**What is Feature Scaling?**

•Feature Scaling is a method to scale numeric features in the same scale or range (like:-1 to 1, 0 to 1).

•This is the last step involved in Data Preprocessing and before ML model training.

•It is also called as data normalization.

•We apply Feature Scaling on independent variables.

•We fit feature scaling with train data and transform on train and test data.

Why Feature Scaling? •The scale of raw features is different according to its units.

•Machine Learning algorithms can’t understand features units, understand only numbers.

•Ex: If hight 140cm and 8.2feet

•ML Algorithms understand numbers then 140 > 8.2

**Which ML Algorithms Required Feature Scaling?**

**Those Algorithms Calculate Distance**

•K-Nearest Neighbors (KNN)

•K-Means

•Support Vector Machine (SVM)

•Principal Component Analysis(PCA)

•Linear Discriminant Analysis

Gradient Descent Based Algorithms •Linear Regression,

•Logistic Regression

•Neural Network

**Tree Based Algorithms not required Feature scaling**

•Decision Tree, Random Forest, XGBoost

**Types of Feature Scaling**

1. Normalization: Min Max Scaler
2. Standardization: Standard Scaler

**Standardization vs Normalization Explained in Detail.**

**What is Standardization?**

•Standardization rescales the feature such as mean(μ) = 0 and standard deviation (σ) = 1.

•The result of standardization is also called as Z-score normalization.

• Data follow a normal distribution (gaussian distribution).

• If the original distribution is normal, then the standardized distribution will be normal.

• If the original distribution is skewed, then the standardized distribution of the variable will also be skewed.

**What is Normalization?**

Normalization is the process of rescaling the data so that it has same scale.

* Measurement unit used can affect the data analysis. Hence data are scaled to fall within a smaller range like 0.0 to 1.0.
* Transformation or mapping the data to a smaller or common range will help all attributes to gain equal weight. This is known as Normalization.

•Normalization also called as Min-Max Scaling.

•If data doesn’t follow normal distribution (Gaussian distribution).

**Why is Normalization needed?**

* If the data is not normalized, one feature might completely dominate the others. Normalization makes every data point have the same scale so each feature is equally important.
* It avoids dependence on the choice of measurement units.
* The application of data mining algorithms becomes easier, effective and efficient.
* More specific data analysing methods can be applied to normalized data.
* It prevents attributes with initially large ranges (e.g., income) from outweighing attributes with initially smaller ranges (e.g., binary attributes).

**Standardization vs Normalization**

•There is no any thumb rule to use Standardization or Normalization for special ML algo.

•But mostly Standardization use for clustering analyses, Principal Component Analysis(PCA).

•Normalization prefers for Image processing because of pixel intensity between 0 to 255, neural network algorithm requires data in scale 0-1, K-Nearest Neighbours.