

# *Regression Models Final Project*

*MP*

*September 27th, 2015*

## *Executive Summary*

This study is about the automobile industry. Looking at a data set of a collection of cars, exploring the relationship between a set of variables and miles per gallon (MPG) (outcome) implemented by some exploratory analysis. Finally a comparison between automatic and manual fuel consumption in automobiles illustrated. The result shows higher fuel consumption of automatic automobiles in comparison to manual automobiles.

## *Headings*

the basic goal of this study is to answering folowing questions:

- 1- Is an automatic or manual transmission better for MPG?
- 2- Quantify the MPG difference between automatic and manual transmissions?

Table 1 shows top 6 values of 2 mtcars features.

	mpg	am
Mazda RX4	21.00	1
Mazda RX4 Wag	21.00	1
Datsun 710	22.80	1
Hornet 4 Drive	21.40	0
Hornet Sportabout	18.70	0
Valiant	18.10	0

Table 1: First rows of mtcars

The name of all predictors that simplified are as shown below:

- 1- mpg Miles/(US) gallon
- 2- cyl Number of cylinders
- 3- disp Displacement (cu.in.)
- 4- hp Gross horsepower
- 5- drat Rear axle ratio
- 6- wt Weight (lb/1000)
- 7- qsec 1/4 mile time
- 8- vs V/S
- 9- am Transmission (0 = automatic, 1 = manual)
- 10- gear Number of forward gears
- 11- carb Number of carburetors

## Data Analysis

In Motor Trend Car Road Tests there are 10 aspects of automobile design and as shown in table below the significance of features in prediction of miles per gallon consumption could be directly taken by the P-value rate.

The predictors that have lower than 0.05 P-values shows uncorrelation and independent features. Table 2 that shows the model of glm just The value of weight shows little significant feature and other variables are less important in comparison to other ones.

The basic strategy in model selection is using significant features in prediction procedure.

```
library(xtable)
options(xtable.comment = FALSE)
options(xtable.booktabs = TRUE)
library(datasets)
data(mtcars)
fit <- glm(mpg ~ ., data = mtcars)
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	12.3034	18.7179	0.6573	0.5181
cyl	-0.1114	1.0450	-0.1066	0.9161
disp	0.0133	0.0179	0.7468	0.4635
hp	-0.0215	0.0218	-0.9868	0.3350
drat	0.7871	1.6354	0.4813	0.6353
wt	-3.7153	1.8944	-1.9612	0.0633
qsec	0.8210	0.7308	1.1234	0.2739
vs	0.3178	2.1045	0.1510	0.8814
am	2.5202	2.0567	1.2254	0.2340
gear	0.6554	1.4933	0.4389	0.6652
carb	-0.1994	0.8288	-0.2406	0.8122

```
plot(mtcars$mpg, mtcars$am, xlab = "Miles/(US) gallon",
      ylab = "Transmission", bg = "lightblue", col = "black",
      cex = 1.1, pch = 21, frame = F)
abline(lm(am ~ mpg, data = mtcars), lwd = 2)
```

The am predictor is about automatic or manual features and The P-value about 0.2340 shows high correlation with other features in prediction of mpg and low significancy.

The Miles Per Gallon residual plot versus Transmission is as Figure 1 and This figure shows high Fuel consumption in Automatic versus Manual Transmission.

Table 2: significant features evaluation base on miles per gallon prediction in generalized linear model

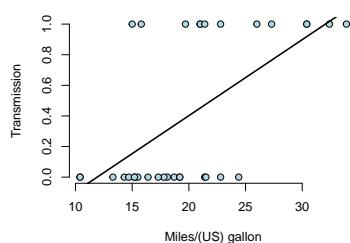


Figure 1: Miles Per Gallon versus Transmission Type

The mean and standard mpg difference of both automatic and manual Transmission analysed as shown in Table 3 and shows that the mean of miles per gallon in manual automobile is about twice of its automatic counterpart.

	Mean Value	Standard Deviation
Automatic Transmission	143.53	110.17
Manual Transmission	290.38	87.20

Table 3: The difference of two Transmission

### Conclusion

In Illustrated figures proved that miles per gallon in automatic Transmission is lower than manual Transmission so manual cars have lower fuel consumption in comparison to Automatic automobile. Mean value of miles per gallon in both Transmission shows that mpg in Manual Transmission is two times larger than automatic counterpart.

### Appendix

For better sense of the fuel consumption of two transmission the Box-plot illustrated in Figure 2 where clearly shows higher Miles Per Gallon in Manual transmission.

```
plot(factor(mtcars$am), mtcars$mpg, pch = 20,
  col = "green", xlab = "Automatic=0,Manual=1",
  ylab = "Miles Per Gallon")
```

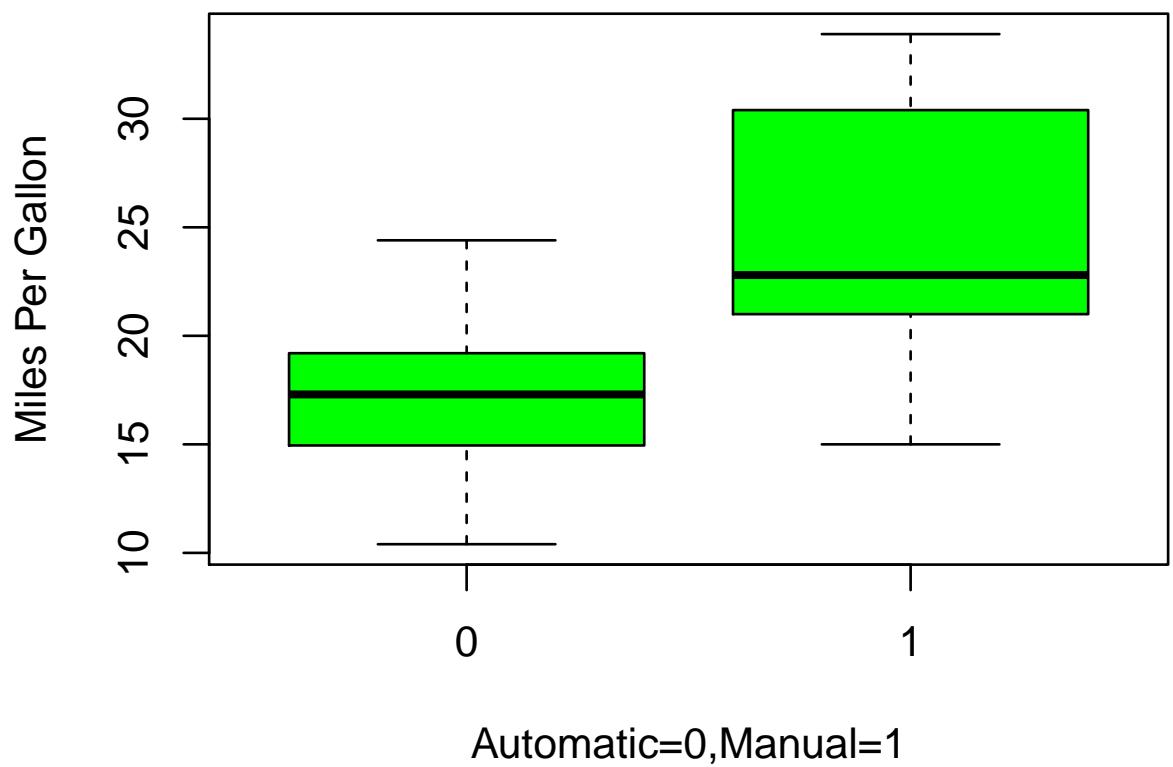


Figure 2: Boxplot of Miles Per Gallon versus Transmission Type