

Day 01 - Introduction to Machine Learning

Introduction to Machine Learning

Machine learning helps machines to learn by itself without getting explicitly programmed. Now what does this "without getting explicitly programmed" means, to understand this we need to look at traditional programming approach where we used to explicitly program every thing and give it to machine, as per the program the machine behaves or gives output. Examples of traditional programming are - Calculator program, To find factorial, To determine a number is odd or even, etc. If we provide the machine with a logic of addition it will always perform addition, it would never learn to perform subtraction until explicitly programmed. Here the machine is not learning it is only giving output as programmed.

To successfully implement machine learning we need two things : Data and Algorithm. These are the very important requirements without which machine learning cannot be implemented. Appropriate data helps to generate more accurate models. Now what does this "appropriate" means, here for example if our objective is to classify students on basis of grades, then the as, the appropriate data would be academic data of students which will help in better classifying the students based on grades. But instead of academic data if we provide students personal information data, the model so generated would not be helpful in fulfilling our objective.

Artificial Intelligence Vs Machine Learning Vs Deep Learning

Artificial Intelligence

The Term AI was first coined in 1956 by John McCarthy. Artificial Intelligence is a field of study in which machines are programmed and given a cognitive ability to think and mimic actions like humans.

Artificial Intelligence has two different levels:

1. **General Artificial Intelligence:** It can perform any intellectual task with the same accuracy level as a human would.
2. **Narrow Artificial Intelligence:** It can perform a specific task better than a human.

Machine Learning

The term ML was first coined in 1959 by Arthur Samuel. Machine Learning is a subset of AI, here we try to provide ability to machine to learn by itself without getting explicitly programmed. In ML, we use statistical algorithm such as Decision Tree, Support Vector Machine(SVM), KNN to predict/classify the output. There are three Machine Learning categories- Supervised Learning, Unsupervised Learning and Reinforcement Learning.

Deep Learning

Deep learning is subset of machine learning. DL is the next evolution of machine learning. It works in a layered architecture and uses the artificial neural network, a concept inspired by the biological neural network. The human brain usually analyzes and converts the information it receives and tries to identify it from the past information the brain has stored. In a similar way. Deep Learning algorithms are trained to identify patterns and classify various types of information to give the desired output when it receives an input. We need to provide the features manually in Machine Learning. But in Deep Learning, it automatically extracts features for classification which in turn demands a huge amount of data for training DL algorithms. So, in Deep Learning, the accuracy of the output depends on the amount of data. In DL we use Artificial Neural Network(ANN). Convolutional Neural Network(CNN) and Recurrent Neural Network(RNN).

Machine Learning Categories

Supervised Learning

As the name suggests “Machine learns under supervision”, to make it more simple for you it says “Train me”. Consider a student preparing for exam, questions and the answer key to those questions is available. So in this case the students is our model, exam questions are input and answer key is desired output. Such type of data are called “Labeled data” that we use in supervised learning. Here we train the model using

the labeled data and during training the model understands the relationship between the input and output variables/features. As the training phase finishes, the model is tested and hence enters into testing phase where the test input features are given to model and now model will classify/predict the output/Predicted output. Now the predicted output and desired output is matched. If the difference between the two is less we can say that the model is more accurate and error margin is low, but if the difference between the predicted and desired output is more then we say the error margin is high and that the model needs to be trained more/well.

So in supervised learning :

- Labeled data should be used to train the model.
- Feedback is provided for model to improve.
- Predicting/classifying the output.

Unsupervised Learning

As the name suggests “Machine learns by itself without any supervision”. In case of unsupervised learning the output variables are unlabeled, combinations of input and output variable aren't known. Unsupervised learning focuses on analyzing relationships between input variables and uncovering hidden patterns that can be extracted to create new labels for possible outputs. For example to a student 50 shapes are given, but the students don't have any idea regarding shapes(still learning) and we are also not specifying any labels means names of shapes. This is a case of unsupervised learning where a unlabeled data is provided. Now the student will try to understand the patterns. For example, student will make a group of shapes that has four corners, another group of shapes with three corners and one more group of shapes with no corners. So here the student tried to make clusters of similar input elements and that's what we do in unsupervised learning. Further to those clusters made by students, new labels could be given. Yeah you are right if you think that the shapes are Quadrilateral, Triangle and Circle.

So in Unsupervised Learning :

- Unlabeled data is provided
- No feedback

- Finds hidden patterns in data

Reinforcement Learning

Unlike supervised and unsupervised learning, reinforcement learning builds a prediction model by gaining feedback from random “trial and error” and also learning from past iterations. We can also say that the reinforcement learning is reward based, for example in case of self driving cars, avoiding a crash earns a positive score and if crashed gets a negative score, from this the model learns at what conditions in environment which actions should be performed.