

Step 08

# MODEL TRAINING

- Model training
- Initialization of parameters
- Optimization techniques



## **Model training**

- Model training is the process of training a machine learning model by feeding preprocessed data.
- During model training, the algorithm adjusts its parameters to minimize the difference between its predicted output and the actual output of the training data.
- The goal of model training is to develop a model that can accurately predict outcomes for new, unseen data.

Let's, explore the important steps involved in model training, such as

- Initialization Parameters
- Optimization of Algorithms

## 01 - Initialization Parameters

- Before training a model, initialization parameters need to be set.
- These parameters define the starting values for the model's parameters, which will then be adjusted during training.
- Initialization parameters can significantly impact the model's accuracy and speed of convergence.

Let's take a simple example of training a linear regression model for predicting the price of a house based on its size in square feet.

- We need to set the initialization parameters such as the intercept and slope of the line.
- These parameters will define the starting point of the line and will be adjusted during training to fit the data.

Initialization Techniques in Supervised Learning are,

### **Random Initialization**

- In this technique, the model parameters are randomly initialized within a specific range, usually between -1 and 1.
- This method is used in most cases for supervised learning tasks, such as image classification, regression, and natural language processing.

### **Xavier Initialization**

- Xavier initialization, also known as Glorot initialization, sets the initial values of the model parameters according to the number of input and output neurons.
- This technique is widely used in feedforward neural networks and convolutional neural networks.

Initialization Techniques in Unsupervised Learning are,

### **K-means++ Initialization**

- K-means++ is a clustering algorithm that partitions data into  $k$  clusters by minimizing the sum of squared distances between the data points and their assigned cluster centroids.
- The K-means++ initialization method selects the initial  $k$  centroids such that they are far apart from each other, resulting in better clustering results.

For example, consider a dataset of customer transaction data. K-means++ initialization would mean selecting the initial centroids of the  $k$  clusters such that they are maximally separated from each other.

## PCA Initialization

- Principal component analysis (PCA) is an unsupervised dimensionality reduction technique that projects high-dimensional data onto a lower-dimensional space.
- The PCA initialization method uses the first  $k$  principal components as the initial basis for clustering.

For example, in a dataset of images, PCA initialization would mean selecting the first  $k$  principal components as the initial basis for clustering similar images.

## 02 - Optimization of Algorithms

- Algorithms require optimization to improve their performance.
- The process involves adjusting the model's parameters to minimize the error between the predicted and actual values.

There are several optimization techniques used in machine learning, such as

- Gradient descent
- Stochastic gradient descent
- And mini-batch gradient descent

## **Gradient descent**

- Gradient descent is one of the most widely used optimization techniques for training supervised machine learning models.
- It is used to minimize the cost function of the model by iteratively adjusting the model parameters in the direction of the steepest descent of the cost function.

## **Stochastic gradient descent**

- Stochastic gradient descent is a variation of gradient descent that randomly samples training examples during each iteration to update the model parameters.
- This technique is particularly useful for large datasets, where computing the gradient for the entire dataset at each iteration is computationally expensive.



**Note : There are many initialization and optimization techniques. But these are common and popular ones.**

In conclusion, model training is a critical step in machine learning that involves setting initialization parameters and optimizing the model's performance through various techniques.

By understanding these techniques, we can improve the accuracy and speed of our machine learning models.

Happy learning!😊

# THANK YOU

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