Chapter 12 Non-parametric Test

Daxiang Na

2022-10-25

Contents

1 Wilcoxon Signed Rank Test **1**

2 Wilcoxon Rank-Sum test (also known as Mann-Whitney U test) **2**

1 Wilcoxon Signed Rank Test

- Only for paired sample.
- Evaluate the null hypothesis: $Z_T = (T - \mu_T)/\sigma_T$
- Note:

$$\mu_T = 0$$
$$\sigma_T = \sqrt{\frac{n(n+1)(2n+1)}{6}}$$

- $$Z_T \sim N(0,1)$$

- usually $n > 12$
- calculate the probability of getting Z_T when $\mu = 0$ is true.
- For two-sided test, follow what we do in the sampling distribution:
  - 2*p when z < 0
  - 2*(1 - p) when z > 0
- if n >= 30, you can just apply CLT, otherwise you can use this.
- in R: `psignrank(T,n)`
- `wilcox.test(before, after, paired = T, exact = F, correct = F)`
-

2 Wilcoxon Rank-Sum test (also known as Mann-Whitney U test)

- nonparametric analog to the two-sample t-test
- get W_1 and W_2
- W = min(W_1, W_2)
- $$z_W = \frac{W - \mu_W}{\sigma_W}$$
- n1 = sample size with the smaller sum of ranks
- n2 = sample size with the larger sum of ranks
- $$\mu_W = \frac{n_1 (n_1 + n_2 + 1)}{2} \text{ and } \sigma_W = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$$
- $z_W \sim$ N(0, 1) when n1 and n2 are large enough (n1, n2 $>$ 10).
- in R: `pwilcox(Wobs, n1, n2)`
  - in this case, Wobs = W - n1(n1 + 1)/2
- in R: `wilcox.test(..., exact = F, correct = F, paired = F, alt = "")`
- when n is small, use exact distribution to calculate p-values
- correct: correct the data with continuity correction
- exact: F: normal distribution, T - wilcoxon.