PAIRED t TEST

Paired t Test

A **paired t-test** is a statistical method used to compare the means of two related groups. It helps determine whether there is a significant difference between the two sets of observations. Here's a simple breakdown:

When is a paired t-test used?
When you have **two measurements from the same group** (e.g., before and after a treatment, or matched pairs like twins).
The data is **continuous** (like test scores, weights, etc.).
The pairs are **dependent** (not independent samples).

What is it?

How does it work?

Calculate the difference between each pair of observations.
Analyze the mean of these differences.
Test whether the average difference is significantly different from zero.

Example scenario

Suppose you want to test if a training program improves employee productivity. You measure productivity **before** and **after** the program for each employee. The paired t-test will tell you if the change is statistically significant.

Formula

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The test statistic is:

$$t = \frac{\bar{d}}{s_d/\sqrt{n}}$$

Where:

$\bar{d}$ = mean of the differences
s_d = standard deviation of the differences
n = number of pairs

Hypothesis & p-value

Null hypothesis (H_0):
The mean difference between the paired observations is **zero**.
$H_0: \mu_d = 0$
where μ_d is the mean of the differences.

Alternative hypothesis (H_1):
$H_1: \mu_d \neq 0$
The mean difference is **not zero** (for a two-tailed test), or is **greater than zero/less than zero** (for a one-tailed test).

Interpretation

p-value < 0.05: Significant difference between the two sets.

p-value ≥ 0.05: No significant difference.