

Testing of Hypothesis - Paired-t-test

Paired T-test:

The paired t-test is a method used to test whether the mean difference between pairs of measurements is zero or not.

Procedure:

- Import the data set
- Determine the critical value and sample statistic using R functions
- Conclude the problem using R functions

$$t = \frac{\mu_d}{\frac{s}{\sqrt{n}}}$$

Program 1:

Our company is testing a new drug that reduces hypertension. A total of 14000 individuals with high blood pressure ($\mu=150$ mmHg, $SD=10$ mmHg) are given the drug for a month, and then their blood pressure is measured again. The mean systolic blood pressure has decreased to 144 mmHg, with a standard deviation of 9 mmHg.

Syntax:

`t.test(x1,x2,paired=TRUE)` # where x1 & x2 are numeric

Code and Results:

```
#program1
set.seed(3000)
before=c(rnorm(2000,mean=150,sd = 10))
after=c(rnorm(2000,mean=144,sd = 9))
t.test(before,after,paired=TRUE)

##
## Paired t-test
##
## data: before and after
## t = 22.06, df = 1999, p-value < 2.2e-16
```

```
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  5.991729 7.161023
## sample estimates:
## mean of the differences
##                6.576376
```

Interpretation: There is a statistically significant difference in means of:

t=22.06 p-value< 2.2e-16

so the test was a success.(new drug that reduces hypertension)

Independent Samples:

The Independent Samples t Test compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different.

Program 2:

Testing the hypothesis in which Chennai and Mumbai spend different amounts for eating outside on a monthly basis.

Syntax:

General form: `_t.test(x1, x2, paired=FALSE)`

By default, R assumes that variances of x1 and x2 are unequal. So we use the flag, `var.equal=TRUE`.

Code and Results:

```
#program2
set.seed(0)
chennai=rnorm(60,mean=350,sd=77)
mumbai=rnorm(60,mean=400,sd=80)
t.test(chennai,mumbai,var.equal=TRUE)

##
##  Two Sample t-test
##
## data:  chennai and mumbai
## t = -3.994, df = 118, p-value = 0.0001134
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
```

```
## -76.35948 -25.73807
## sample estimates:
## mean of x mean of y
## 349.8529 400.9017
```

Interpretation:

There is difference in mean and $t=-3.994$ and $p\text{ value}=0.00134$

Mumbai spend more amounts each month at restaurants than Chennai do.