What is the difference between Normalization and standardization?

**Normalization and standardization**: are two methods used to preprocess data in machine learning and statistics, but they have different approaches.

**Normalization :**scales the data to a specific range, typically between 0 and 1 or -1 and 1, making the values relative to each other within that range. For instance, consider a dataset with features like age (ranging from 0 to 100) and income (ranging from 20,000 to 200,000). Normalizing these features would scale them proportionally within a common range, say between 0 and 1. So, age of 50 (on a scale of 0-100) might become 0.5, and an income of 100,000 might become 0.5 as well.

**standardization (or z-score normalization)**: centers the data by subtracting the mean and dividing by the standard deviation, resulting in a distribution with a mean of 0 and a standard deviation of 1. Let's take the same dataset with age and income. Standardization would adjust the values based on their mean and standard deviation. So, an age of 50 might have a different standardized value, perhaps around -0.05, and an income of 100,000 might be standardized to 0.5.

In summary, normalization brings values within a specific range (e.g., 0 to 1), while standardization centers the data around a mean of 0 with a standard deviation of 1, allowing for easier comparison between different features in a dataset. Both methods are used depending on the requirements of the model being used and the nature of the data.