week3 regression

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Report Summary

The aim of this reoprt is to analyze the relation bewteen the transmission type of the vehicle(automatic or manual)and the distance(in miles) as we all know it covers per gallon(mpg). The final result aims at determe as to which transmission type gives more miles per gallon rating is v low. The `mtcars` dataset as we are using is used to make the analysis.

Load Data

Load the dataset and convert categorical variables to factors.

```
library(ggplot2)
data(mtcars)
head(mtcars, n=3)
dim(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)
```

Exploratory Analysis

See Appendix Figure I The graph leads us to believe that there is a significant increase in MPG when for vehicles with a manual transmission vs automatic.

Statistical Inference

T-Test transmission type and MPG

```
trs <- t.test(mpg ~ am)
trs$p.value

## [1] 0.001373638
```

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

```
trs$estimate
```

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

The difference estimate between the given 2 transmissions is 7.2449 MPG in favor of the manual.

Regression Analysis

Fit the full model of the data

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

Since none of the coefficients that we have found have a p-value less than 0.05 we cannot conclude that we have found out which variables are more statistically significant.

Backward selection to determine whi other variables are most statistically significant than any othr

```
sft <- step(fmft)
summary(sft) # results hidden
summary(sft)$coeff # results hidden
```

The new model has 4 variables (cylinders, horsepower, weight, transmission). The R-squared value of 0.8659 confirms that this model explains about 87% of the variance in MPG. The p-values also as we have known are statistically significantly because they have a p-value less than 0.05. The coefficients conclude from the gven above that increasing the number of cylinders from 4 to 6 with decrease the the the MPG by 3.03. Further increasing the cylinders to 8 with the utmost 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 Appendix Figure II**

The plots conclude:

A: The randomness supports the assumption that we have made of independence
B: The distribution of all residuals is normal
C: Confirms the constant of the variance assumption
D: Since all the points that we have seen are under 0.05, there are no outliers

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

## [1] 0
```

Results

The analysis performed shows that the vehicles with manual transmission have a higher MPG rating than vehicles with automatic transmission by 7.245. When fitted with multiple

linear regressions, the results went on to show that the transmission type had less to do with the earlier results, that is, the manual transmission itself contributed less to MPG, still giving it an edge over automatic transmission, but by 1.81 MPG. Other variables like it's enigne capacity(horsepower), it's weight and number of cylinders had a greater effect on the MPG of vehicles.

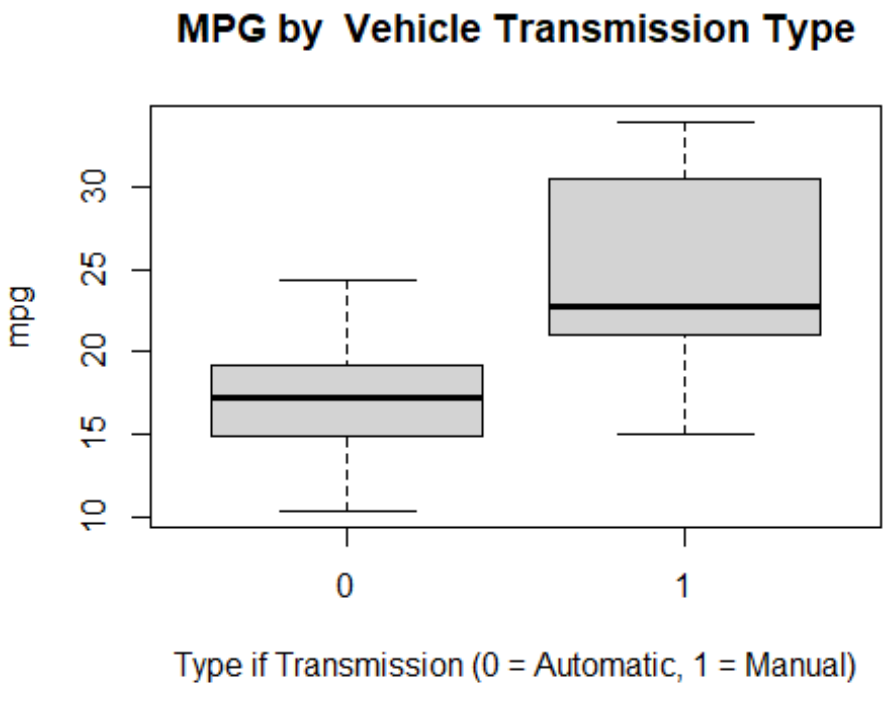
Conclusion

There is a difference given in the observed MPG based on transmission type.

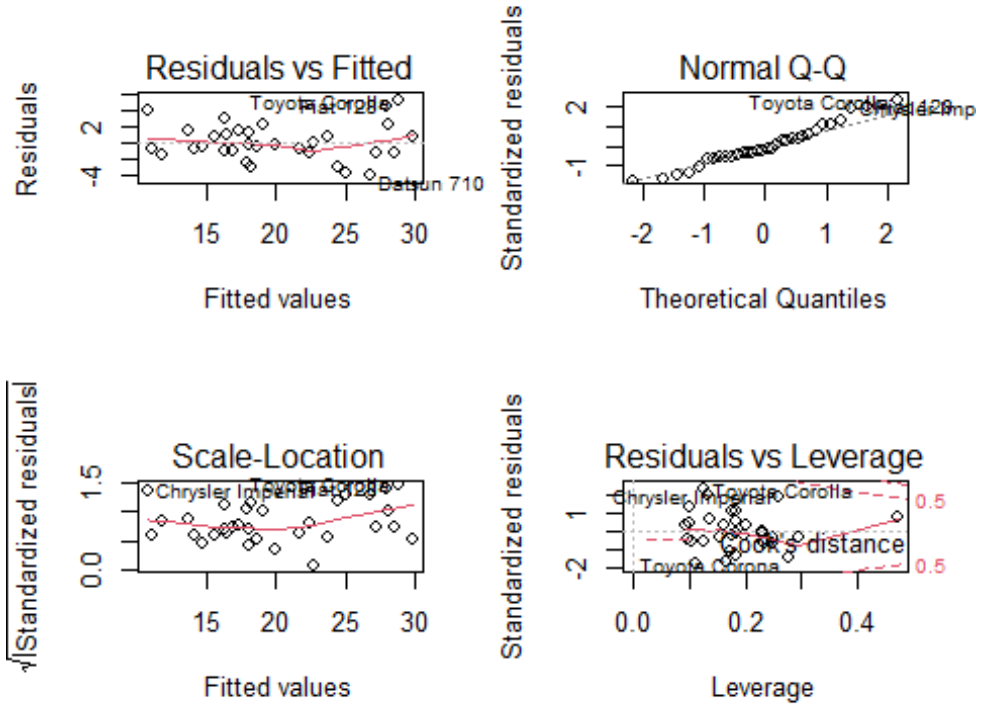
Appendix Figures

I

Exploratory Box graph has een shwn fr whatthat compares Automatic and Manual transmission MPG.



part 2 as shown



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