Untitled

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### Executive Summary

### Analysis Details

First, let's compare the mileage of cars with automatic transmissions to those with manual transmissions.

Figure 1 shows a simple summarization of the mileage for each transmission type. There appears a sizeable difference in the median, with manual transmissions getting better gas mileage (22.8 MpG) than automatics (17.3 MpG). Doing a Student T Test (see Figure 2) shows the difference in average mileage is significant (a p-value of 0.001374 is less than the 95-th percentile threshold of 0.05) and that the 95% confidence interval says automatics get 3.2 to 11.3 MpG *less* than manuals.

So, in this data set, cars with manual transmissions do get better gas mileage, but remember *correlation does not imply causation*. Is the mileage difference due to the transmission type or is it due to other factors such as weight or horsepower? Let's look further and see which factors influence mileage the most.

## mpg cyl disp hp drat wt qsec vs am gear carb  
## mpg 1 -0.85 -0.85 -0.78 0.68 -0.87 0.42 0.66 0.6 0.48 -0.55  
## cyl 1 0.9 0.83 -0.7 0.78 -0.59 -0.81 -0.52 -0.49 0.53  
## disp 1 0.79 -0.71 0.89 -0.43 -0.71 -0.59 -0.56 0.39  
## hp 1 -0.45 0.66 -0.71 -0.72 -0.24 -0.13 0.75  
## drat 1 -0.71 0.09 0.44 0.71 0.7 -0.09  
## wt 1 -0.17 -0.55 -0.69 -0.58 0.43  
## qsec 1 0.74 -0.23 -0.21 -0.66  
## vs 1 0.17 0.21 -0.57  
## am 1 0.79 0.06  
## gear 1 0.27  
## carb 1

## mpg cyl disp hp drat wt qsec vs am gear carb   
## 1.00 -0.85 -0.85 -0.78 0.68 -0.87 0.42 0.66 0.60 0.48 -0.55

## mpg cyl disp hp drat wt qsec vs am gear carb   
## -0.87 0.78 0.89 0.66 -0.71 1.00 -0.17 -0.55 -0.69 -0.58 0.43

## mpg cyl disp hp drat wt   
## 1.0000000 -0.8521620 -0.8475514 -0.7761684 0.6811719 -0.8676594   
## qsec vs am gear carb   
## 0.4186840 0.6640389 0.5998324 0.4802848 -0.5509251

## mpg wt cyl disp hp drat vs am carb gear qsec   
## 1.00 -0.87 -0.85 -0.85 -0.78 0.68 0.66 0.60 -0.55 0.48 0.42

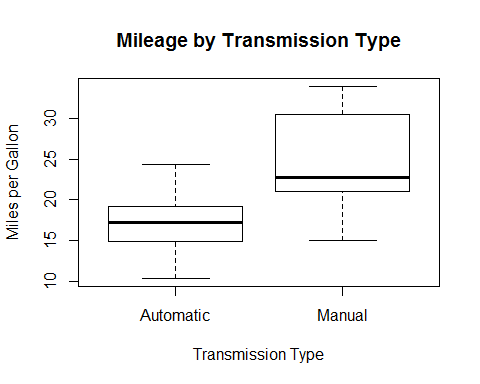
## starting httpd help server ... done

## function (..., na.last = TRUE, decreasing = FALSE)   
## {  
## z <- list(...)  
## if (any(unlist(lapply(z, is.object)))) {  
## z <- lapply(z, function(x) if (is.object(x))   
## xtfrm(x)  
## else x)  
## if (!is.na(na.last))   
## return(do.call("order", c(z, na.last = na.last, decreasing = decreasing)))  
## }  
## else if (!is.na(na.last)) {  
## if (length(z) == 1L && is.factor(zz <- z[[1L]]) && nlevels(zz) <   
## 1e+05)   
## return(.Internal(radixsort(zz, na.last, decreasing)))  
## else return(.Internal(order(na.last, decreasing, ...)))  
## }  
## if (any(diff(l.z <- vapply(z, length, 1L)) != 0L))   
## stop("argument lengths differ")  
## ans <- vapply(z, is.na, rep.int(NA, l.z[1L]))  
## ok <- if (is.matrix(ans))   
## !apply(ans, 1, any)  
## else !any(ans)  
## if (all(!ok))   
## return(integer())  
## z[[1L]][!ok] <- NA  
## ans <- do.call("order", c(z, decreasing = decreasing))  
## keep <- seq\_along(ok)[ok]  
## ans[ans %in% keep]  
## }  
## <bytecode: 0x000000000fd00180>  
## <environment: namespace:base>

Figure 3 shows the correlation between mileage and the other factors in the data set.

### Appendix

This section contains the figures referenced in the Analysis Details.



**Figure 1**: Automobiles with manual transmissions appear to get better mileage than those with automatic transmissions

t <- t.test(mpg ~ am, paired=FALSE, var.equal=FALSE, data=D)

##   
## Welch Two Sample t-test  
##   
## data: mpg by 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 Automatic mean in group Manual   
## 17.14737 24.39231

**Figure 2**: Mileage difference is statistically significant and manuals get better MpG