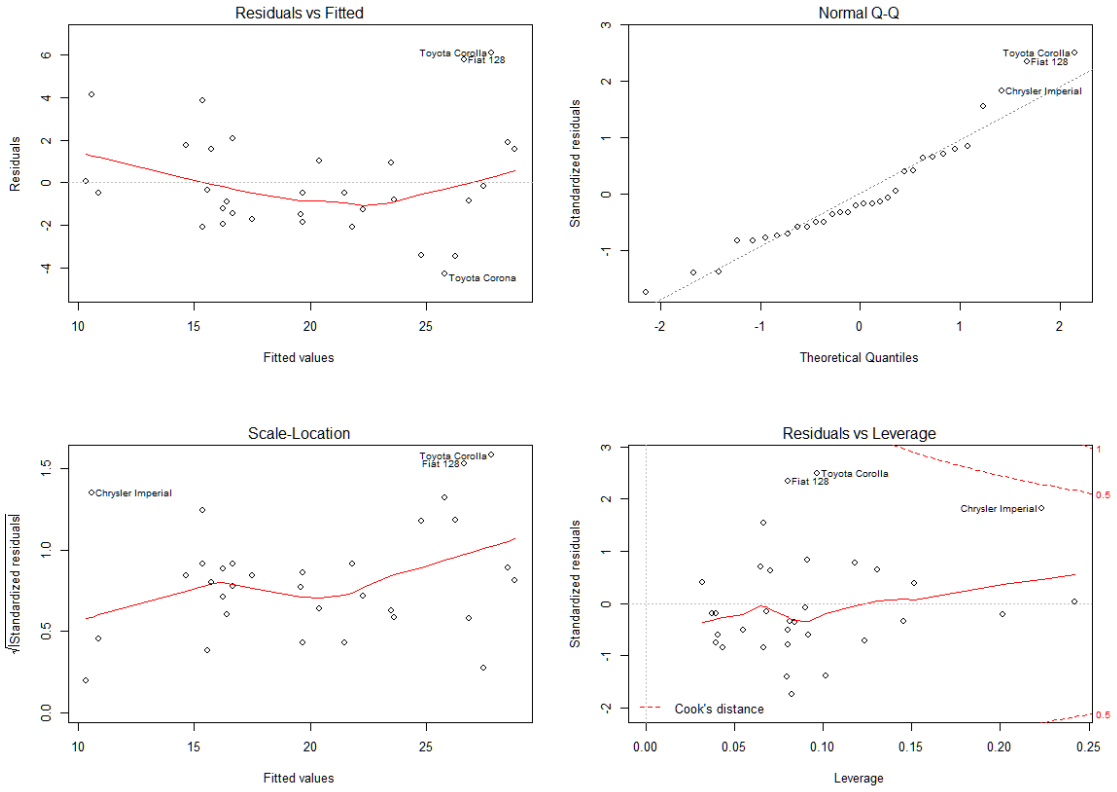
```
## [1] 0.7149405
```

Cylinders + Weight + Transmission Type vs MPG:

```
## [1] 0.8121603
```

Cylinders and Weight have the best R Squared to fuel consumption.

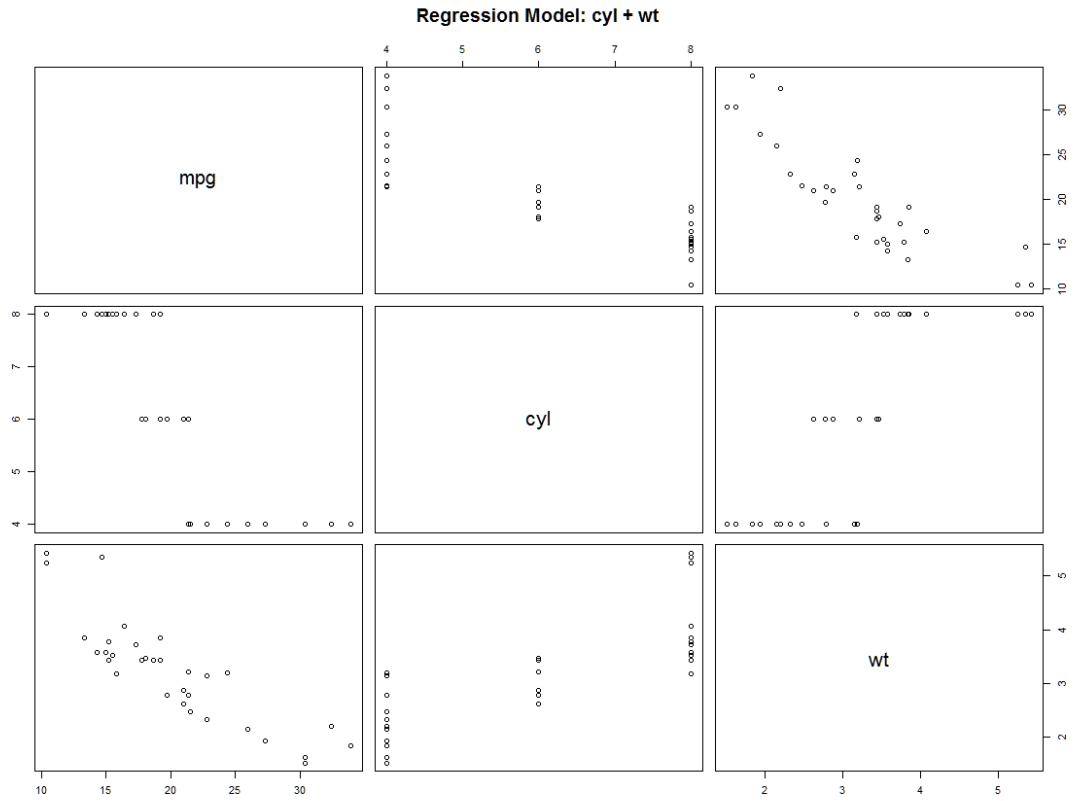
```
par(mfrow=c(2,2))
plot(singlevar_cyl_wt)
```



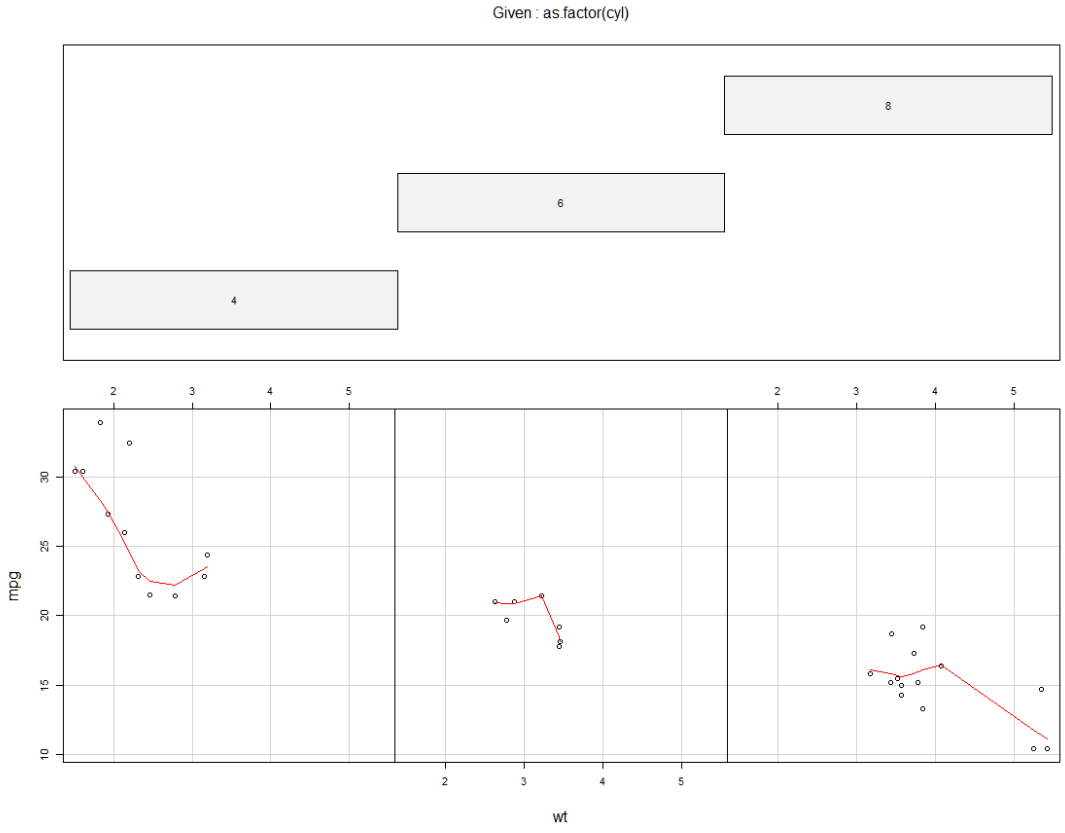
Comparison with an Transmission Type only model

Model with Cylinders and Weight (wt + cyl)

```
pairs(mpg ~ cyl + wt, data=mtcars,main="Regression Model: cyl + wt", pch=21)
```

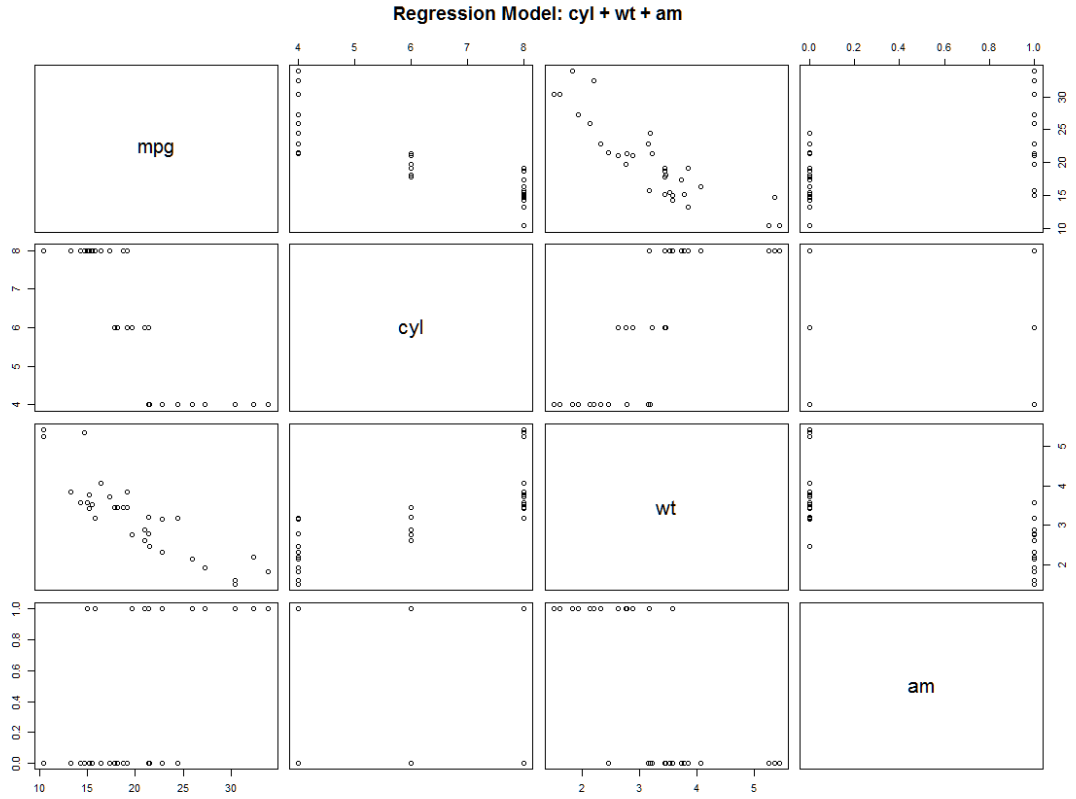



```
coplot(mpg ~ wt | as.factor(cyl), data = mtcars,
       panel = panel.smooth, rows = 1)
```



Adding to the previous model Transmission Type (ac + wt + cyl) is even slighly worse than without it.

```
pairs(mpg ~ cyl + wt + am, data=mtcars,main="Regression Model: cyl + wt + am", pch=21)
```




```r
coplot(mpg ~ wt + am | as.factor(cyl), data = mtcars,
       panel = panel.smooth, rows = 1)
```