

MACHINE LEARNING:

1. What is the crux of machine learning?

The field of machine learning is concerned with the question of how to computer programs that automatically improve with experience. The crux of machine learning lies in the ability to create algorithms and models that enable computers to learn from data and improve their performance on a specific task without being explicitly programmed. The crux of ML is based on the recognition that human intelligence hinges more on 'probability' than 'reason' or 'logic'.

2. What are the different types in machine learning?

Machine learning is broadly categorized into the following types or headings:

- i. Supervised Learning
- ii. Unsupervised Learning
- iii. Reinforcement Learning
- iv. Deep Learning
- v. Deep Reinforcement Learning

i. Supervised Learning: It is a type of machine learning in which the algorithm is trained on a labelled dataset, and on the basis of that data, machines predict the output. Labelled dataset means that the input data is accompanied by corresponding target labels or output values. In supervised learning, the training data provided to the machines work as the supervisor that teaches the machines to predict the output correctly. The goal is to learn a mapping from input features to correct output labels or values so that the algorithm can make accurate predictions on new, unseen data.

Supervised learning can be further divided into two types of problems:

- a. Regression
- b. Classification

a. **Regression:** Regression algorithms are used if there is a relationship between the input variable and the output variable. It is used for the

prediction of continuous variables, such as Weather forecasting, Market Trends, etc.

b. Classification: Classification algorithms are used when the output variable is categorical, which means there are two classes such as Yes-No, Male-Female, True-false, etc.

ii. Unsupervised Learning: Unsupervised learning is a type of machine learning where algorithms learn from unlabelled data, that is, there are no explicit labels or target outputs provided during the training process. The goal of unsupervised learning is to find patterns, structures, or relationships within the data without any pre-defined guidance or supervision.

iii. Reinforcement Learning: RL is a machine learning paradigm in which an agent learns to make decisions by interacting with an environment; by performing actions and seeing the results of such actions. The agent aims to maximize a cumulative reward over time through a series of actions. Reinforcement learning involves learning from the consequences of actions taken in an environment.

iv. Deep Learning: Deep Learning is a subfield of machine learning that is based on the use of Artificial Neural Networks (ANN), more specifically Convolutional Neural Networks (CNN) to model and solve complex problems. Deep learning is capable of learning complex patterns and relationships within data. There are several architectures used in deep learning such as deep neural networks, deep belief networks, recurrent neural networks and convolutional neural networks.

v. Deep Reinforcement Learning: DRL combines the techniques of both deep and reinforcement learning to tackle complex decision-making problems.

3. What are the different algorithms available for developing machine learning models?

There are different algorithms available for different categories of machine learning.

Supervised Learning algorithms:

- a. k-Nearest Neighbours
- b. Decision Trees

- c. Naive Bayes
- d. Logistic Regression
- e. Support Vector Machines
- f. Scikit-learn

Unsupervised Learning algorithms:

- a. k-means clustering
- b. Clustering identification

Reinforcement Learning algorithms:

- a. Q-Learning
- b. State Action Reward State action (SARSA)
- c. Deep Q Neural Network (DQN)

Deep Learning algorithms:

- a. Convolutional Neural Networks (CNNs)
- b. Long Short Term Memory Networks (LSTMs)
- c. Recurrent Neural Networks (RNNs)
- d. Generative Adversarial Networks (GANs)
- e. Radial Basis Function Networks (RBFNs)
- f. Multilayer Perceptrons (MLPs)
- g. Self Organizing Maps (SOMs)
- h. Deep Belief Networks (DBNs)
- i. Restricted Boltzmann Machines (RBMs)

Deep Reinforcement Learning algorithms:

Different ANN architectures

4. What tools are available for developing these models?

The popular and commonly used tools for developing ML models are:

- a. **Python:** Python is one of the most widely used programming languages for machine learning. It has a rich ecosystem of libraries and frameworks that make it easy to build machine learning models. Some popular libraries include:
 - **NumPy:** A fundamental package for numerical computations in Python.
 - **Pandas:** A library for data manipulation and analysis.

- **Scikit-learn:** A powerful machine learning library that provides various algorithms and tools for data mining and analysis.
 - **TensorFlow and Keras:** Deep learning frameworks that allow you to build and train neural networks easily.
 - **PyTorch:** Another popular deep learning framework with a dynamic computation graph and strong community support.
 - **XGBoost and LightGBM:** Libraries for gradient boosting, which are powerful for structured/tabular data problems.
- b. **Google Cloud ML Engine:** It is a hosted platform where ML developers and data scientists build and run optimum quality machine, learning models. It provides a managed service that allows developers to easily create ML models with any type of data and of any size.
- c. **Jupyter Notebooks:** Jupyter Notebooks provide an interactive computing environment that allows you to write, execute, and visualize code in a web browser. They are commonly used for data exploration, model prototyping, and sharing analyses.

5. What are the programming language choices?

The programming language choices for ML are:

- Python
- R
- Matlab
- Octave
- Julia
- C++
- C

6. What platforms support development and deployment of Machine Learning applications?

The platforms that support development and deployment of Machine Learning applications are:

- IBM
- Microsoft Azure
- Google Cloud
- Amazon

- Mlflow

7. What IDEs (Integrated Development Environment) are available?

The IDEs available for ML are:

- R Studio
- Pycharm
- iPython/Jupyter Notebook
- Julia
- Spyder
- Anaconda
- Rodeo
- Google –Colab

8. How to quickly upgrade your skills in this important area?

Machine Learning has a very large width and requires skills across several domains. The skills that we need to acquire for becoming an expert in Machine Learning are:

- Statistics
- Probability Theories
- Calculus
- Optimization techniques
- Visualization

These skills, along with improving our programming skills, can help us upgrade and be efficient in this important area.