Motor Trend Analysis: regmods-011

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Executive Summary

From the analysis detailed below, it can be determined that transmission has a significant effect on fuel economy, with manual transmissions having a 7.24 mpg improvement on average.

Loading Data and Exploratory Analysis

First, we need to load the mtcars analysis

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

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

Using ?mtcars, we can get a description for the dataset. The relevant factor for this analysis is the transmission

[, 9] am Transmission (0 = automatic, 1 = manual)

Specifically, we're interested in knowing the transmission type and its effect on fuel economy (MPG)

See appendix for boxplot of mpg range for transmission type.

Answering The First Question

"Is an automatic or manual transmission better for MPG"

To answer this question, we first look at the mean fuel economy aggregated by transmission type:

```
aggregate(mpg~am, data = mtcars, mean)
```

```
##   am      mpg
## 1  0 17.14737
## 2  1 24.39231
```

This shows that manual transmissions, on average, have better fuel economny than automatic transmissions.

A simple t-test will allow us to reject the null hypothesis, that automatic transmissions average better fuel economy than manual transmissions:

```
m_trans_data <- mtcars[mtcars$am == 1,]
a_trans_data <- mtcars[mtcars$am == 0,]

t.test(m_trans_data$mpg, a_trans_data$mpg)
```

```
##
##  Welch Two Sample t-test
##
## data:  m_trans_data$mpg and a_trans_data$mpg
## t = 3.7671, df = 18.332, p-value = 0.001374
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   3.209684 11.280194
## sample estimates:
## mean of x mean of y
##  24.39231  17.14737
```

A p-value of 0.001374 allows us to reject this null hypothesis.

Answering The Second Question

"Quantify the MPG difference between automatic and manual transmissions"

First, we can create a regression model:

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

```
##
## 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 summary shows that the adjusted R-squared value is 0.3385, meaning that transmission type only accounts for 33.9% of the variance. The difference is 7.24 mpg.

Appendix

```
boxplot(mpg~am,
        data = mtcars,
        main = "Fuel Economy by Transmission Type",
        xlab = "Transmission Type",
        ylab = "Fuel Economy (mpg)",
        names = c("Automatic", "Manual"))
```