Two-sample T-test Exercise

Data Science Dojo

Overview

During the bootcamp's lecture "Online Experimentation and AB Testing", we already understood the concept of hypothesis test. In a real-world AB testing experiment, data scientists usually approximate the distribution of a certain metric (like dwell time of web pages, revenue, etc.) by t-distribution. T-distribution is a generalized version of normal distribution with freedom. (See wikipedia page: http://en.wikipedia.org/wiki/Student%27s_t-distribution.)

After this approximation, what we want to do is to compare the metric quantity's means in control and treatment groups before coming to the conclusion. This step is also called two-sample t-test for equal means. The mathematical procedure of this important step of AB test is well explained in one of National Information Technology Laboratory (NITL)'s web pages at: http://www.itl.nist.gov/div898/handbook/eda/section3/eda353.htm.

What this sample code trying to do is to guide students to implement t-test and relevant analysis using R.

Example

There are two groups of students (8 at each group). And each student has a score of a certain test.

- In group A, students slep for 8 hours at the night before test
- In group B, students slep for 4 hours at the night before test

The data test scores are as following:

```
| Group A | 5 | 7 | 5 | 3 | 5 | 3 | 3 | 9 |
|---------|---|---|---|---|---|---|---|---|
| Group B | 8 | 1 | 4 | 6 | 6 | 4 | 1 | 2 |
```

The goal of the hypothesis test is to confirm if the students' scores are different between the 8 hours sleep and 4 hours sleep groups.

Question 1

Input the above data into R, what are the mean and standard deviation of test scores in group A and B?

```
groupA <- c(5, 7, 5, 3, 5, 3, 3, 9)
groupB <- c(8, 1, 4, 6, 6, 4, 1, 2)
```

Question 2

What would be the null and alternative hypothesis in this study?

Question 3

What significance level did you choose and why?

Question 4

What is the t-score of this t test?
(You may want to use the function t.test, make sure the alternative and conf.level parameters in this function are assighted with correct values.)

```
t.test(groupA, groupB, alternative="two.sided", conf.level=0.95)
```

```
##
##  Welch Two Sample t-test
##
## data:  groupA and groupB
## t = 0.8473, df = 13.563, p-value = 0.4115
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -1.538936  3.538936
## sample estimates:
## mean of x mean of y
##         5         4
```

Question 5

Is there a significant difference between the two groups? Interpret your answer.

Question 6

If you have made an error, would it be a Type I or a Type II error?