

Statistical Inference course project - Part 2

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Overview

In this part of the project we're going to analyze the ToothGrowth data in the R datasets package.

1. Load the ToothGrowth data and perform some basic exploratory data analyses
2. Provide a basic summary of the data.
3. Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose. (Only use the techniques from class, even if there's other approaches worth considering)
4. State your conclusions and the assumptions needed for your conclusions.

Loading the ToothGrowth dataset and preparing it for analysis.

```
#Loading the ToothGrowth dataset  
library(datasets)  
data(ToothGrowth)
```

```
# Fetching the first few rows  
head(ToothGrowth)
```

```
##      len supp dose  
## 1   4.2   VC  0.5  
## 2  11.5   VC  0.5  
## 3   7.3   VC  0.5  
## 4   5.8   VC  0.5  
## 5   6.4   VC  0.5  
## 6  10.0   VC  0.5
```

```
# Summarizing the dataset  
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
```

Further breaking down the dataset for analysis

```
unique(ToothGrowth$supp)
```

```
## [1] VC OJ  
## Levels: OJ VC
```

```
unique(ToothGrowth$dose)
```

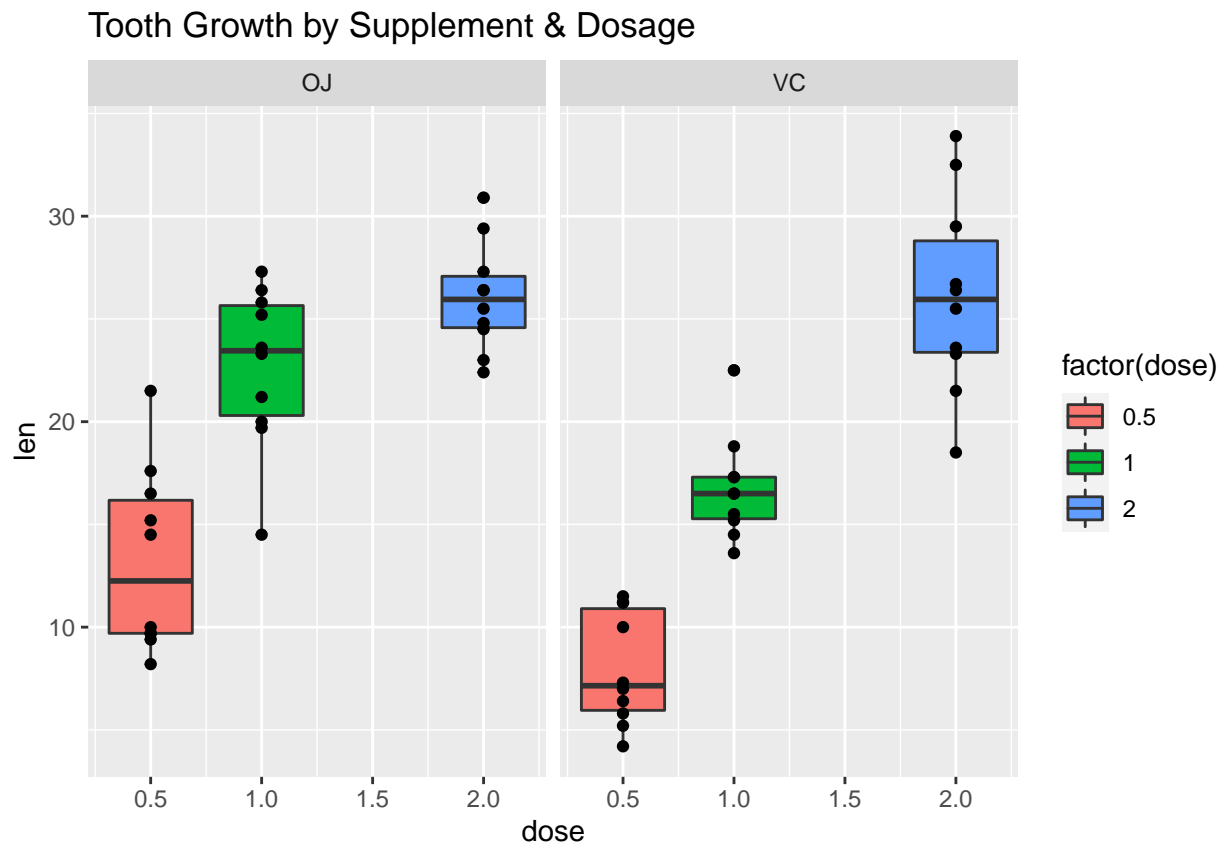
```
## [1] 0.5 1.0 2.0
```

So from the above we get 2 levels of supplements and 3 levels of dose.

- supp = 'OJ', 'VC'
- dose = 0.5, 1, 2

Graphically, we can also use boxplot to provide a quick visual on the impact of dosage and supplement on the tooth growth, see below:

```
library(ggplot2)
tg_supp_dose <- ggplot(ToothGrowth, aes(x=dose, y=len))
tg_supp_dose <- tg_supp_dose + geom_boxplot(aes(fill=factor(dose)))
tg_supp_dose <- tg_supp_dose + geom_point()
tg_supp_dose <- tg_supp_dose + facet_grid(.~supp)
tg_supp_dose <- tg_supp_dose + ggtitle("Tooth Growth by Supplement & Dosage")
tg_supp_dose
```



Comparison of Tooth growth based on supplements and dosage

Applying the Hypothesis Testing, we conduct it based on two parameters

- Do the use of supplements really have an impact on the tooth growth?
- Does an increased amount of dosage accelerate teeth growth?

(a) Hypothesis testing by Supplements

H_0 = Both the supplements have the same mean

H_a = The Means are different

```
t.test(ToothGrowth$len[ToothGrowth$supp == "OJ"],
       ToothGrowth$len[ToothGrowth$supp == "VC"],
       paired = FALSE,
       var.equal = FALSE)

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth$len[ToothGrowth$supp == "OJ"] and ToothGrowth$len[ToothGrowth$supp == "VC"]
## t = 1.9153, df = 55.309, p-value = 0.06063
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1710156  7.5710156
## sample estimates:
## mean of x mean of y
##  20.66333  16.96333
```

From the above test hypothesis result we see that the p-value 0.06 which is close to 0.05 and also we see a 0 within the confidence interval and hence we cannot reject the null hypothesis. Thus, we can conclude that the use of supplements **does not have an impact on tooth growth**

(b) Hypothesis testing by Dosage

```
t.test(ToothGrowth$len[ToothGrowth$dose == 2],
       ToothGrowth$len[ToothGrowth$dose == 1],
       paired = FALSE,
       var.equal = TRUE)

##
##  Two Sample t-test
##
## data:  ToothGrowth$len[ToothGrowth$dose == 2] and ToothGrowth$len[ToothGrowth$dose == 1]
## t = 4.9005, df = 38, p-value = 1.811e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  3.735613 8.994387
## sample estimates:
## mean of x mean of y
##  26.100  19.735
```

We find from the above observation that the p-value is less than 0 and so the null hypothesis can be rejected and we find that the confidence interval is greater than 0 and for any dosage 1mg or 2mg we find that it has a significant tooth growth.

Conclusion

- The use of supplements does not have an impact on tooth growth.
- Increase in the dosage accelerates tooth growth