Exponential Distribution Investigation in R - Statistical Inference: Course Project - Question 2

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Overview

Analysis of the ToothGrowth data from the R datasets package, as part of the Statistical Inference course from Coursera.

Required tools

Loading the required libraries.

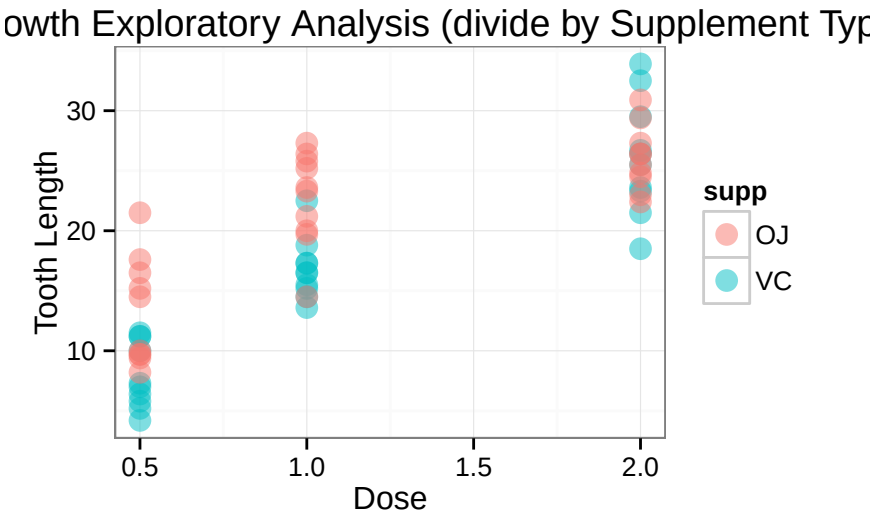
```
##
## Attaching package: 'dplyr'
##
## The following object is masked from 'package:stats':
##
##     filter
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

Exploratory Data Analysis

Overall analysis, by dose and supplement

```
# Load the data and convert to DPLYR data.frame
attach(ToothGrowth)
data <- tbl_df(ToothGrowth)

# Plot the length changes by the dose and type of supplement
ggplot(data, aes(dose, len)) +
  geom_point(aes(color = supp), size=4, alpha=1/2) +
  xlab("Dose") +
  ylab("Tooth Length") +
  labs(title="ToothGrowth Exploratory Analysis (divide by Supplement Type)") +
  theme_bw()
```

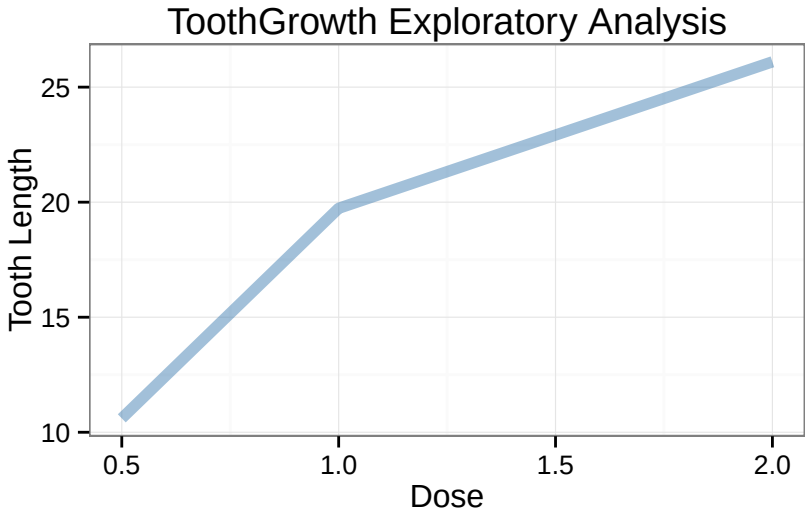


From the plot above, it seems the 'supp' (Supplement Type) doesn't impact the tooth growth although as the dosage increases, there seems to be a clear increase in tooth growth.

Analysis, by dose only

```
# Summarise the data by dose and average changes of teeth
data_bydose <- data %>%
  group_by(dose) %>%
  summarise(AVG = mean(len))

# Plot the length changes by the dose only
ggplot(data_bydose, aes(dose, AVG)) +
  geom_line(color="steelblue", size=2, alpha=1/2) +
  xlab("Dose") +
  ylab("Tooth Length") +
  labs(title="ToothGrowth Exploratory Analysis") +
  theme_bw()
```



From the latest plot, it seems clearer that as the dose increases, the tooth length changes increase.

Summary of the data

```
# Basic summary of the data
summary(data)
```

```
##       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
```

Confidence Intervals and Hypothesis Tests

Assumptions

1. 'len' is a continuous random variable, hence using a T distribution (as a better alternative to a normal distribution)
2. The observations are unrelated and independent (hence, using the "Independent T Confidence Intervals")

Condidence Intervals

```
# Testing dose
t.test(data$len, data$dose, paired=FALSE, var.equal=FALSE)
```

```
##
##  Welch Two Sample t-test
##
## data:  data$len and data$dose
## t = 17.8096, df = 59.798, p-value < 2.2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  15.66453 19.62881
## sample estimates:
## mean of x mean of y
## 18.813333  1.166667
```

```
# Testing supp
t.test(data$len ~ data$supp)
```

```
##
##  Welch Two Sample t-test
##
## data:  data$len by data$supp
## 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 in group OJ mean in group VC
##         20.66333         16.96333
```

Conclusions

1. Strong relation as the dose increases, the changes to the tooth growth increase.
2. No relation can be made between the changes in tooth growth and the supplement type.