DaigleInClassLabWk6D3.R

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Sun Feb 25 08:49:19 2018

```
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## In class Lab: Wk6D2

#Bootstrapping ####

# Sample Model ####
plot(mtcars$wt, mtcars$mpg)
x <- mtcars$wt
y <- mtcars$mpg

reg <- lm(y ~ x)
abline(reg)
```
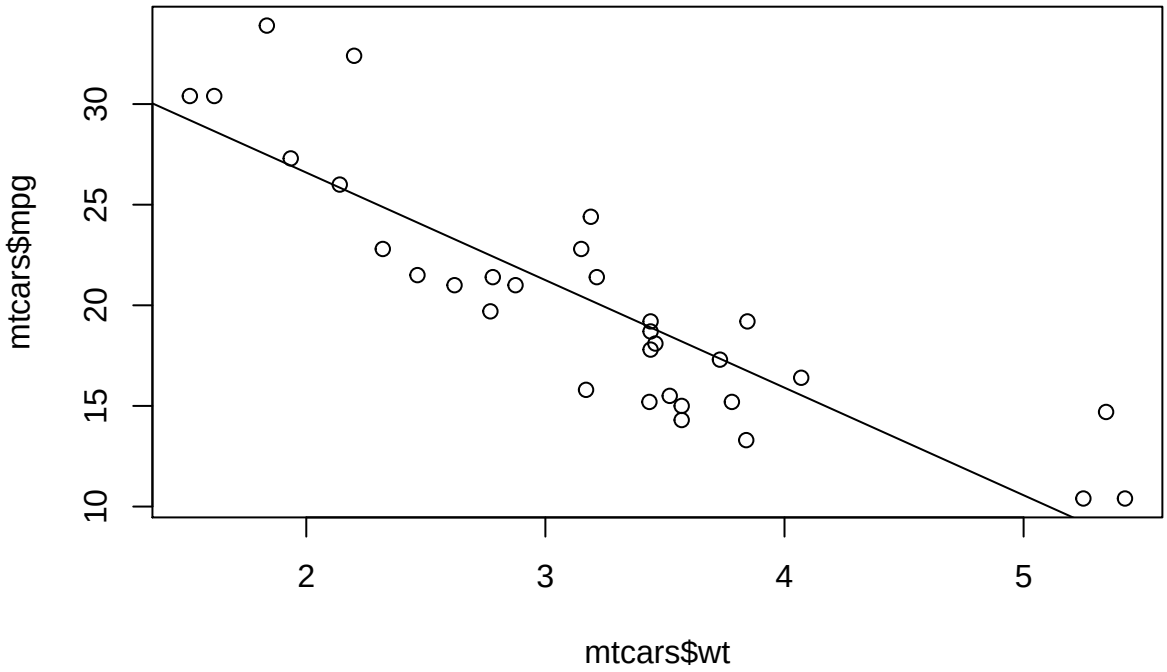
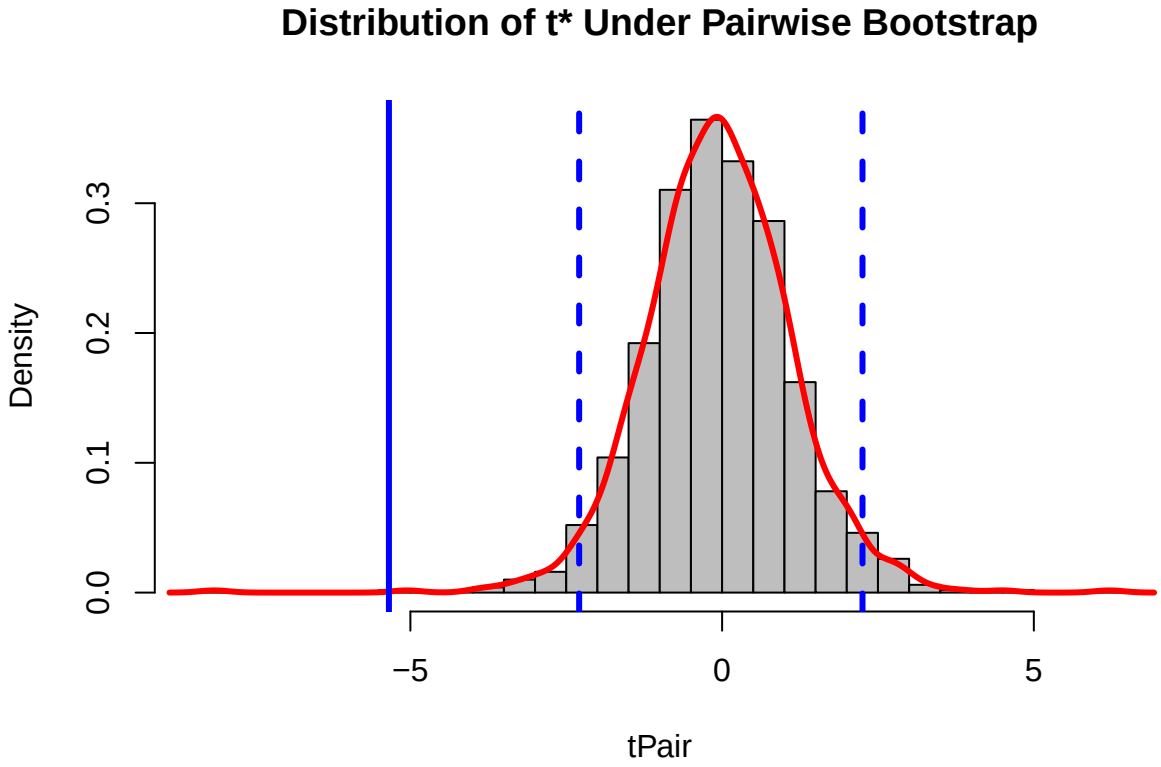




```
bHat <- reg$coefficients[2]
aHat <- reg$coefficients[1]
n <- nrow(mtcars)
num <- sum(((x - mean(x)) ^ 2) * (reg$residuals^2))/n
den <- sum((x-mean(x))^2)/(n-1)
se <- sqrt(num)/den

t <- sqrt(n) * bHat / se

# Pairwise Bootstrap ####
B <- 999
bPair <- rep(NA, B)
tPair <- rep(NA, B)
```

```r
for (b in 1:B) {

  index <- sample(1:nrow(mtcars), size = n, replace = TRUE)
  xPair <- mtcars$wt[index]
  yPair <- mtcars$mpg[index]

  regPair <- lm(yPair ~ xPair)
  bPair[b] <- regPair$coefficients[2]

  numPair <- sum(((xPair - mean(xPair)) ^ 2) * (regPair$residuals ^ 2)) / n
  denPair <- sum((xPair - mean(xPair)) ^ 2) / (n - 1)
  sePair <- sqrt(numPair) / denPair

  tPair[b] <- sqrt(n) * (bPair[b] - bHat) / sePair
}

tPair <- sort(tPair)

hist(tPair, breaks = 30, probability = TRUE, col = "grey",
     main = "Distribution of t* Under Pairwise Bootstrap")
lines(density(tPair), col = "red", lwd = 3)
critPair <- c(tPair[25], tPair[975])
abline(v = c(critPair, bHat), col = c("blue"), lty = c(2, 2, 1), lwd = 3)
```



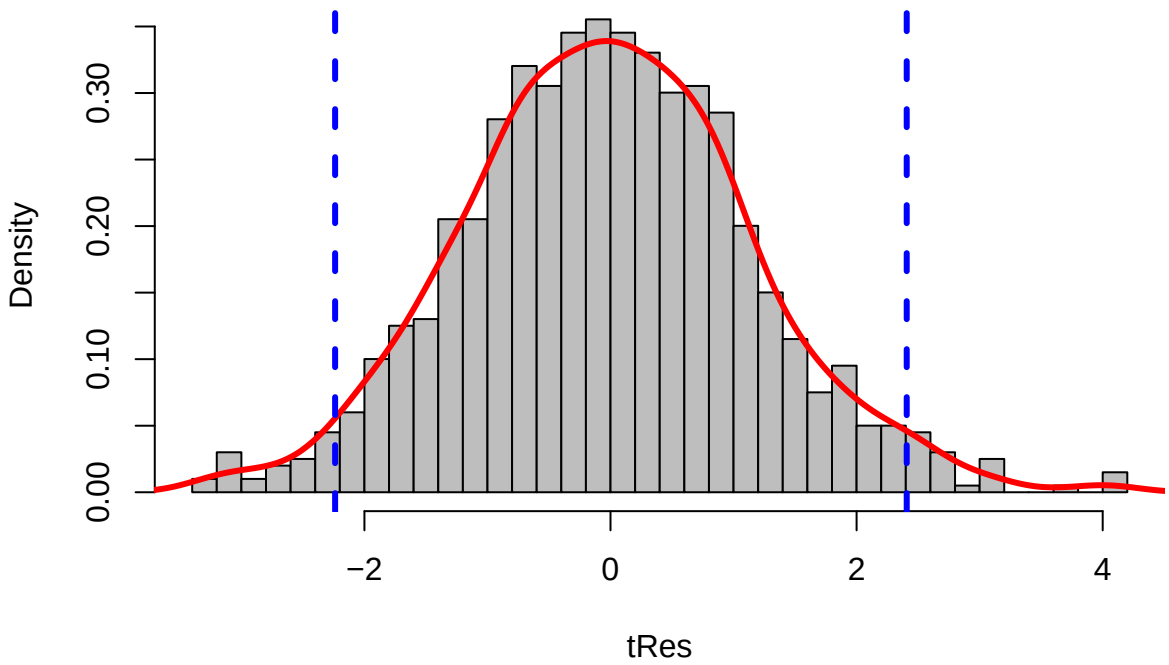

```r
cat(paste("The coefficient of intrest is", round(bHat, 3),
          "and the t-statistic is", round(t, 3), "."))
```

```
## The coefficient of intrest is -5.344 and the t-statistic is -8.706 .
```

```r
cat(paste("The 95% critical values are", round(critPair[1], 3),
          "and", round(critPair[2], 3), "."))
```

```
## The 95% critical values are -2.293 and 2.252 .
```

```r
# Residual Bootstrap ####
bRes <- rep(NA, B)
tRes <- rep(NA, B)

for (b in 1:B) {
  index <- sample(1:nrow(mtcars), size = n, replace = TRUE)
  xRes <- x
  uRes <- reg$residuals[index]
  yRes <- aHat + bHat * xRes + uRes

  regRes <- lm(yRes ~ xRes)
  bRes[b] <- regRes$coefficients[2]


  numRes <- sum(((xRes - mean(xRes)) ^ 2) * (regRes$residuals ^ 2)) / n
  denRes <- sum((xRes - mean(xRes)) ^ 2) / (n - 1)
  seRes <- sqrt(numRes) / denRes

  tRes[b] <- sqrt(n) * (bRes[b] - bHat) / seRes
}

tRes <- sort(tRes)

hist(tRes, breaks = 30, probability = TRUE, col= "grey",
     main = "Distribution of t* Under Residual Bootstrap")
lines(density(tRes), col = "red", lwd = 3)
critRes <- c(tRes[25], tRes[975])
abline(v = c(critRes, bHat), col = c("blue"), lty = c(2, 2, 1), lwd = 3)
```




```
cat(paste("The coefficient of intrest is", round(bHat, 3),
          "and the t-statistic is", round(t, 3), "."))
```

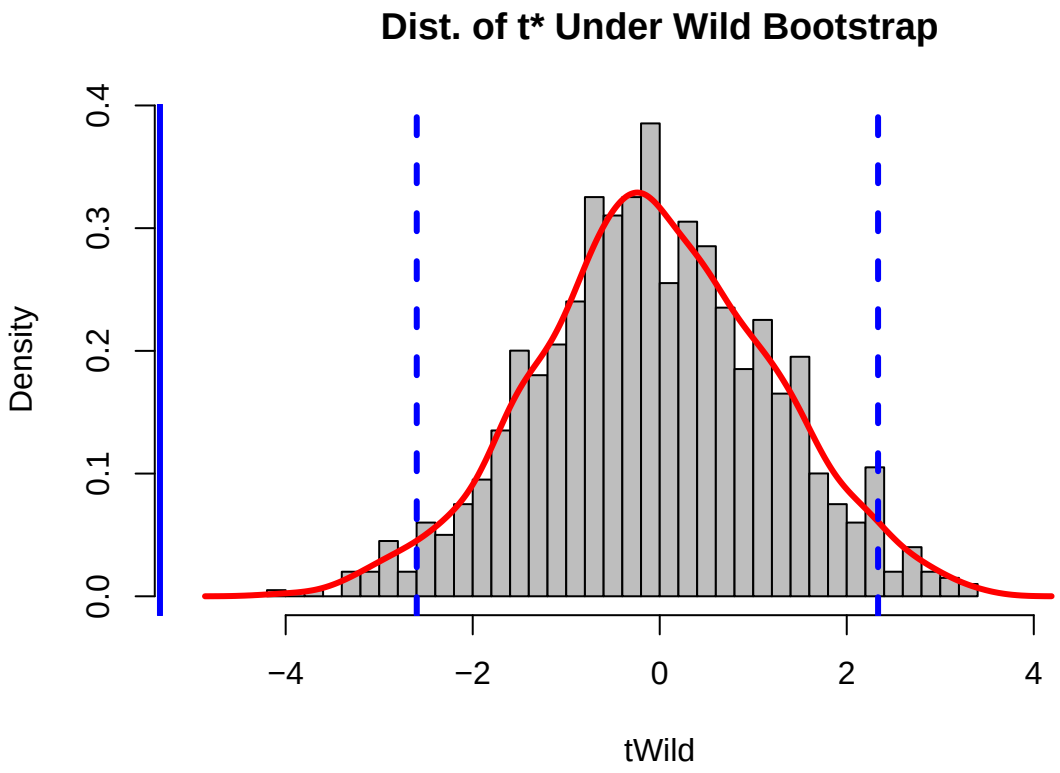
```
## The coefficient of intrest is -5.344 and the t-statistic is -8.706 .
```

```
cat(paste("The 95% critical values are", round(critRes[1], 3),
          "and", round(critRes[2], 3), "."))
```

```
## The 95% critical values are -2.238 and 2.407 .
```

```
# Wild Bootstrap ####
bWild <- rep(NA, B)
tWild <- rep(NA, B)

for (b in 1:B) {
  sig <- sample(c(-1, 1), size = n, replace = TRUE)
  xWild <- x
  uWild <- reg$residuals*sig
  yWild <- aHat + bHat * xWild + uWild

  regWild <- lm(yWild ~ xWild)
  bWild[b] <- regWild$coefficients[2]

  numWild <- sum(((xWild - mean(xWild)) ^ 2) * (regWild$residuals ^ 2)) / n
  denWild <- sum((xWild - mean(xWild)) ^ 2) / (n - 1)
  seWild <- sqrt(numWild)/ denWild

  tWild[b] <- (sqrt(n) * (bWild[b] - bHat)) / seWild
}

tWild <- sort(tWild)
```

```
hist(tWild, breaks = 30, probability = TRUE, col = "grey",
     main = "Dist. of t* Under Wild Bootstrap", xlim = c(-5, 5))
lines(density(tWild), col = "red", lwd = 3)
critWild <- c(tWild[25], tWild[975])
abline(v = c(critWild, bHat), col = c("blue"), lty = c(2, 2, 1), lwd = 3)
```




```
cat(paste("The coefficient of intrest is", round(bHat, 3),
          "and the t-statistic is", round(t, 3), "."))
```

```
## The coefficient of intrest is -5.344 and the t-statistic is -8.706 .
```

```
cat(paste("The 95% critical values are", round(critWild[1], 3),
          "and", round(critWild[2], 3), "."))
```

```
## The 95% critical values are -2.598 and 2.335 .
```