Variance and standard deviation are both measures of the dispersion or spread of a set of data points around the mean (average). While they are closely related, they differ in how they express this spread:

1. **Variance:**
    - Variance measures the average squared deviations from the mean.
    - It is calculated by taking the differences between each data point and the mean, squaring those differences, and then averaging the squared differences.
    - Formula for population variance (σ^2):

      $$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2$$

      where N is the number of data points, x_i represents each data point, and μ is the mean of the data set.
    - Formula for sample variance (s^2):

      $$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$$

      where n is the sample size and $\bar{x}$ is the sample mean.
2. **Standard Deviation:**
    - Standard deviation is the square root of the variance.
    - It provides a measure of spread in the same units as the original data, making it more interpretable.
    - Formula for population standard deviation (σ):

      $$\sigma = \sqrt{\sigma^2} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

    - Formula for sample standard deviation (s):

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

Key Differences:

- **Units:** Variance is expressed in squared units of the original data, while standard deviation is expressed in the same units as the original data.
- **Interpretability:** Standard deviation is generally more interpretable because it is in the same units as the data, making it easier to understand the extent of dispersion.
- **Calculation Relationship:** Standard deviation is the square root of variance.

Example: If you have a data set of test scores, the variance will give you an idea of how much the scores differ from the average score in squared terms, while the standard deviation will tell you, on average, how much the scores deviate from the mean in the original unit (e.g., points).