Paired-sample Hypotheses

LECTURE 13

Objectives

▶ Define terms.
▶ Recognize when a paired-sample test is appropriate.
▶ Choose between parametric and nonparametric tests
▶ Select and execute the correct test for a given situation.

Overview

▶ The two-sample testing procedures we have just finished discussing apply when the two samples are independent – implying that each datum in one sample is in no way associated with any specific datum in the other sample.

Overview

▶ However, there are instances when each observation in sample 1 is in someway related with an observation in sample 2.
  ▶ The data may be said to occur in pairs.

The members of a pair have something in common

- ▶ The pair might be the same individual tested twice.
  - ▶ Before and after
- ▶ The pair might be different but similar portions of the same individual at one time.
- ▶ The pair might be twins or siblings.
- ▶ The pair might be organisms that were reared under the same conditions but differ in the independent variable.

Paired t-test

- ▶ Assumptions
  - ▶ Random sample
  - ▶ The differences in the means are normally distributed.

  - ▶ Variances should not be important if the reason for pairing the data is valid.

Paired t-test

- ▶ Violation of assumptions and minimization
  - ▶ The t-test in fairly robust to violations of assumptions
  - ▶ Larger sample sizes reduce the problems associated with violations

Paired t-test

- ▶ We can define a mean population difference as:

$$\mu_d = \mu_1 - \mu_2$$

Example

▶ Example 16

Wilcoxon paired-sample test

▶ Used in situations similar to paired t-test, you want to see if the two samples differ significantly in magnitude (medians).

▶ Data has to be at least ordinal.

▶ We do no use the actual measurements, but rather we use the rank of the measurements.

  ▶ If two or more measurements are tied then all of the tied values are assigned the average rank.

Wilcoxon paired-sample test

▶ This is the nonparametric version of the paired sample t-test

Assumptions

▶ Random sample
▶ The differences are distributed symmetrically (not necessarily normally).

Example

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