

# Stats\_Inference\_Project\_PartII

LI CHENYANG

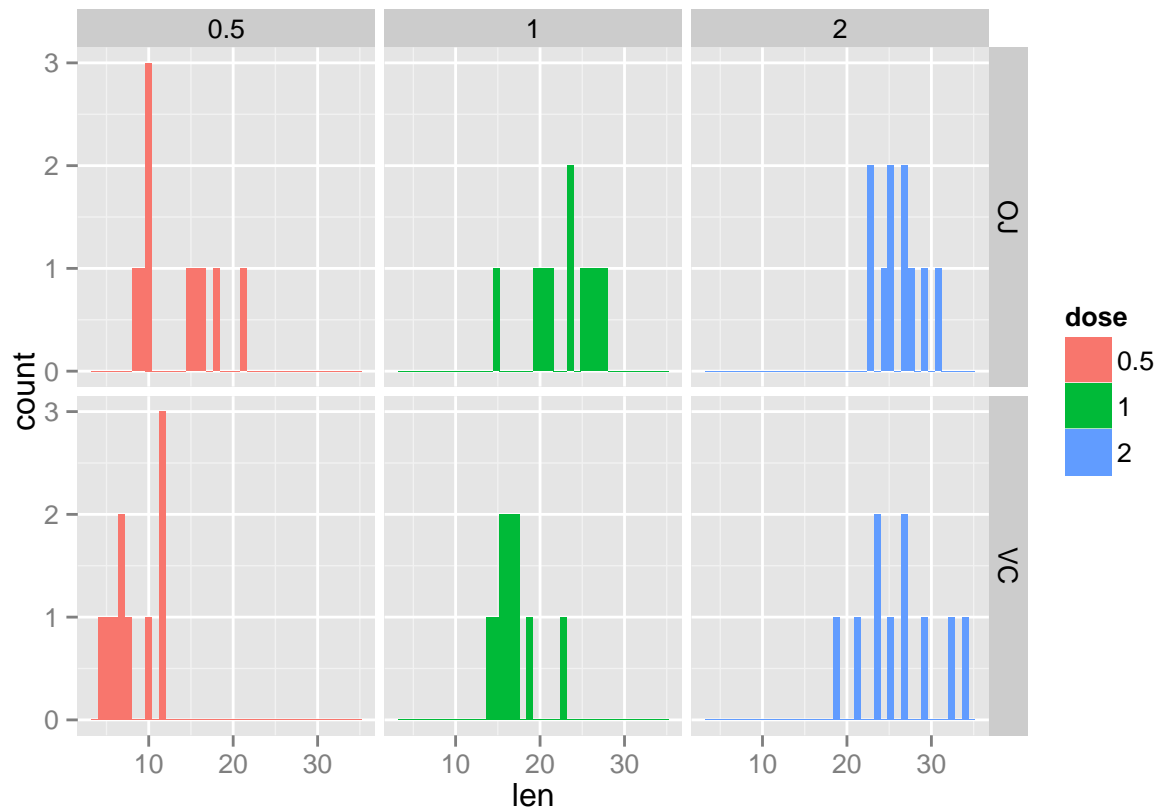
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## Overview

- In the second portion of the class, we're going to analyze the ToothGrowth data in the R datasets package.

## 1. Basic Exploratory data analyses

- In this case, I plot six histograms, with each representing one possible combination between supp and dose factors.
- From the graph below, we can see roughly see that
  - 1.OJ may be a better supplement than VC when it comes to teeth growth.
  - 2.The higher the dose, the longer the teeth will grow. However I am more interested in the extent of growth when the dosage increases. By the law of marginal diminishing return, I would guess that increasing dosage from 1 to 2 will not necessarily yeild a better growth than increasing dosage from 0.5 to 1.



## 2. Provide a basic summary of the data.

- The data frame has 60 observation made by the same 10 guinea pigs.
- The data frame has 3 columns, which are len, supp and dose
- len represent the length of the teeth
- supp represent the supplement type
- dose represent dosage amount for the supplement

perhaps a statistic summary will help us understand the big picture

```
## Source: local data frame [6 x 4]
## Groups: supp [?]
##
##      supp    dose mean_len  var_len
##   (fctr) (fctr)   (dbl)    (dbl)
## 1     OJ    0.5   13.23 19.889000
## 2     OJ     1   22.70 15.295556
## 3     OJ     2   26.06  7.049333
## 4     VC    0.5    7.98  7.544000
## 5     VC     1   16.77  6.326778
## 6     VC     2   26.14 23.018222
```

## 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)

### Compare tooth growth by dose

- I would like to compare the growth of teeth between two scenarios. First scenarios is when dosage is raised from 0.5 to 1, and second scenarios is when dosage raised from 1 to 2
- **Null Hypotheses**
- $H_0$ : mean of difference in scenario 1 = mean of difference in scenario 2
- set alpha as 0.05
- I consider dose = 0.5 as the base level.
- **Assumption:**
- The growth in tooth is not affected by factors not mentioned in the datasets
- The guinea pig has not done anything to shorten its teeth during the process.
- All the observations made are based on the original 10 guinea pigs.
- We only use data from the VC group

```
g10 <- RawData$len[11:20] - RawData$len[1:10]
g21 <- RawData$len[21:30] - RawData$len[11:20]
t.test(g10, g21, paired = TRUE)$p.value
```

```
## [1] 0.8290479
```

- The p-value = 0.829 > 0.05
- Therefore I do not reject the null hypothesis
- This result suggest that increasing the dose from 1 to 2 renders similar growth result as when increasing dose from 0.5 to 1.

### Compare tooth growth by changing supp

- compare growth when changing supp for dose group 0.5, calculate confidence interval

```
g0_s <- RawData$len[1:10] - RawData$len[31:40]
g1_s <- RawData$len[11:20] - RawData$len[41:50]
g2_s <- RawData$len[21:30] - RawData$len[51:60]
t.test(g0_s)$conf
```

```
## [1] -9.236542 -1.263458
## attr(,"conf.level")
## [1] 0.95
```

- The confidence interval (95%, 2 side) is [-9.24, -1.26], entirely below zero.
- This suggest that changing VC to OJ for dose 0.5 totally increased the tooth length

```
t.test(g1_s)$conf
```

```
## [1] -9.908089 -1.951911
## attr(,"conf.level")
## [1] 0.95
```

- The confidence interval (95%, 2 side) is [-9.908089 -1.951911], entirely below zero.
- This suggest that changing VC to OJ for dose 1 totally increased the tooth length

```
t.test(g2_s)$conf
```

```
## [1] -4.168976 4.328976
## attr(,"conf.level")
## [1] 0.95
```

- The confidence interval (95%, 2 side) is [-4.168976 4.328976], evenly distributed around 0.
- In this case the change of supp *may not have made a difference*.

### 4. State your conclusions and the assumptions needed for your conclusions.

- **Conclusion 1**, increasing dosage from 0.5 to 1 generates similar tooth growth as increasing dosage from 1 to 2.
- **\*\* Conclusion 2\*\***, Changing supplement from VC to OJ helps tooth growth when the dosage is low. When dosage reaches 2, the change of supplement does not affect the tooth growth very much.