Course Project

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Summary

As a employees in a Motor Trend magazine we were given a task to look at a data set of a collection of cars and to explore the relationship between a set of variables and miles per gallon (MPG) (as outcome). The goal of this analysis was to determine which type of transmission (automatic or manual) is better for MPG and to quantify the MPG difference between automatic and manual transmissions.
If were only to look on a effect of transmission type on MPG disregarding other variables we could conclude that the manual transsmision is better regarding MPG, and the difference is 7.2 miles/gallon more with manual transmission.
But, when weight of a car is included, type of transmission appears to have no impact on MPG. Thus, weight needs to be taken into consideration.

Data

```
data(mtcars)
attach(mtcars)
```

Description

The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973???74 models).

Format

A data frame with 32 observations on 11 variables.

[, 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

Analysis

To look at the data box plot was created (*Fig.1*). The plot shows that there is a difference in MPG for transmission type. So, in order to find out if the difference is significant and to quantify it a linear model was created:

```
fit <- lm(mpg ~ am)
summary(fit)$coeff
```

```
##             Estimate Std. Error t value  Pr(>|t|)
## (Intercept)   17.147      1.125  15.247 1.134e-15
## am             7.245      1.764   4.106 2.850e-04
```

This model shows a significant difference between transmission type effect on MPG. Intercept represents average MPG values for automatic transmission, while second coefficient represents difference in average MPG for automatic and manual.
However, on account on previous experience with this data set it was reasonable to fit another model involving weight as confounder:

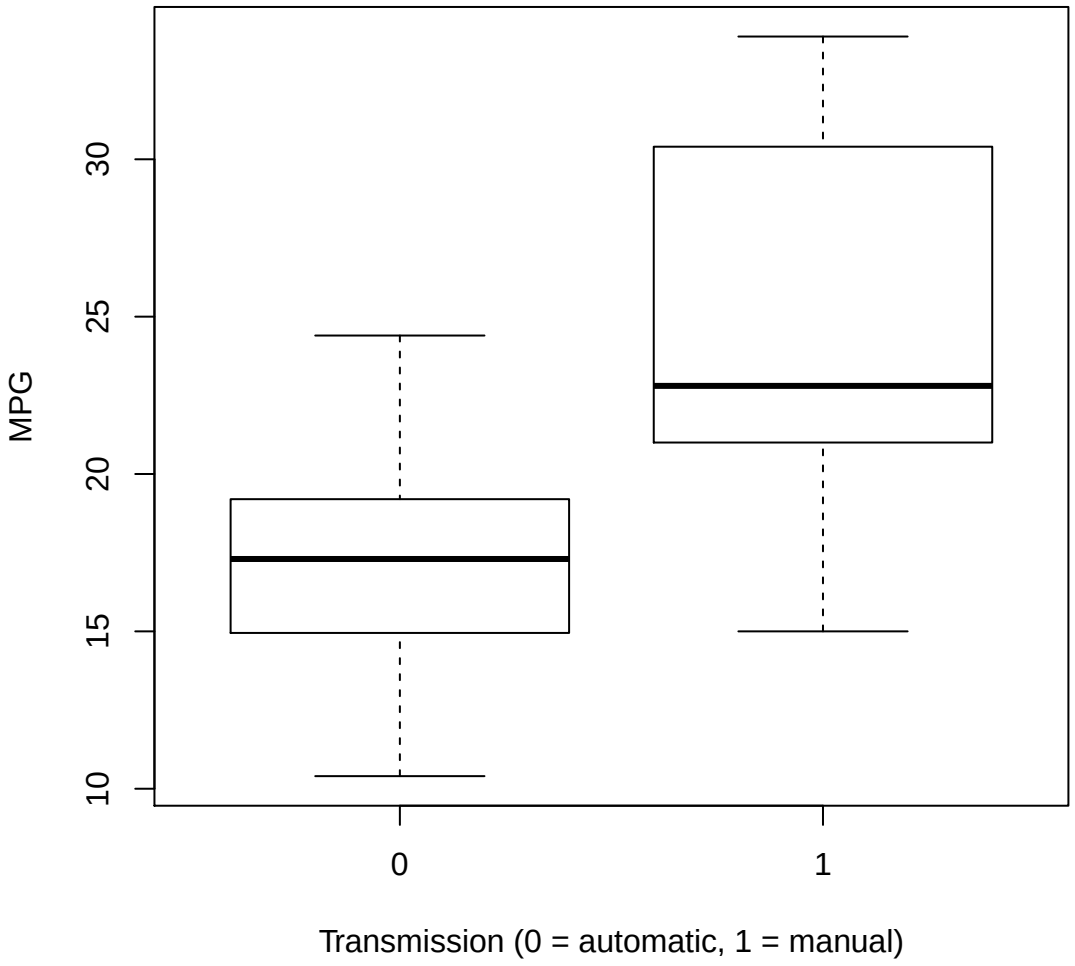
```
fit1 <- lm(mpg ~ am + wt)
summary(fit1)$coeff
```

```
##             Estimate Std. Error  t value  Pr(>|t|)
## (Intercept) 37.32155     3.0546 12.21799 5.843e-13
## am          -0.02362     1.5456 -0.01528 9.879e-01
## wt          -5.35281     0.7882 -6.79081 1.867e-07
```

Adjustment with weight attenuates the effect of transmission type so it is no longer important what type it is. This is easily seen on *Fig. 2.*

Appendix

Fig. 1: Box plot of Miles per gallon vs transmission type



g. 2: Unadjusted (left) and udjasted (right) change of MPG vs transsmision ty

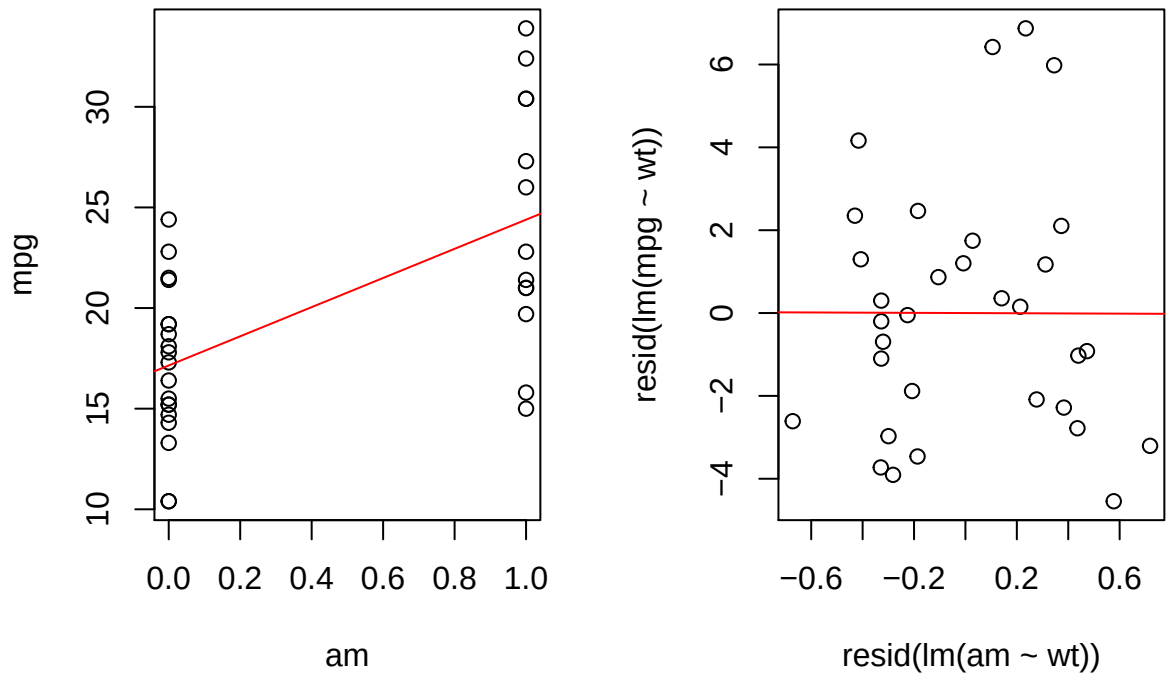


Fig. 3: Residuals vs Fitted for unadjusted model

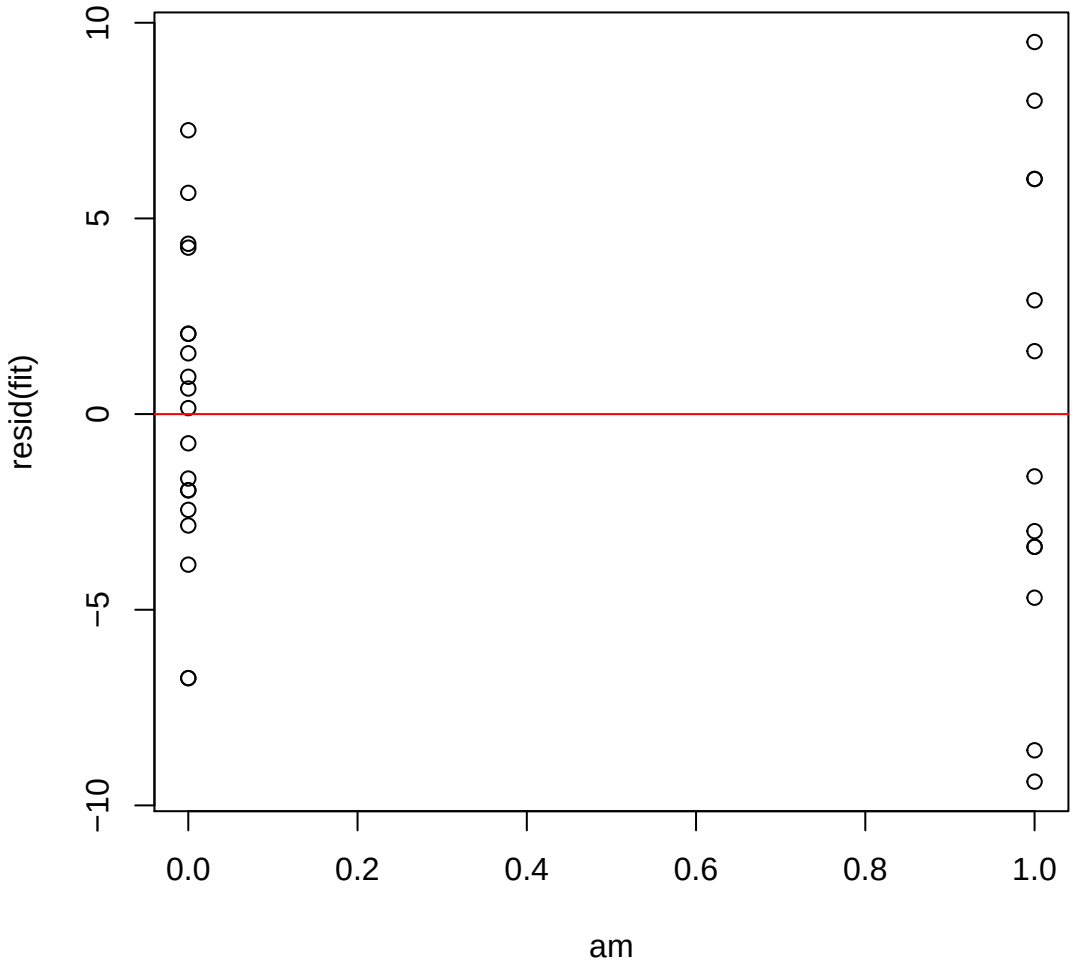


Fig. 4: Residuals vs Fitted for adjusted model