What is the difference between Coefficient of Variation and Standard Deviation?

Authored by

stats writer

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The Coefficient of Variation (CV) and Standard Deviation (SD) are two measures of variability commonly used in statistics. The SD measures the spread of data values around the mean, while the CV measures the relative variability of data by comparing the SD to the mean. In other words, the SD is an absolute measure, while the CV is a relative measure. The SD is expressed in the same units as the data, while the CV is expressed as a percentage. This makes the CV a useful tool for comparing the variability of data sets with different units or scales. Additionally, the SD can only be used to compare data sets with similar means, while the CV can be used to compare data sets with different means. Ultimately, the choice between using SD or CV depends on the specific research question and the type of data being analyzed.

Coefficient of Variation vs. Standard Deviation: The Difference

The standard deviation of a dataset is a way to measure how far the average value lies from the mean.

To find the standard deviation of a given , we can use the following formula:

$s = \sqrt{(\Sigma(xi - x)2 / (n-1))}$

where:

Σ: A symbol that means "sum"xi: The value of the ith observation in the samplex: The mean of the samplen: The sample size

The higher the value for the standard deviation, the more spread out the values are in a sample. However,

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it's hard to say if a given value for a standard deviation is "high" or "low" because it depends on the type of data we're working with.

For example, a standard deviation of 500 may be considered low if we're talking about annual income of residents in a certain city. Conversely, a standard deviation of 50 may be considered high if we're talking about exam scores of students on a certain test.

One way to understand whether or not a certain value for the standard deviation is high or low is to find the coefficient of variation, which is calculated as:

CV = s / x

where:

s: The sample standard deviationx: The sample mean

In simple terms, the coefficient of variation is the ratio between the standard deviation and the mean.

The higher the coefficient of variation, the higher the standard deviation of a sample *relative* to the mean.

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Example: Calculating the Standard Deviation & Coefficient of Variation

Suppose we have the following dataset:

Dataset: 1, 4, 8, 11, 13, 17, 19, 19, 20, 23, 24, 24, 25, 28, 29, 31, 32

Using a calculator, we can find the following metrics for this dataset:

Sample mean (x): 19.29Sample standard deviation (s): 9.25

We can then use these values to calculate the coefficient of variation:

CV = s / xCV = 9.25 / 19.29CV = 0.48

Both the standard deviation and the coefficient of variation are useful to know for this dataset.

The standard deviation tells us that the typical value in this dataset lies 9.25 units away from the mean. The coefficient of variation then tells us that the standard deviation is about half the size of the sample mean.

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Standard Deviation vs. Coefficient of Variation: When to Use Each

The standard deviation is most commonly used when we want to know the spread of values in a single dataset.

However, the coefficient of variation is more commonly used when we want to compare the variation between two datasets.

For example, in finance the coefficient of variation is used to compare the mean expected return of an investment relative to the expected standard deviation of the investment.

For example, suppose an investor is considering investing in the following two mutual funds:

Mutual Fund A: mean = 9%, standard deviation = 12.4%

Mutual Fund B: mean = 5%, standard deviation = 8.2%

The investor can calculate the coefficient of variation for each fund:

CV for Mutual Fund A = 12.4% / 9% = 1.38CV for Mutual

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Fund B = 8.2% / 5% = 1.64

Since Mutual Fund A has a lower coefficient of variation, it offers a better mean return relative to the standard deviation.

Summary

Here's a brief summary of the main points in this article:

Both the standard deviation and the coefficient of variation measure the spread of values in a dataset.The standard deviation measures how far the average value lies from the mean.The coefficient of variation measures the ratio of the standard deviation to the mean.The standard deviation is used more often when we want to measure the spread of values in a single dataset.The coefficient of variation is used more often when we want to compare the variation between two different datasets.

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