

# Report for Motor Trend. Regression Assignment

Madhushree Sharma

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## Executive Summary

One of the greatest debate about cars is on the transmission type. While the manual transmission is on its way towards extinction in the US, they are still very popular in Europe. One often stated advantage of manual transmission over automatic one is the fuel efficiency. The purpose of this analysis is to find if there is any relationship between a set of variables and miles per gallon (MPG).

The mtcars dataset is used in the analysis. The variable names are shown below:

There are 11 variables in this data table and the data columns [,1] mpg (Miles per gallon) and [,9] am (Transmission: 0-automatic, 1-manual) are of primary interest.

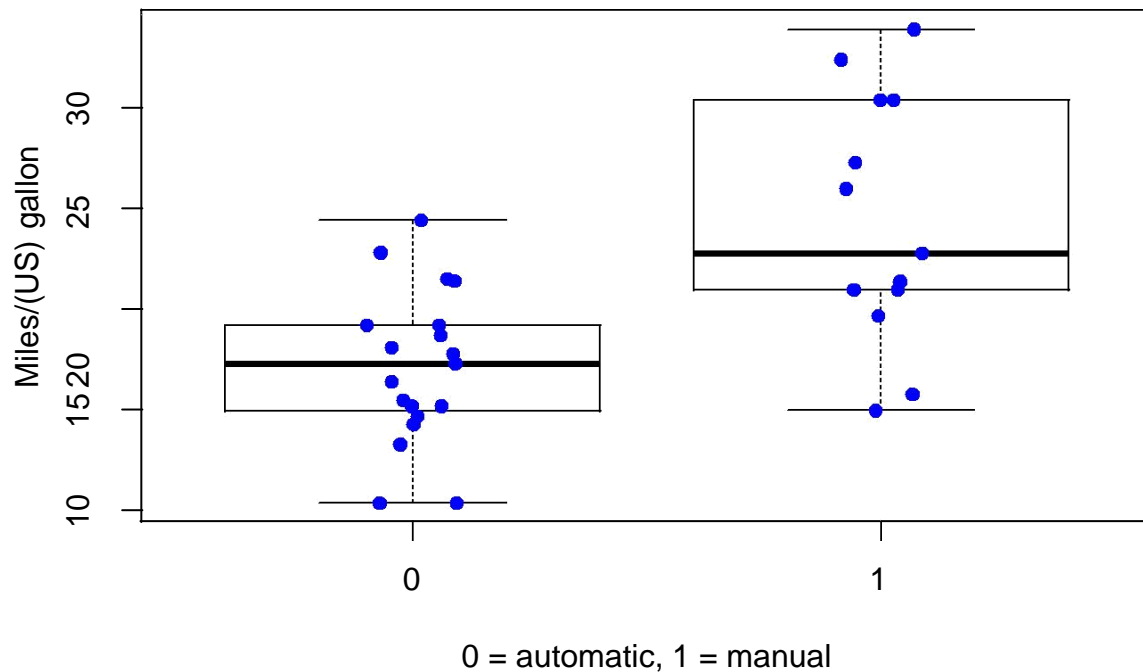
```
data(mtcars)
names(mtcars)
```

```
## [1] "mpg" "cyl" "disp" "hp" "drat" "wt" "qsec" "vs" "am" "gear"
## [11] "carb"
```

```
# mpg      Miles/(US) gallon
# am       Transmission (0 = automatic, 1 = manual)
summary(mtcars[, c("mpg", "am")])
```

```
##           mpg           am
## Min.      :10.40  Min.    :0.0000
## 1st Qu.:15.43   1st Qu.:0.0000
## Median :19.20   Median :0.0000
## Mean     :20.09   Mean    :0.4062
## 3rd Qu.:22.80   3rd Qu.:1.0000
## Max.     :33.90   Max.    :1.0000
```

```
boxplot(mpg ~ am, data = mtcars, ylab = "Miles/(US) gallon", xlab = "0 = automatic, 1 = manual")
stripchart(mpg ~ am, data = mtcars, vertical = T, method = "jitter",
           add = TRUE, pch = 16, col = 'blue')
```



The above boxplot above shows that there is a clear increase in miles per gallon for manual transmission.

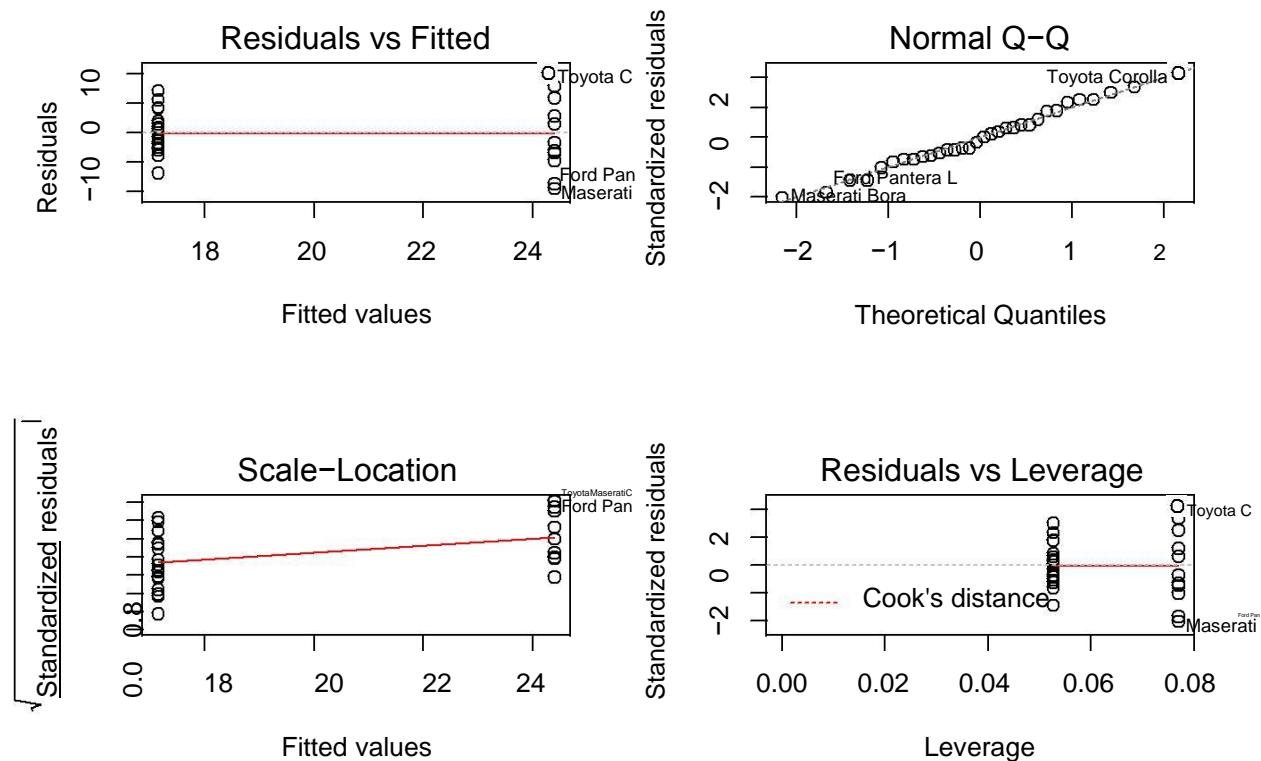
```
fit <- lm(mpg ~ am, data = mtcars)
summary(fit)
```

```
##
## Call:
## lm(formula = mpg ~ am, data = mtcars)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -9.3923 -3.0923 -0.2974  3.2439  9.5077
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   17.147      1.125   15.247 1.13e-15 ***
## am             7.245      1.764    4.106 0.000285 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.902 on 30 degrees of freedom
## Multiple R-squared:  0.3598, Adjusted R-squared:  0.3385
## F-statistic: 16.86 on 1 and 30 DF, p-value: 0.000285
```

The manual transmission increases average miles per gallon (mpg) (7.24 mpg more than the average mpg in automatic transmission vehicles). Hence, manual transmission has better performance, reducing fuel

consumption. The average mpg driven by automatic transmission vehicles is 17.15, while the average mpg manual transmission vehicles is 24.39 mpg,

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



```
cor(mtcars)
```

```
##          mpg          cyl          disp          hp          drat          wt
## mpg    1.0000000 -0.8521620 -0.8475514 -0.7761684  0.68117191 -0.8676594
## cyl   -0.8521620  1.0000000  0.9020329  0.8324475 -0.69993811  0.7824958
## disp -0.8475514  0.9020329  1.0000000  0.7909486 -0.71021393  0.8879799
## hp    -0.7761684  0.8324475  0.7909486  1.0000000 -0.44875912  0.6587479
## drat   0.6811719 -0.6999381 -0.7102139 -0.4487591  1.00000000 -0.7124406
## wt    -0.8676594  0.7824958  0.8879799  0.6587479 -0.71244065  1.0000000
## qsec   0.4186840 -0.5912421 -0.4336979 -0.7082234  0.09120476 -0.1747159
## vs     0.6640389 -0.8108118 -0.7104159 -0.7230967  0.44027846 -0.5549157
## am     0.5998324 -0.5226070 -0.5912270 -0.2432043  0.71271113 -0.6924953
## gear   0.4802848 -0.4926866 -0.5555692 -0.1257043  0.69961013 -0.5832870
## carb -0.5509251  0.5269883  0.3949769  0.7498125 -0.09078980  0.4276059
##          qsec          vs          am          gear          carb
## mpg    0.41868403  0.6640389  0.59983243  0.4802848 -0.55092507
## cyl   -0.59124207 -0.8108118 -0.52260705 -0.4926866  0.52698829
## disp -0.43369788 -0.7104159 -0.59122704 -0.5555692  0.39497686
## hp    -0.70822339 -0.7230967 -0.24320426 -0.1257043  0.74981247
```

```
## drat    0.09120476  0.4402785  0.71271113  0.6996101 -0.09078980
## wt     -0.17471588 -0.5549157 -0.69249526 -0.5832870  0.42760594
## qsec    1.00000000  0.7445354 -0.22986086 -0.2126822 -0.65624923
## vs      0.74453544  1.0000000  0.16834512  0.2060233 -0.56960714
## am     -0.22986086  0.1683451  1.00000000  0.7940588  0.05753435
## gear   -0.21268223  0.2060233  0.79405876  1.0000000  0.27407284
## carb   -0.65624923 -0.5696071  0.05753435  0.2740728  1.00000000
```

```
fit.all <- lm(mpg ~ am + ., data = mtcars)
summary(fit.all)
```

```
##
## Call:
## lm(formula = mpg ~ am + ., data = mtcars)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.4506 -1.6044 -0.1196  1.2193  4.6271
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   12.30337    18.71788   0.657  0.5181
## am             2.52023     2.05665   1.225  0.2340
## cyl          -0.11144     1.04502  -0.107  0.9161
## disp           0.01334     0.01786   0.747  0.4635
## hp           -0.02148     0.02177  -0.987  0.3350
## drat           0.78711     1.63537   0.481  0.6353
## wt           -3.71530     1.89441  -1.961  0.0633
## qsec           0.82104     0.73084   1.123  0.2739
## vs            0.31776     2.10451   0.151  0.8814
## gear           0.65541     1.49326   0.439  0.6652
## carb          -0.19942     0.82875  -0.241  0.8122
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.65 on 21 degrees of freedom
## Multiple R-squared:  0.869, Adjusted R-squared:  0.8066
## F-statistic: 13.93 on 10 and 21 DF, p-value: 3.793e-07
```