

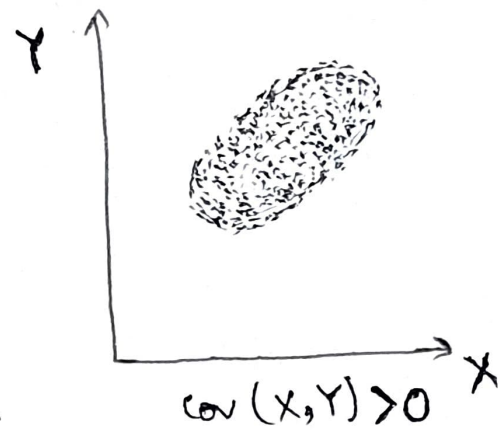
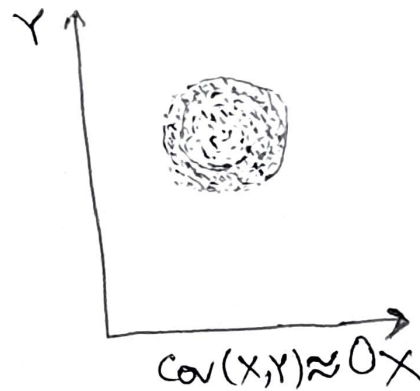
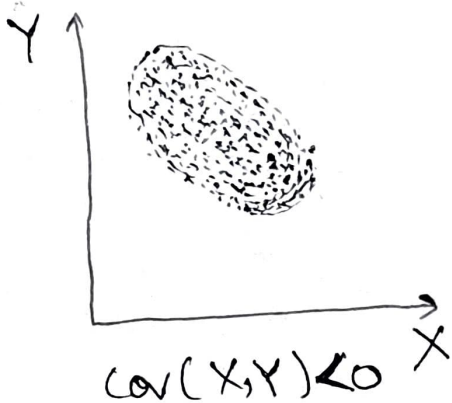
→ Covariance: Covariance signifies the direction of linear relationship between two variables. By direction we mean, either the variables are directly or inversely proportional to each other. The value of covariance can be any value b/w  $(-\infty, \infty)$ . Also, it should be noted down that, covariance only measures how two variables change together, not the dependency of one variable over another variable.

Covariance of two variables can be calculated using the formula-

$$\text{Cov}(x, y) = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{N}$$

The upper and lower limits for the covariance depend on the variances of the variables involved. These variances, in turn, can vary with the scaling of the variable. Even a change in units of the variable can change the covariance. Thus, covariance is only useful to find the direction of relationship between two variables and not the magnitude.

Different plots related to covariance -



→ Correlation: Correlation analysis is a method of statistical evaluation used to study the strength of a relationship between two, numerically measured, continuous variables. It not only shows the kind of relation (in terms of direction) but also how strong the relationship is. It can assume values between -1 to +1.

The main result of correlation is called the correlation coefficient which is given by the formula,

$$\text{Correlation} = \frac{\text{Cov}(x, y)}{\sigma_x \sigma_y}, \quad \begin{array}{l} \text{Cov}(x, y): \text{Covariance of } x \text{ \& } y. \\ \sigma_x: \text{Std. Dev. of } x \\ \sigma_y: \text{Std. Dev. of } y. \end{array}$$

- The closer the correlation coefficient to +1 and -1, the more strongly they are correlated to each other.
- When there is no <sup>or little</sup> relationship between the two variables, then the correlation coefficient will be close to 0 or will be 0. However, if it is 0, we will say there is no linear relationship.
- When the correlation coefficient is positive, an increase in one variable also increases the other variable.
- When the correlation coefficient is negative, the changes in two variables are opposite in direction, i.e., increase in one decreases another and vice-versa.

