

# Motor Trend

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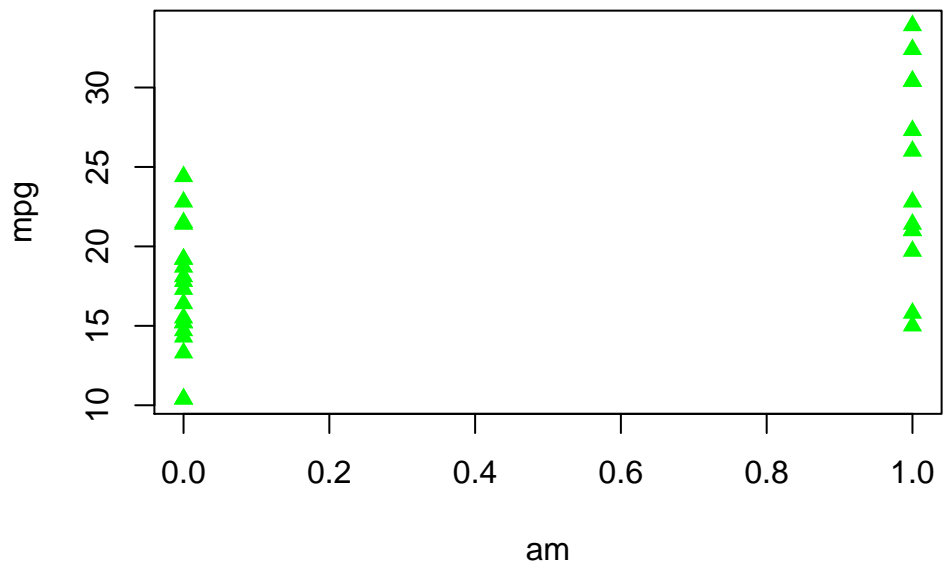
## Summary

In general, it's not significant to say manual or automatic car is better. Include more features, we can tell for lower features, manual is better for mpg, while for higher features, automatic is better for mpg.

## Automatic versus Manual

Devide the data into two groups, g0 is automatic transmission and g1 is manual transmission.

### mpg of automatic and manual



First, we want to plot mpg of two type.

It seems that manual is better for mpg. Then let's do the hypothesis to see if it's true. Our null hypothesis is that it makes no difference whether it's manual or automatic.  $H_0: \mu_0 = \mu_1$   $H_a: \mu_0 < \mu_1$

```
##  
## Welch Two Sample t-test  
##  
## data: g0 and g1  
## t = 1.8772, df = 348.4, p-value = 0.06132  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -0.7538182 32.3497623  
## sample estimates:  
## mean of x mean of y  
## 46.02645 30.22848
```

As  $p > 0.05$  and  $t$  value is small, we're not able to reject the null hypothesis. That's say, you can't say manual is better for mpg, compared to automatic. The difference might be caused by particular driving habit or other features of the car.

## Regression Model

We notice there seem to be regression models outcome as mpg, income as disp, hp, wt or carb. Let's first do linear regression one by one and then do a multivariable regression.

### Linear Regression

```
##           [,1]      [,2]
## [1,] -0.7926335 -0.8348954
## [2,] -0.8315065 -0.8006683
## [3,] -0.7676554 -0.9089148
## [4,] -0.6564196 -0.7737834
## attr("names")
## [1] "auto"  "manual" NA      NA      NA      NA      NA
```

### Multivariable Regression

```
l0 <- lm(mpg~disp+hp+wt+carb,g0);l0
```

```
##
## Call:
## lm(formula = mpg ~ disp + hp + wt + carb, data = g0)
##
## Coefficients:
## (Intercept)      disp          hp          wt          carb
##    29.69420    -0.00572   -0.03093   -1.27311   -0.41299
```

```
l1 <- lm(mpg~disp+hp+wt+carb,g1);l1
```

```
##
## Call:
## lm(formula = mpg ~ disp + hp + wt + carb, data = g1)
##
## Coefficients:
## (Intercept)      disp          hp          wt          carb
##    42.66681    -0.02824    0.01826   -6.12643   -0.60466
```

According to the above regression model, it's convincing that disp, hp, wt and carb has a linear relationship with mpg. According to the multivariable regression, we can see automatic has a lower starting point of mpg, but features has less affects on the mpg compared to manual car. For lower disp, hp, wt and carb, manual cars are better for mpg; For higher disp, hp, wt and carb, automatic cars are better for mpg.

# Appendix

