

Normalization and Standardization are two common techniques used for preprocessing and scaling data in machine learning and data analysis. They have distinct characteristics, purposes, and use cases:

Normalization (Min-Max Scaling):

1. **Range:** Normalization scales data to a specific range, usually [0, 1], making it suitable for data that has well-defined minimum and maximum values.
2. **Formula:** The formula for Normalization is:

$$\text{Standardized Value} = \frac{\text{Value} - \text{Min}}{\text{Max} - \text{Min}}$$

where 'Value' is the original data point, 'Min' is the minimum value in the dataset, and 'Max' is the maximum value in the dataset.

3. **Use Cases:**

- Normalization is often used when you want to scale data to a specific range, especially when you have a clear understanding of the minimum and maximum values.
- It's suitable for algorithms that require input features to be in the same range, such as neural networks and support vector machines.
- It's also useful for image processing tasks when pixel values need to be in the [0, 1] range.

4. **Advantages:**

- Preserves the relationships between data points.
- Useful for features with known meaningful minimum and maximum values.
- Helpful when working with algorithms that expect features to be in a bounded range.