

tooth_growth

Title

In the second portion of the project, we're going to analyze the ToothGrowth data in the R datasets package.

Data summary

```
library(datasets)
data(ToothGrowth)
summary(ToothGrowth)
```

```
##      len      supp      dose
##  Min.   : 4.20   OJ:30   Min.    :0.500
##  1st Qu.:13.07   VC:30   1st Qu.:0.500
##  Median :19.25           Median :1.000
##  Mean   :18.81           Mean    :1.167
##  3rd Qu.:25.27           3rd Qu.:2.000
##  Max.   :33.90           Max.    :2.000
```

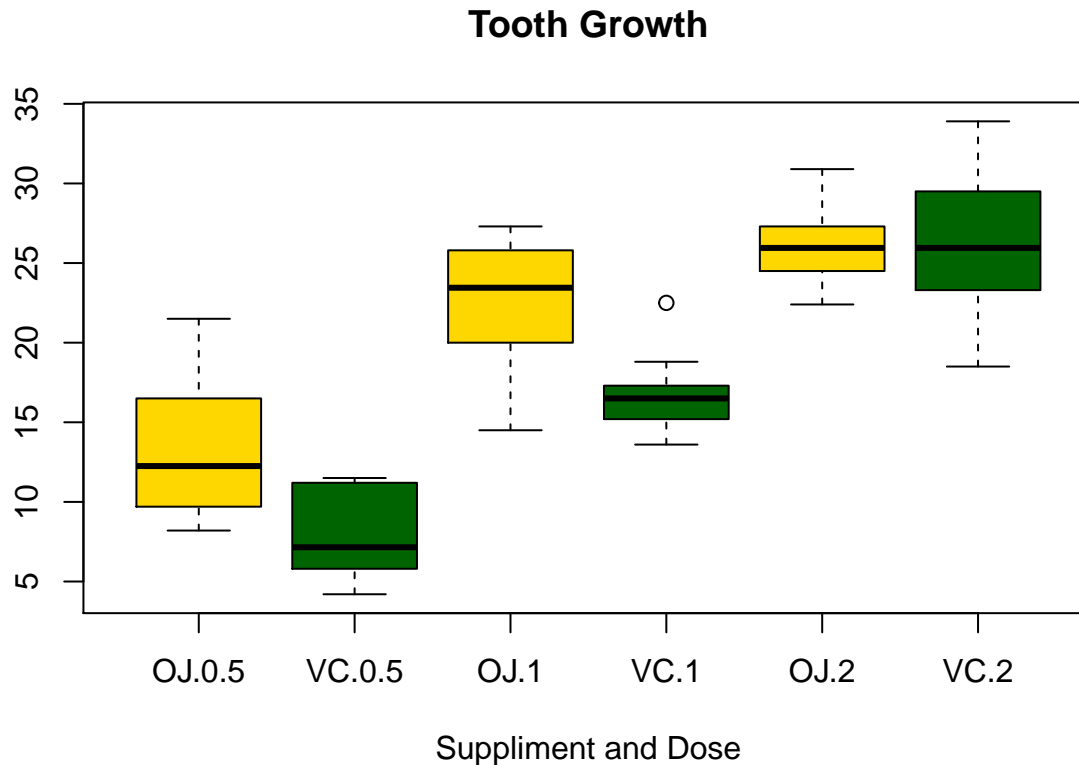
```
str(ToothGrowth)
```

```
## 'data.frame':   60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

Data plot

We can also use bwplot to show the tooth growth by factors: supp and dose.

```
boxplot(len~supp*dose, data=ToothGrowth, notch=FALSE,
        col=c("gold","darkgreen")),
        main="Tooth Growth", xlab="Suppliment and Dose")
```



```
aggregate(ToothGrowth$len, list(ToothGrowth$dose, ToothGrowth$supp),
  FUN=function(x) c(x_mean = mean(x), x_sd = sd(x)))
```

##	Group.1	Group.2	x.x_mean	x.x_sd
## 1	0.5	OJ	13.230000	4.459709
## 2	1.0	OJ	22.700000	3.910953
## 3	2.0	OJ	26.060000	2.655058
## 4	0.5	VC	7.980000	2.746634
## 5	1.0	VC	16.770000	2.515309
## 6	2.0	VC	26.140000	4.797731

Observation

From the plot above, we can see that when dose=0.5 or dose=1, the teeth grow differently by using supplement OJ0.5 and VC0.5. We will verify that hypothesis in next section.

Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose.

We will only use dose=1 as example to test our hypothesis that tooth growth different by using different supplements.

```
oj1 <- ToothGrowth[which(ToothGrowth$dose==1.0 & ToothGrowth$supp=="OJ" ),1]
vc1 <- ToothGrowth[which(ToothGrowth$dose==1.0 & ToothGrowth$supp=="VC" ),1]
t1_oj_vc <- t.test(oj1, vc1, paired=FALSE, var.equal=TRUE)
t1_oj_vc
```

```
##
## Two Sample t-test
##
## data:  oj1 and vc1
## t = 4.0328, df = 18, p-value = 0.0007807
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  2.840692 9.019308
## sample estimates:
## mean of x mean of y
##      22.70      16.77
```

Result

We can see a very small p-value < 0.05 , then we should reject the hypothesis and accept the alternative, that different supplements has different effect on the tooth growth when we specify the dose=1.0