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Non-asymptotic Two-Sample Test using t-statistic

Assume

- $X_1, \dots, X_n \stackrel{iid}{\sim} \mathcal{N}(\mu_X, \sigma_X^2),$
- $Y_1, \dots, Y_m \stackrel{iid}{\sim} \mathcal{N}(\mu_Y, \sigma_Y^2),$
- $X_1, \dots, X_n, Y_1, \dots, Y_m$ are independent.

Then, for any n and m , the distribution of the test statistic below is approximated by a t -distribution:

$$\frac{\bar{X}_n - \bar{Y}_m - (\mu_X - \mu_Y)}{\sqrt{\hat{\sigma}_X^2/n + \hat{\sigma}_Y^2/m}} \underset{\text{approx.}}{\sim} t_N$$

where the degrees of freedom N is given by the **Welch-Satterthwaite formula** :

$$\min(n, m) \leq N = \frac{(\hat{\sigma}_X^2/n + \hat{\sigma}_Y^2/m)^2}{\frac{\hat{\sigma}_X^4}{n^2(n-1)} + \frac{\hat{\sigma}_Y^4}{m^2(m-1)}} \leq n + m$$

讨论

显示讨论

主题: Unit 4 Hypothesis testing: Lecture 14: Wald's Test, Likelihood Ratio Test, and Implicit Hypothesis Test / 2. Worked Example: Two-Sample T-test with Small Sample Sizes