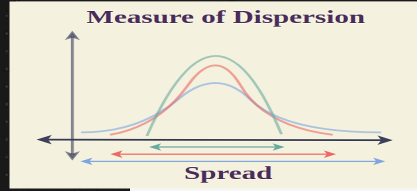


① Measure of Dispersion

① Variance

② Standard deviation

① Variance

Population Variance

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

$x_i \rightarrow$ DATA POINTS

$\mu \rightarrow$ Population mean

$N \rightarrow$ Population size

Sample Variance

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

$x_i \rightarrow$ DATA POINTS

$\bar{x} \rightarrow$ Sample Mean

$n \rightarrow$ Sample size

Why we divide Sample Variance by $n-1$?

Ans) The sample variance is divide by $n-1$ so that we can create an unbiased estimator of the population variance

Bessel's Correction

Eg: $\{1, 2, 3, 4, 5\}$

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

$n = 5$

x	$\bar{x}$	$(x_i - \bar{x})^2$
1	3	4
2	3	1
3	3	0
4	3	1
5	3	4
3		10

$$s^2 = \frac{\cancel{10}^{\,5}}{\cancel{4}_{\,2}} = \underline{\underline{2.5}}$$

$X = \{ \quad \}$ $\qquad$ $y = \{ \quad \}$

$s^2 = 2.5$ $\qquad$ $s^2 = 7.5$

$\Downarrow$

Dispersion or Spread

$\Downarrow$

$s^2 = 7.5$

$s^2 = 2.5$

② Standard Deviation

Population Standard Deviation

$\sigma = \sqrt{\text{Variance}}$

$X = \{1, 2, 3, 4, 5\}$

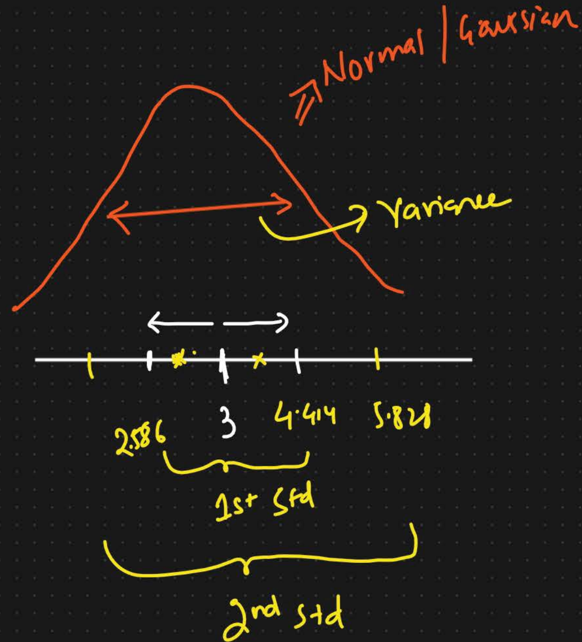
$\bar{X} = 3$

$\sigma = 1.414$

Sample Std

$\text{Std} = \sqrt{S^2}$

$S^2 = \text{Sample Variance}$



$$\begin{array}{r} 3.000 \\ -1.414 \\ \hline 2.586 \end{array} \qquad \begin{array}{r} 4.414 \\ +1.414 \\ \hline 5.828 \end{array}$$

	Population	Sample
Variance	$\sigma^2 = \frac{\sum_{i=1}^{N} (x_i - \mu)^2}{N}$	$S^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n - 1}$
Standard deviation	$\sigma = \sqrt{\frac{\sum_{i=1}^{N} (x_i - \mu)^2}{N}}$	$S = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n - 1}}$