

Description

What are Statistical Tests?

Statistical tests are a way of mathematically determining whether two sets of data are significantly different from each other. To do this, statistical tests use several statistical measures, such as the mean, standard deviation, and coefficient of variation. Once the statistical measures are calculated, the statistical test will then compare them to a set of predetermined criteria. If the data meet the criteria, the statistical test will conclude that there is a significant difference between the two sets of data.

There are various statistical tests that can be used, depending on the type of data being analyzed. However, some of the most common statistical tests are t-tests, chi-squared tests, and ANOVA tests.

Types of Statistical Tests

When working with statistical data, several tools can be used to analyze the information.

1. Parametric Statistical Tests

Parametric statistical tests have precise requirements compared with non-parametric tests. Also, they make a strong inference from the data. Furthermore, they can only be conducted with data that adhere to common assumptions of statistical tests. Some common types of parametric tests are regression tests, comparison tests, and correlation tests.

1.1. Regression Tests

Regression tests determine cause-and-effect relationships. They can be used to estimate the effect of one or more continuous variables on another variable.

- **Simple linear regression** is a type of test that describes the relationship between a dependent and an independent variable using a straight line. This test determines the relationship between two quantitative variables.
- **Multiple linear regression** measures the relationship between a quantitative dependent variable

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and two or more independent variables, again using a straight line.
- **Logistic regression** predicts and classifies the research problem. Logistic regression helps identify data anomalies, which could be predictive fraud.

1.2. Comparison Tests

Comparison tests determine the differences among the group means. They can be used to test the effect of a categorical variable on the mean value of other characteristics.

- **T-test**

One of the most common statistical tests is the t-test, which is used to compare the means of two groups (e.g. the average heights of men and women). You can use the t-test when you are not aware of the population parameters (mean and standard deviation).

- **Paired T-test**

It tests the difference between two variables from the same population (pre-and post-test scores). For example, measuring the performance score of the trainee before and after the completion of the training program.

- **Independent T-test**

The independent t-test is also called the two-sample t-test. It is a statistical test that determines whether there is a statistically significant difference between the means in two unrelated groups. For example, comparing cancer patients and pregnant women in a population.

- **One Sample T-test**

In this test, the mean of a single group is compared with the given mean. For example, determining the increase and decrease in sales in the given average sales.

- **ANOVA**

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ANOVA (Analysis of Variance) analyzes the difference between the means of more than two groups. One-way ANOVAs determine how one factor impacts another, whereas two-way analyses compare samples with different variables. It determines the impact of one or more factors by comparing the means of different samples.

- **MANOVA**

MANOVA, which stands for Multivariate Analysis of Variance, provides regression analysis and analysis of variance for multiple dependent variables by one or more factor variables or covariates. Also, it examines the statistical difference between one continuous dependent variable and an independent grouping variable.

- **Z-test**

It is a statistical test that determines whether two population means are different, provided the variances are known and the sample size is large.

1.3. Correlation Tests

Correlation tests check if the variables are related without hypothesizing a cause-and-effect relationship. These tests can be used to check if the two variables you want to use in a multiple regression test are correlated.

- **Pearson Correlation Coefficient**

It is a common way of measuring the linear correlation. The coefficient is a number between -1 and 1 and determines the strength and direction of the relationship between two variables. The change in one variable changes the course of another variable change in the same direction.

2. Non-parametric Statistical Tests

Non-parametric tests do not make as many assumptions about the data compared to parametric tests. They are useful when one or more of the common statistical assumptions are violated. However, these inferences are not as accurate as with parametric tests.

- **Chi-square test**

The chi-square test compares two categorical variables. Furthermore, calculating the chi-square statistic value and comparing it with a critical value from the chi-square distribution allows you to

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assess whether the observed frequency is significantly different from the expected frequency.

7 Essential Ways to Choose the Right Statistical Test

1. Research Question

The decision for a statistical test depends on the research question that needs to be answered. Additionally, the research questions will help you formulate the data structure and research design.

2. Formulation of Null Hypothesis

After defining the research question, you could develop a null hypothesis. A null hypothesis suggests that no statistical significance exists in the expected observations.

3. Level of Significance in Study Protocol

Before performing the study protocol, a level of significance is specified. The level of significance determines the statistical importance, which defines the acceptance or rejection of the null hypothesis.

4. The Decision Between One-tailed and Two-tailed

You must decide if your study should be a one-tailed or two-tailed test. If you have clear evidence where the statistics are leading in one direction, you must perform one-tailed tests. However, if there is no particular direction of the expected difference, you must perform a two-tailed test.

5. The Number of Variables to Be Analyzed

Statistical tests and procedures are divided according to the number of variables that are designed to analyze. Therefore, while choosing the test , you must consider how many variables you want to analyze.

6. Type of Data

It is important to define whether your data is continuous, categorical, or binary. In the case of continuous data, you must also check if the data are normally distributed or skewed, to further define which statistical test to consider.

7. Paired and Unpaired Study Designs

A paired design includes comparison studies where the two population means are compared when the two samples depend on each other. In an unpaired or independent study design, the results of the two samples are grouped and then compared.

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Now that you know the seven steps for choosing a statistical test, you are on your way to finding the right test for your research question. Each situation is unique; it is important to understand all of your options and make an informed decision.

Remember to always consult with your principal investigator or statistician, or software, if you are unsure which test to choose.

We would love to hear from you on how you choose a statistical test for your research. Write to us or leave a comment below.

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