Statistical inference w4 report

Part 2 Basic Inferential Data Analysis

Stephane Marceau

Summary

In this project, we're going to analyze the ToothGrowth data in the R datasets package. First we will look at the data table and print out a data frame summary. Then we will visualize the growth of guinea pig tooth with regards to supp and vitamin C dose. Finally, we will compare tooth growth due to supp effect and then tooth growth due to vitamin C dose effect using the hypothesis testing.

Printing out data table head

```
data(ToothGrowth)
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
```

Summarising data

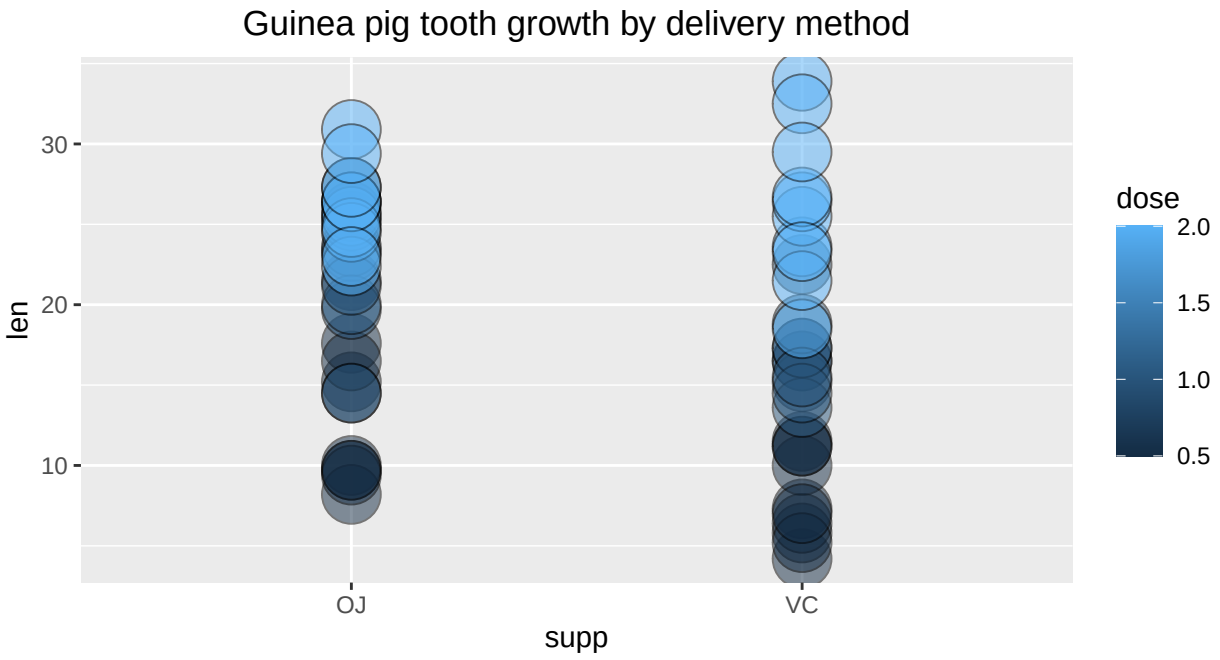
```
summary(ToothGrowth)
```

```
##       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
```

Plotting the data

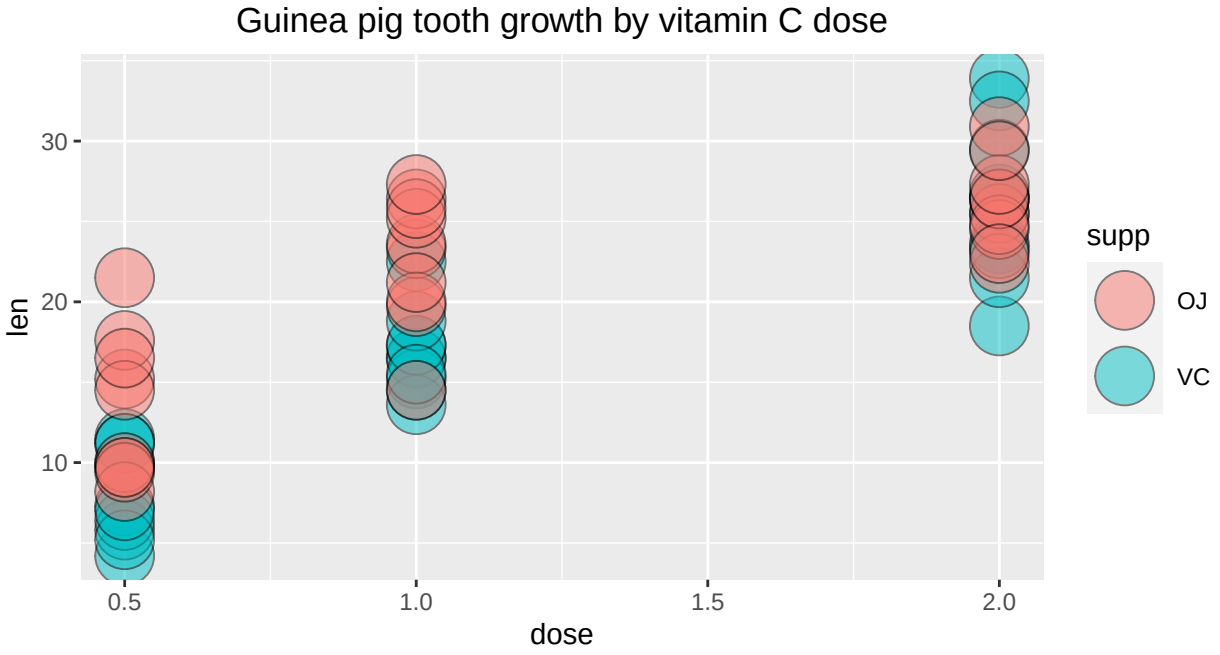
Reviewing tooth growth by supp

```
library(ggplot2)
g <- ggplot(ToothGrowth, aes(x = supp, y = len, group = factor(dose)))
g <- g  + geom_point(size =10, pch = 21, aes(fill = dose), alpha = .5)+ggtitle("Guinea pig tooth growth
g+theme(plot.title = element_text(hjust = 0.5))
```



Reviewing tooth growth by dose

```
g <- ggplot(ToothGrowth, aes(x = dose, y = len, group=factor(supp)))
g <- g  + geom_point(size =10, pch = 21, aes(fill = supp), alpha = .5)+ggtitle("Guinea pig tooth growth
g+theme(plot.title = element_text(hjust = 0.5))
```



Spliting data into groups

```
# grouping by supp
vc_group<-ToothGrowth[ToothGrowth$supp=="VC",]
oj_group<-ToothGrowth[ToothGrowth$supp=="OJ",]
```

```r
# grouping by dose
dose_group1<-ToothGrowth[ToothGrowth$dose==.5,]
dose_group2<-ToothGrowth[ToothGrowth$dose==1,]
dose_group3<-ToothGrowth[ToothGrowth$dose==2,]
```

Comparing tooth growth by supp

Testing $H_o : \mu_{vc} = \mu_{oj}$ **vs** $H_a : \mu_{vc} \neq \mu_{oj}$ Using t.test function with two variables not paired

```r
t.test(x = oj_group$len,y = vc_group$len,mu = 0,paired = FALSE, var.equal = FALSE)
```

```
##
##  Welch Two Sample t-test
##
## data:  oj_group$len and vc_group$len
## 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
```

p-value is above 5%. We fail to reject the null hypothesis with a 95% confidence interval. Using different supp does not affect tooth growth.

Comparing tooth growth by dose

Testing $H_0 : \mu_1 = \mu_2$ **vs** $H_a : \mu_1 < \mu_2$ Using t.test function with two variables not paired

```r
t.test(x = dose_group1$len,y = dose_group2$len,mu = 0,paired = FALSE, var.equal = FALSE,alternative = "
```

```
##
##  Welch Two Sample t-test
##
## data:  dose_group1$len and dose_group2$len
## t = -6.4766, df = 37.986, p-value = 6.342e-08
## alternative hypothesis: true difference in means is less than 0
## 95 percent confidence interval:
##       -Inf -6.753323
## sample estimates:
## mean of x mean of y
##    10.605    19.735
```

p-value is significantly lower than 5%, thus we reject the null hypothesis. Group 2 tooth growth is greater than group 1. A dose of 1mg/day improves tooth growth.

Testing $H_0 : \mu_2 = \mu_3$ **vs** $H_a : \mu_2 < \mu_3$ Using t.test function with two variables not paired

```r
t.test(x = dose_group2$len,y = dose_group3$len,mu = 0,paired = FALSE, var.equal = FALSE,alternative = "
```

```
##
##  Welch Two Sample t-test
##
## data:  dose_group2$len and dose_group3$len
## t = -4.9005, df = 37.101, p-value = 9.532e-06
## alternative hypothesis: true difference in means is less than 0
```

```
## 95 percent confidence interval:
##      -Inf -4.17387
## sample estimates:
## mean of x mean of y
##    19.735    26.100
```

p-value is significantly lower than 5%, thus we reject the null hypothesis. Group 3 tooth growth is greater than group 2. A dose of 2mg/day improves tooth growth.

Conclusion

Based on the sample data ToothGrowth, we conclude that tooth growth if not affected by the supp factor, but rather by the dose of Vitamin C received by the Guinea Pigs.