

Statistics How To

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Cross Correlation

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Cross Correlation in Statistics

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}}$$

The Pearson Product-Moment Correlation equation.

In statistics, a **cross-correlation function** is a measure of association. For example, the most common correlation coefficient, the **Pearson product-moment correlation coefficient (PPMC)**, is a normalized version of a cross-correlation. The PPMC gives a measure of temporal similarity for two **time series**.

Cross Correlation in Signal Processing

In signal processing, cross correlation is where you take two signals and produce a third signal. The method, which is basically a generalized form of "regular" linear correlation, is a way to objectively compare different time series and allows you to see how two signals match and where the best match occurs. It can be used to create plots that may reveal hidden sequences.

The basic process involves:

1. **Calculate a correlation coefficient.** The coefficient is a measure of how well one series predicts the other.
2. **Shift the series**, creating a lag. Repeat the calculations for the correlation coefficient.
3. **Repeat steps 1 and 2.** How many times you repeat the process will depend on your data, but as the lag increases the potential matches will decrease.
4. **Identify the lag with the highest correlation coefficient.** The lag with the highest correlation coefficient is where the two series match the best.

Difference Between Cross Correlation and Autocorrelation

Cross correlation and **autocorrelation** are very similar, but they involve different types of correlation:

- Cross correlation happens when two **different** sequences are correlated.
- Autocorrelation is the correlation between two of the **same** sequences. In other words, you correlate a signal with itself.

References

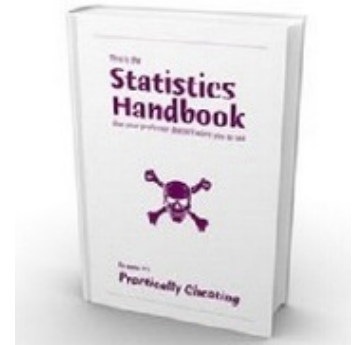
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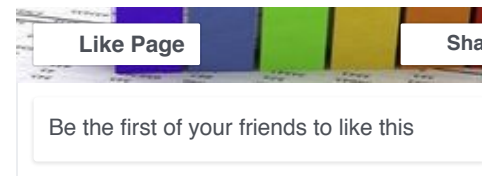
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Online Tables (z-table, chi-square, t-dist
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