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A New Definition Of Standard Deviation. ISSN 1751-3030

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Abstract

In this research investigation, the author has detailed a novel definition of Standard Deviation.

Theory

Standard Deviation in general literature is given by

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}\left(x_i - \left(\frac{\sum_{i=1}^{n} x_i}{n}\right)\right)^2}{n}} = \sqrt{\frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}}$$

In the above formula, we can note that the Numerator is square root of the sum of the deviates (of the observations from the mean) squared. The definition of Standard Deviation given above is in fact the Root Mean Square Value of the aforementioned Deviates. However, we can note that we can consider taking the square root of the sum of the deviates (of the observations from the mean) squared and then divide this value by n, the number of observations. This novel definition of Standard Deviation is much truer as we are considering the average of the square root of the sum of the deviates (of the observations from the mean) squared rather than taking the square root of the sum of the deviates (of the observations from the mean) squared divided by n. That is, we define the novel Standard Deviation as

$$\sigma_N = \frac{\sqrt{\sum_{i=1}^{n}\left(x_i - \left(\frac{\sum_{i=1}^{n} x_i}{n}\right)\right)^2}}{n} = \frac{\sqrt{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}}{n}$$

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We can note that $\sigma_N = \frac{\sigma}{\sqrt{n}}$, i.e., $\sigma = \sigma_N \sqrt{n}$, i.e., the general Standard Deviation inflates the True Stanadard Deviation by a factor of $\sqrt{n}$.

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