Motor Trend Analysis

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Executive summary

You work for Motor Trend, a magazine about the automobile industry. Looking at a data set of a collection of cars, they are interested in exploring the relationship between a set of variables and miles per gallon (MPG) (outcome). They are particularly interested in the following two questions:

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

Data Processing

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).

```
library(datasets)
library(ggplot2)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
##
##               from 'package:stats':
##
##     filter, lag
##
##               from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
data(mtcars) #Load mtcars dataset
```

Let's have a brief look at mtcars dataset.

```
head(mtcars)
```

```
##                   mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4         21.0   6  160 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag     21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710        22.8   4  108  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive    21.4   6  258 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout 18.7   8  360 175 3.15 3.440 17.02  0  0    3    2
## Valiant           18.1   6  225 105 2.76 3.460 20.22  1  0    3    1
```

```r
dim(mtcars)
```

```
## [1] 32 11
```

```r
summary(mtcars)
```

```
##       mpg             cyl             disp             hp
##  Min.   :10.40   Min.   :4.000   Min.   : 71.1   Min.   : 52.0
##  1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8   1st Qu.: 96.5
##  Median :19.20   Median :6.000   Median :196.3   Median :123.0
##  Mean   :20.09   Mean   :6.188   Mean   :230.7   Mean   :146.7
##  3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0   3rd Qu.:180.0
##  Max.   :33.90   Max.   :8.000   Max.   :472.0   Max.   :335.0
##       drat             wt             qsec             vs
##  Min.   :2.760   Min.   :1.513   Min.   :14.50   Min.   :0.0000
##  1st Qu.:3.080   1st Qu.:2.581   1st Qu.:16.89   1st Qu.:0.0000
##  Median :3.695   Median :3.325   Median :17.71   Median :0.0000
##  Mean   :3.597   Mean   :3.217   Mean   :17.85   Mean   :0.4375
##  3rd Qu.:3.920   3rd Qu.:3.610   3rd Qu.:18.90   3rd Qu.:1.0000
##  Max.   :4.930   Max.   :5.424   Max.   :22.90   Max.   :1.0000
##        am              gear            carb
##  Min.   :0.0000   Min.   :3.000   Min.   :1.000
##  1st Qu.:0.0000   1st Qu.:3.000   1st Qu.:2.000
##  Median :0.0000   Median :4.000   Median :2.000
##  Mean   :0.4062   Mean   :3.688   Mean   :2.812
##  3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:4.000
##  Max.   :1.0000   Max.   :5.000   Max.   :8.000
```

The dataset consists of 32 observations on 11 variables. We are interested in examine 3 variables to answer the analysis questions: 1. mpg - Miles/(US) gallon 2. am - Transmission (0 = automatic, 1 = manual) 3. hp - Gross horsepower 4. wt - Weight (lb/1000) 5. cyl - Number of cylinders

Analysis

Is an automatic or manual transmission better for MPG?

To answer that question lets compare average mpg for automatic and manual transmissions.

```r
mean(filter(mtcars, am == 1)$mpg) #Calculate mean mpg for manual transmission
```

```
## [1] 24.39231
```

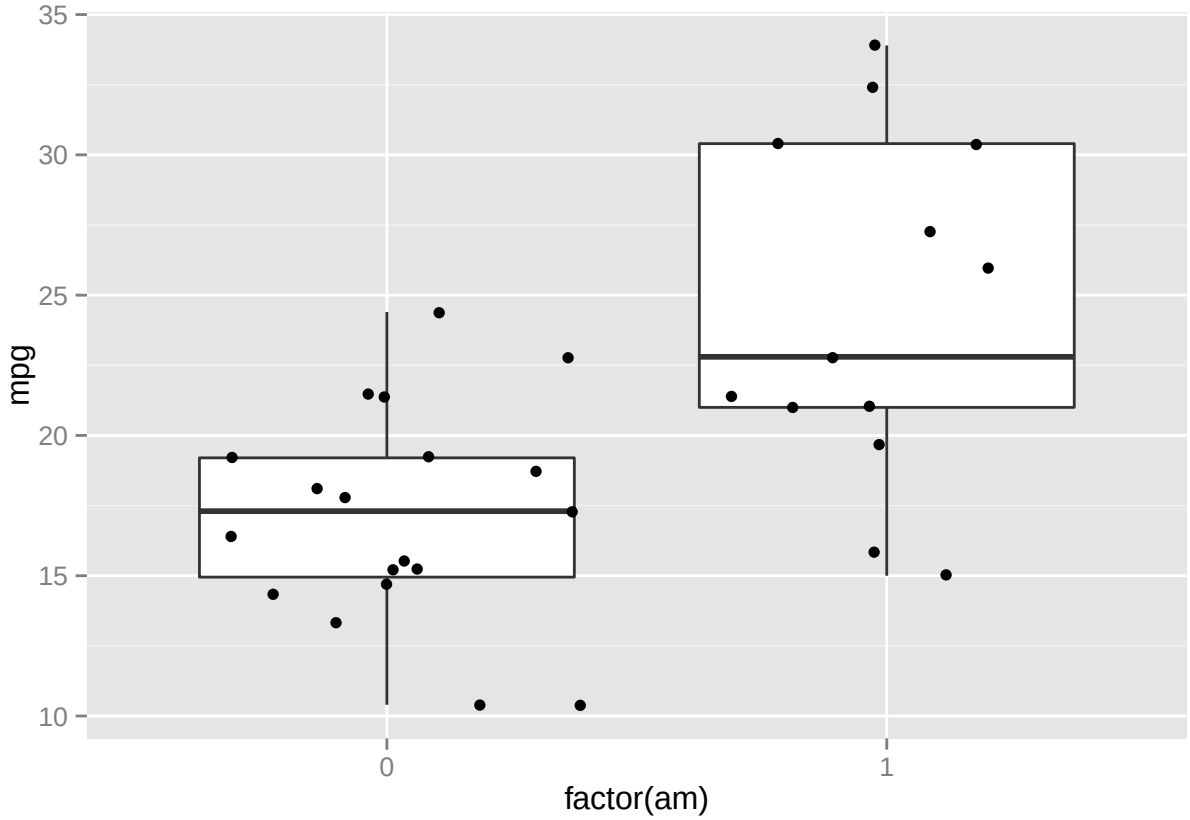
```r
mean(filter(mtcars, am == 0)$mpg) #Calculate mean mpg for automatic transmission
```

```
## [1] 17.14737
```

As we can see cars with manual transmission have greater mpg than cars with manual transmission.

Lets build a boxplot displaying mpg per transmission type.

```
p <- ggplot(mtcars, aes(factor(am), mpg))
p + geom_boxplot() + geom_jitter()
```



The plot also prooves that cars with manual transmission type (represented by 1) has a higher mean for mpg than automatic (represented by 0).

Lets perform a t-test to confirm the null hypothesis that transmission type affects mpg.

```
t.test(mtcars$mpg ~ mtcars$am, conf.level=0.95)
```

```
##
##  Welch Two Sample t-test
##
## data:  mtcars$mpg by mtcars$am
## 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:
##  -11.280194  -3.209684
## sample estimates:
## mean in group 0 mean in group 1
##        17.14737        24.39231
```

p-value = 0.001374 is less then 0.005, so we reject the null hypothesis that there is no difference in MPG per transmission type.

Quantify the MPG difference between automatic and manual transmissions.