

Analysing the ToothGrowth data

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Overview

This report aims to analyze the ToothGrowth data in the R datasets package. The data is set of 60 observations, length of odontoblasts (teeth) in each of 10 guinea pigs at each of three dose levels of Vitamin C (0.5, 1 and 2 mg) with each of two delivery methods (orange juice or ascorbic acid).

Load the ToothGrowth data and perform some basic exploratory data analyses

```
library(ggplot2)

data(ToothGrowth)
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 ...

#Display the first few rows of data
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

#Unique Values
unique(ToothGrowth$len)

## [1]  4.2 11.5  7.3  5.8  6.4 10.0 11.2  5.2  7.0 16.5 15.2
##    17.3 22.5 13.6
## [15] 14.5 18.8 15.5 23.6 18.5 33.9 25.5 26.4 32.5 26.7 21.5
##    23.3 29.5 17.6
## [29]  9.7  8.2  9.4 19.7 20.0 25.2 25.8 21.2 27.3 22.4 24.5
##    24.8 30.9 29.4
## [43] 23.0
```

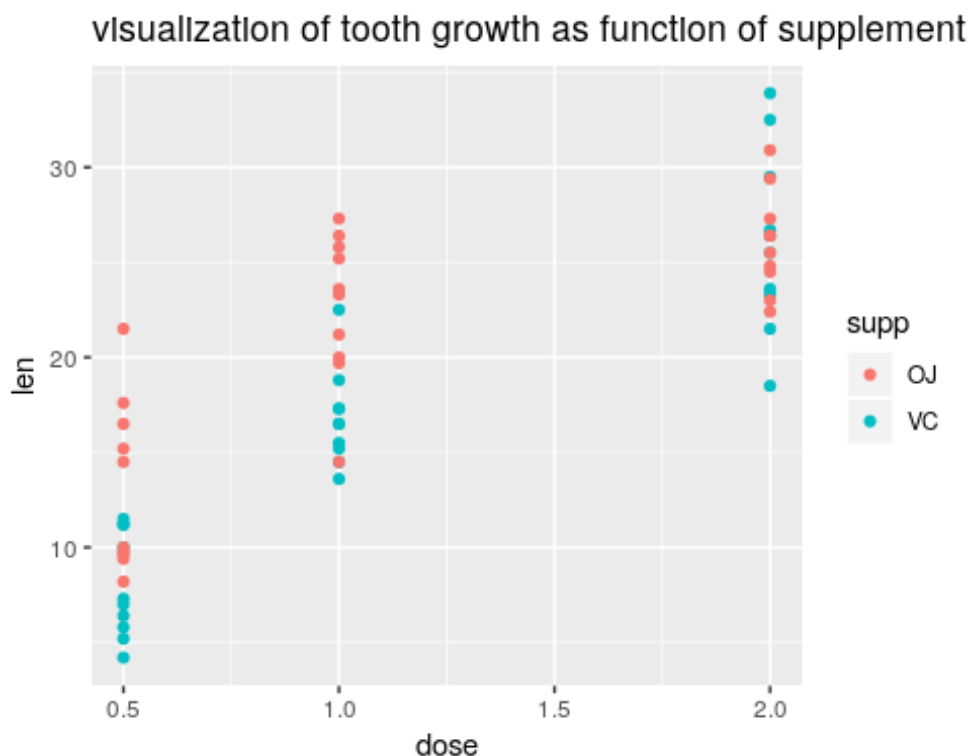
Provide a basic summary of the data

```
summary(ToothGrowth)
```

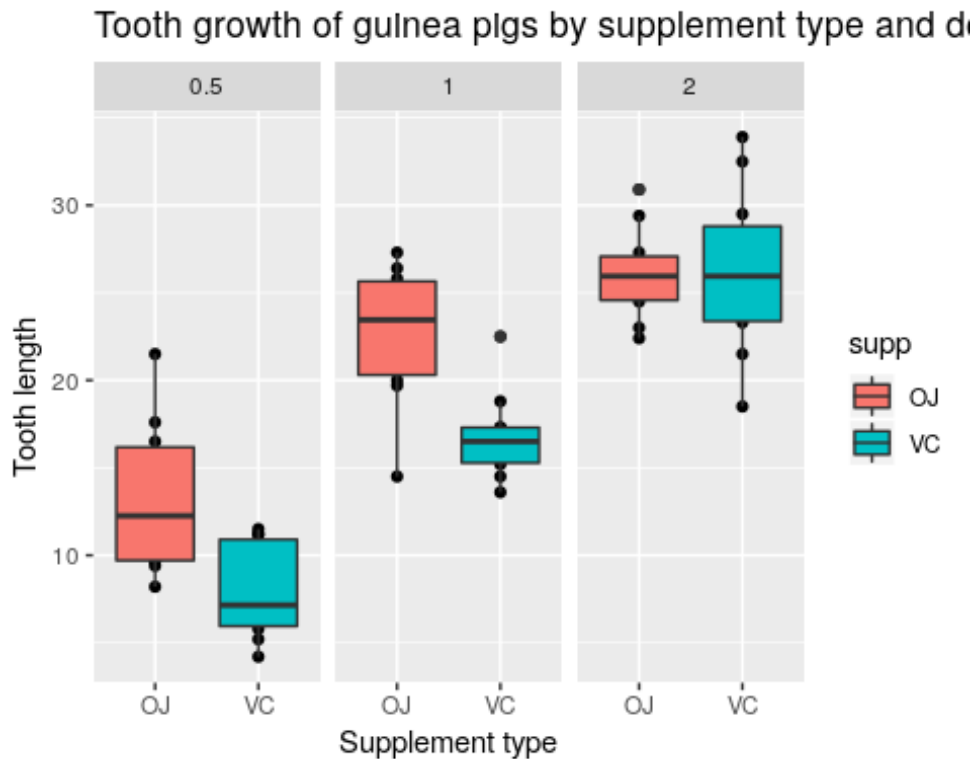
```
##      len      supp      dose
##  Min.   : 4.20   OJ:30   Min.    :0.500
##  1st Qu.:13.07   VC:30   1st Qu.:0.500
##  Median :19.25                Median :1.000
##  Mean   :18.81                Mean    :1.167
##  3rd Qu.:25.27                3rd Qu.:2.000
##  Max.   :33.90                Max.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

Next we will create some plots to explore the data.

```
g <- ggplot(aes(x=dose, y = len), data = ToothGrowth,
main="visualization of tooth growth as function of supplement
type") +
  geom_point(aes(color = supp))
g + ggtitle("visualization of tooth growth as function of
supplement type")
```



```
qplot(supp, len, data=ToothGrowth, facets=~dose, main="Tooth growth
of guinea pigs by supplement type and dosage
(mg)", xlab="Supplement type", ylab="Tooth length") +
  geom_boxplot(aes(fill = supp))
```



Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose ### Do the tooth length of the guinea pigs depends on delivery methods?

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

##
## Welch Two Sample t-test
##
## data: len[supp == "OJ"] and len[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
```

The p-value is 0.06, and the confidence interval contains zero. This indicates that we can not reject the null hypothesis that the different supplement types have no effect on tooth length. ### Now we will test the tooth length of the group with vitamin C dosage

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

##
## Two Sample t-test
##
## data: len[dose == 2] and len[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
```

Since the p-value is less than the significance level and the confidence interval does not contain 0, there is enough evidence to reject the null hypothesis. Therefore, higher doses have impact result in greater tooth growth.

State your conclusions and the assumptions needed for your conclusions.

Conclusions

- Supplement type has no effect on tooth growth.
- Increasing the dose level leads to increased tooth growth.

Assumptions

- Each subject is randomly assigned
- Observations are independent

References

- [Statistical Inference Course Project - Part 2](#) by taipan2806
- [Statistical Inference Course Project - Part 2](#) by Aatish Kumar