What Is Machine Learning?

Machine learning (ML) is a discipline of artificial intelligence (AI) that provides machines with the ability to automatically learn from data and past experiences while identifying patterns to make predictions with minimal human intervention.

Machine learning derives insightful information from large volumes of data by leveraging algorithms to identify patterns and learn in an iterative process. ML algorithms use computation methods to learn directly from data instead of relying on any predetermined equation that may serve as a model.

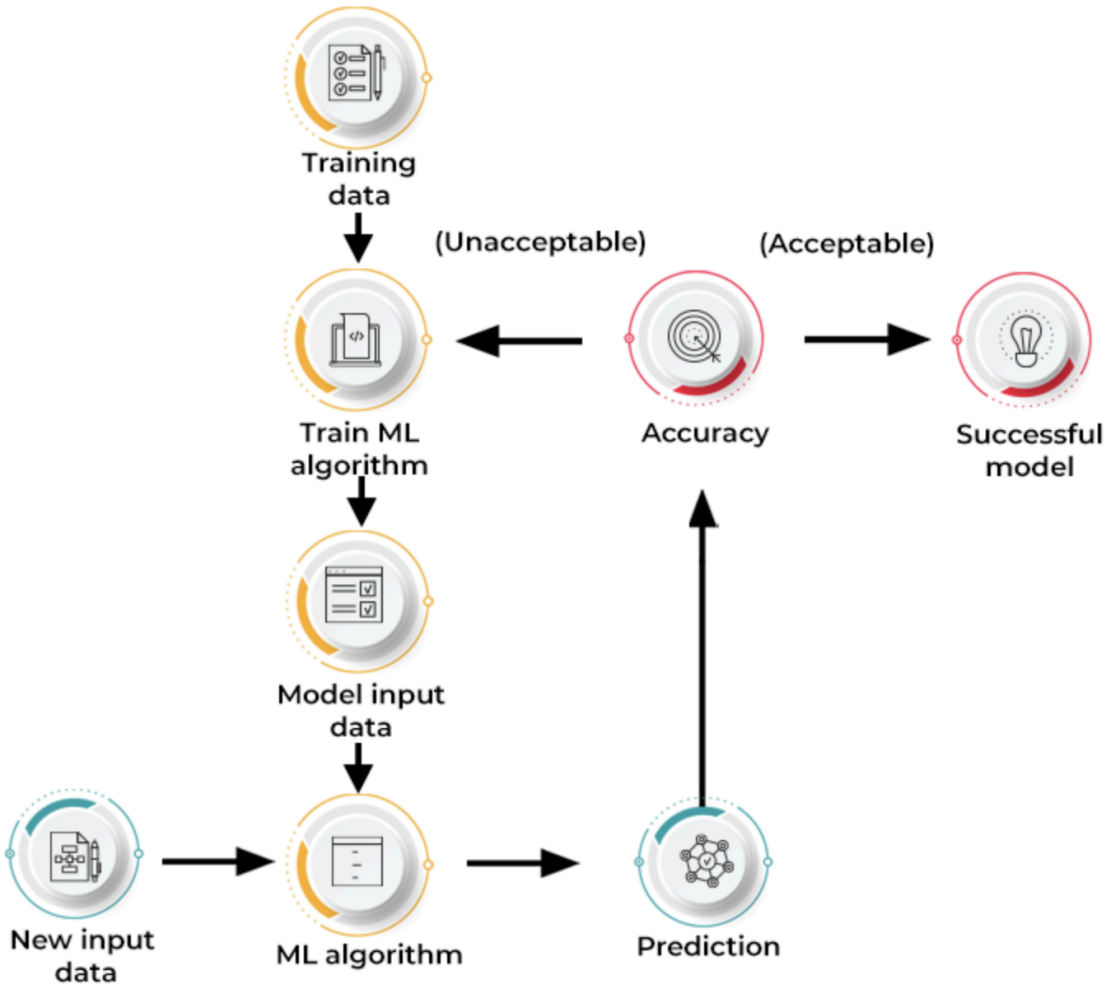
The performance of ML algorithms adaptively improves with an increase in the number of available samples during the ‘learning’ processes.

Some real life examples:

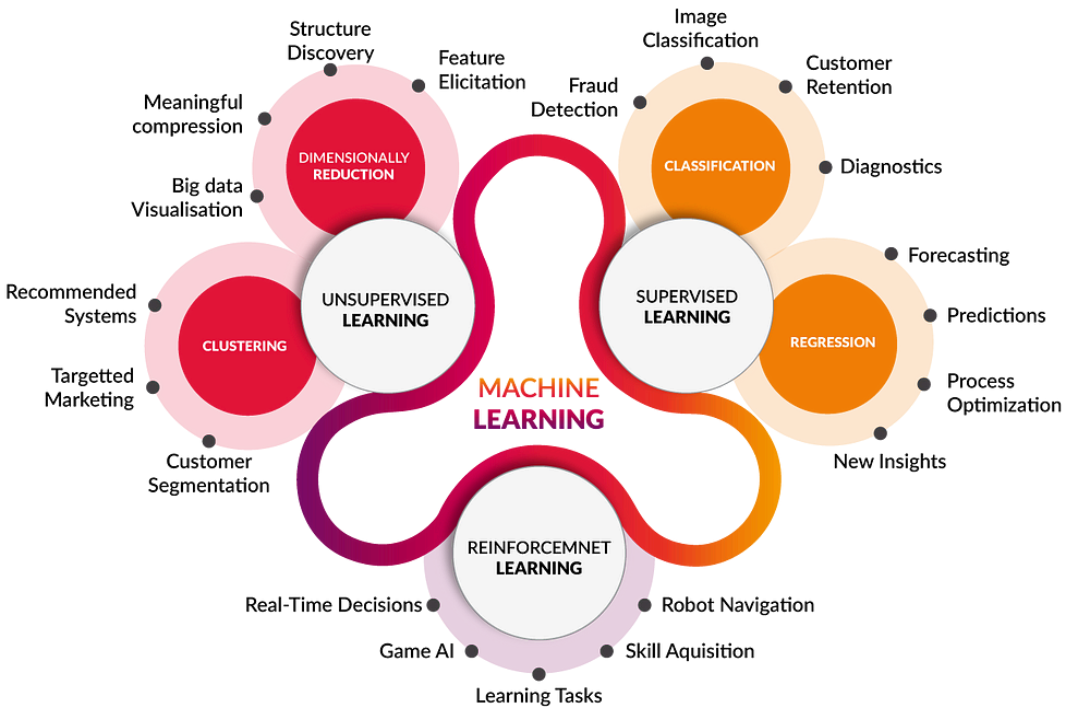
- Computational finance (credit scoring, algorithmic trading)
- Computer vision (facial recognition, motion tracking, object detection)
- Computational biology (DNA sequencing, brain tumor detection, drug discovery)
- Automotive, aerospace, and manufacturing (predictive maintenance)
- Natural language processing (voice recognition)

How does machine learning work?

Machine learning algorithms are molded on a training dataset to create a model. As new input data is introduced to the trained ML algorithm, it uses the developed model to make a prediction.



Types of Machine Learning



1. Supervised machine learning

This type of ML involves supervision, where machines are **trained on labeled datasets** and enabled to predict outputs based on the provided training.

The labeled dataset specifies that some input and output parameters are already mapped. Hence, the machine is trained with the input and corresponding output.

Supervised machine learning is further classified into two broad categories:

Classification: These refer to algorithms that address classification problems where the **output variable is categorical**; for example, yes or no, true or false, male or

female, etc. Real-world applications of this category are evident in spam detection and email filtering.

Some known classification algorithms include the **Random Forest Algorithm**, **Decision Tree Algorithm, Logistic Regression Algorithm, and Support Vector Machine Algorithm**.

Regression: Regression algorithms handle regression problems where **input and output variables have a linear relationship.** These are known to predict continuous output variables. Examples include weather prediction, market trend analysis, etc.

Popular regression algorithms include the **Simple Linear Regression Algorithm, Multivariate Regression Algorithm, Decision Tree Algorithm, and Lasso Regression.**

2. Unsupervised machine learning

Unsupervised learning refers to a learning technique that's devoid of supervision. Here, the machine is trained using an unlabeled dataset and is enabled to predict the output without any supervision.

An unsupervised learning algorithm aims to group the unsorted dataset based on the input's similarities, differences, and patterns.

Unsupervised machine learning is further classified into two types:

Clustering: The clustering technique refers to grouping objects into clusters based on parameters such as similarities or differences between objects. For example, grouping customers by the products they purchase.

Some known clustering algorithms include the **K-Means Clustering Algorithm, Mean-Shift Algorithm, DBSCAN Algorithm, Principal Component Analysis, and Independent Component Analysis.**

3. Semi-supervised learning

Semi-supervised learning comprises characteristics of both supervised and unsupervised machine learning. It uses the combination of labeled and unlabeled datasets to train its algorithms. Using both types of datasets, semi-supervised learning overcomes the drawbacks of the options mentioned above.

4. Reinforcement learning

Reinforcement learning is a feedback-based process.

Here, the AI component automatically takes stock of its surroundings by the hit & trial method, takes action, learns from experiences, and improves performance.

The component is rewarded for each good action and penalized for every wrong move. Thus, the reinforcement learning component aims to maximize the rewards by performing good actions.

Reinforcement learning is further divided into two types of methods or algorithms:

Positive reinforcement learning: This refers to adding a reinforcing stimulus after a specific behavior of the agent, which makes it more likely that the behavior may occur again in the future, e.g., adding a reward after a behavior.

Negative reinforcement learning: Negative reinforcement learning refers to strengthening a specific behavior that avoids a negative outcome.