Assessing the To othGrowth Dataset with R

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Abstract

In this rep ort we analyze the To othGrowth dataset. We statistically compare the effectiveness of tooth growth in Guinea pigs for each combination of dose level of Vitamin C and delivery method. According to our findings, 0.5 and 1.0 mg doses of Orange Juice promote distinct average to oth growth when compared to Vitamin C. With a 2.0 mg dose, there is a high probability that there is no difference b etween delivery methods.

ToothGrowth Dataset

```
data("ToothGrowth")
str(ToothGrowth)
```

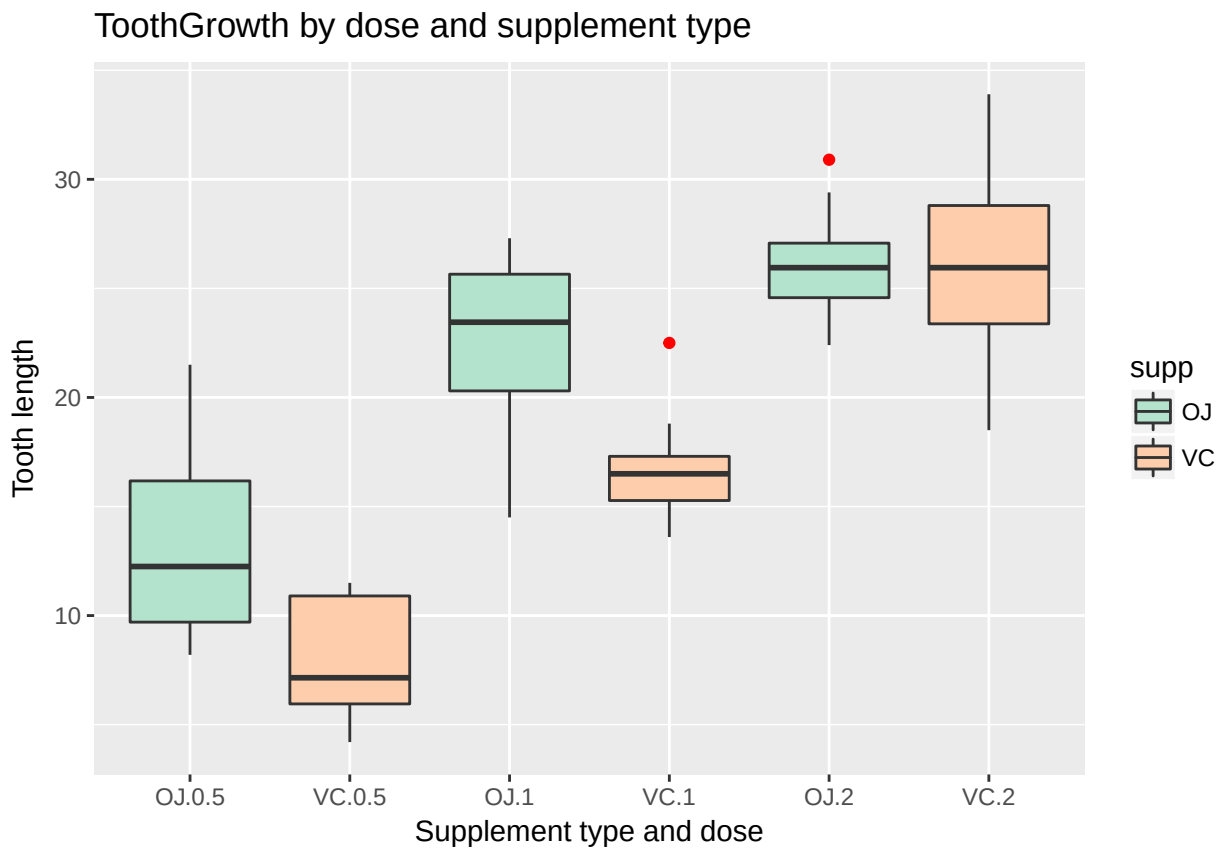
```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

Let us now see an orange juice vs ascorbic acid plot!

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.3.2
```

```
g <- ggplot(data = ToothGrowth, aes(x = interaction(supp, dose), y = len, fill = supp))
g <- g + geom_boxplot(outlier.colour = "red") + scale_fill_brewer(palette = "Pastel2")
g <- g + labs(title="ToothGrowth by dose and supplement type",
x="Supplement type and dose", y="Tooth length");
g
```



Data Processing

In this dataset, rows 1 to 10 corresp ond to the observations from Guinea pigs 1 to 10. The eleventh row contains another observation of Guinea pig numb er 1, and so on. In order to tidy this dataset, we are going to fit it into 6 columns and 10 rows. Each row corresp onds to one sp ecific Guinea pig, and each column represents a supplement (VC or OJ) and its asso ciated dose (0.5, 1.0 or 2.0).

```
library(reshape2)
```

```
## Warning: package 'reshape2' was built under R version 3.3.2
```

```
ToothGrowth$guinea.pig <- rep( c(1: 10), 6)
print(tidy <- dcast(ToothGrowth, guinea.pig ~ supp + dose, value.var = "len"))
```

```
##    guinea.pig OJ_0.5 OJ_1 OJ_2 VC_0.5 VC_1 VC_2
## 1           1   15.2 19.7 25.5    4.2 16.5 23.6
## 2           2   21.5 23.3 26.4   11.5 16.5 18.5
## 3           3   17.6 23.6 22.4    7.3 15.2 33.9
## 4           4    9.7 26.4 24.5    5.8 17.3 25.5
## 5           5   14.5 20.0 24.8    6.4 22.5 26.4
## 6           6   10.0 25.2 30.9   10.0 17.3 32.5
## 7           7    8.2 25.8 26.4   11.2 13.6 26.7
## 8           8    9.4 21.2 27.3   11.2 14.5 21.5
```

```
## 9           9   16.5 14.5 29.4    5.2 18.8 23.3
## 10         10    9.7 27.3 23.0    7.0 15.5 29.5
```

Data Analysis

In this section, we are going to p erform several tests to compare tooth growth of Guinea pigs by supplement (OJ, VC) and dose (0.5, 1.0, and 2.0 milligrams). For every comparation, we will consider the following hypotheses: * H_0: For a given dose level of Vitamin C, there is no difference in average tooth growth when we compare the delivery method (Orange Juice or Ascorbic Acid). * H_a: For a given dose level of Vitamin C, there is an actual difference in average tooth growth when we compare the delivery method (Orange Juice or Ascorbic Acid).

Performing a t test for each thing. 0.5, 1.0 and 2.0 milligrams we get.

1. 0.5 milligrams

```
tres_0.5 <- t.test(tidy$OJ_0.5, tidy$VC_0.5, paired = FALSE, var.equal = FALSE)
tres_0.5$p.value
```

```
## [1] 0.006358607
```

As p value is very small. We reject the null hypothesis! Thus OJ and VC dont promote the same average tooth growth when the dosage is 0.5 mg.

2. 1.0 milligrams

```
tres_1 <- t.test(tidy$OJ_1, tidy$VC_1, paired = FALSE, var.equal = FALSE)
tres_1$p.value
```

```
## [1] 0.001038376
```

As p value is very small again. We reject the null hypothesis! Thus OJ and VC dont promote the same average tooth growth when the dosage is 1.0 mg.

3. 2.0 milligrams

```
tres_2 <- t.test(tidy$OJ_2, tidy$VC_2, paired = FALSE, var.equal = FALSE)
tres_2$p.value
```

```
## [1] 0.9638516
```

As p value is big enough here. We reject the alternate hypothesis! Thus OJ and VC equally promote the same average tooth growth when the dosage is 1.0 mg.