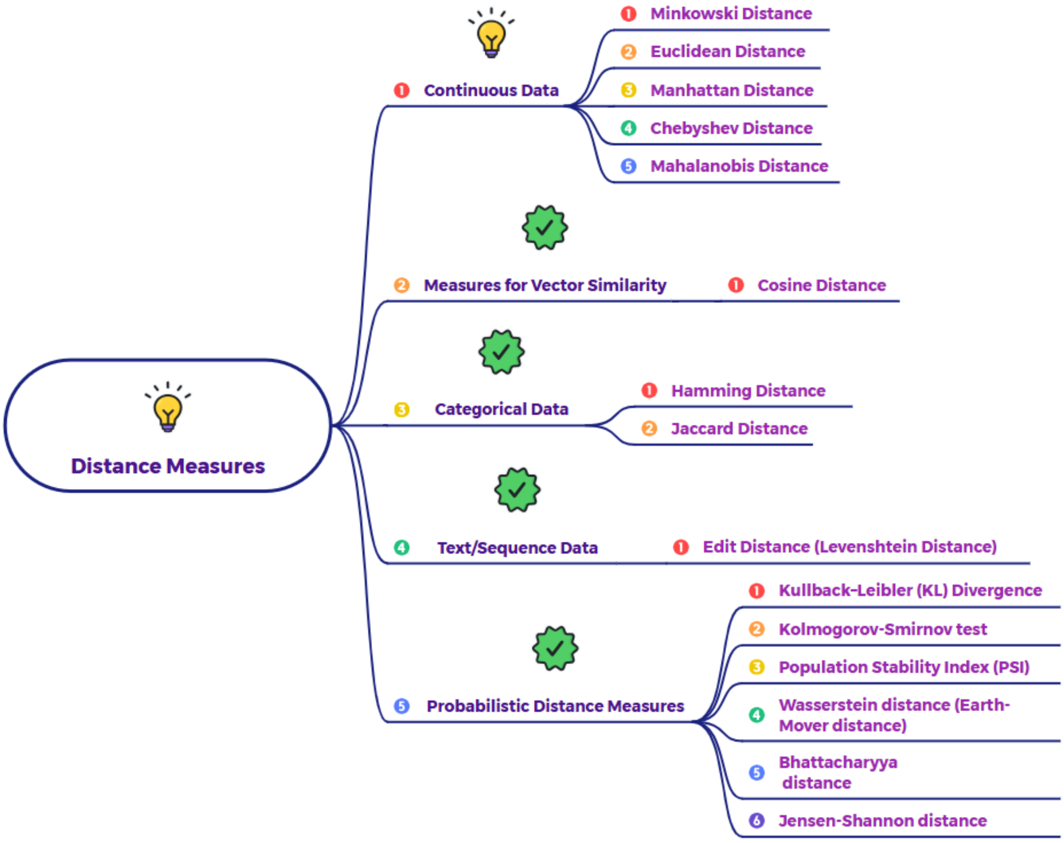
What are distance measures for Continuous data ?

Distance measures for continuous data are functions that calculate the dissimilarity between two data points in a continuous feature space. The most common types are based on the **Minkowski distance**, a generalized formula that includes other popular metrics as special cases.



Key Distance Measures for Continuous Data

These measures are essential for algorithms like k-nearest neighbors (k-NN) and k-means clustering.

This measure accounts for the covariance between the variables. It measures the distance between a point and a distribution, taking into account the correlations between features. This is useful when features are not independent.

1. Minkowski Distance

The Minkowski distance is a metric in a normed vector space, which can be defined as:
$D(x, y) = (\sum_{i=1}^{n} |x_i - y_i|^p)^{\frac{1}{p}}$

- It's a generalized form that can be tuned by changing the parameter p.
- For different values of p, it gives rise to other well-known distances.

2. Euclidean Distance

This is the most common distance measure, representing the shortest straight-line distance between two points. It's a special case of the Minkowski distance where $p = 2$. It's also known as the **L2 norm**.

$D_{Euclidean}(x, y) = \sqrt{\sum_{i=1}^{n} (x_i - y_i)^2}$

3. Manhattan Distance

Also known as the **L1 norm** or "taxicab" distance, it's the sum of the absolute differences of the coordinates. It's a special case of the Minkowski distance where $p = 1$.

$D_{Manhattan}(x, y) = \sum_{i=1}^{n} |x_i - y_i|$

4. Chebyshev Distance

This measures the maximum difference between any single dimension of the two data points. It's a special case of the Minkowski distance where $p \to \infty$. It's also known as the **L-infinity norm**.

$D_{Chebyshev}(x, y) = \max_i(|x_i - y_i|)$

5. Mahalanobis Distance

This measure accounts for the covariance between the variables. It measures the distance between a point and a distribution, taking into account the correlations between features. This is useful when features are not independent.

$D_{Mahalanobis}(x, y) = \sqrt{(x - y)^T \Sigma^{-1} (x - y)}$

Here, Σ is the covariance matrix.