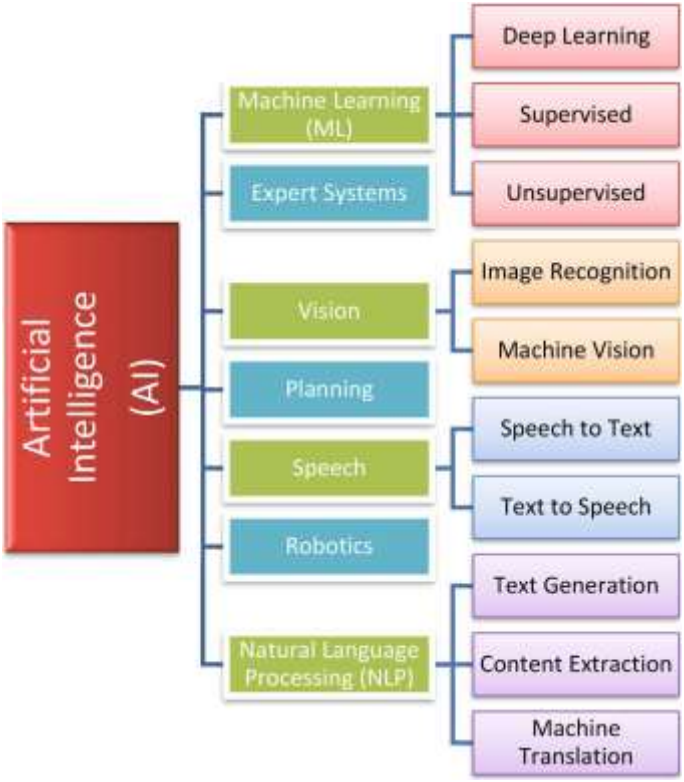
Lecture 3: Machine Learnning

The AI is defined as the science and engineering of creating intelligent machines, particularly intelligent computer programs. There are many ways of implementing AI. One of the most branches of the AI is a Machine Learning.

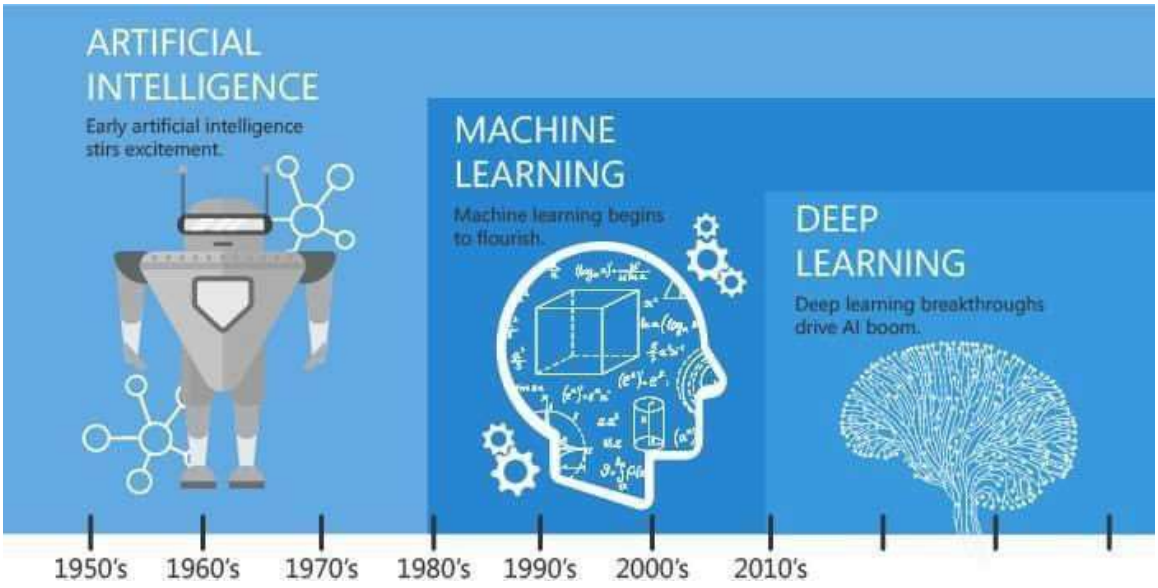


What is Machine Learning ?

Machine learning (ML) is a branch of artificial intelligence (AI) that enables computers to self- learn and improve over time without being explicitly programmed. In short, machine learning algorithms are able to detect and learn from patterns in data and make their own predictions.

While artificial intelligence and machine learning are often used interchangeably, they are two different concepts. AI is the broader concept – machines making decisions, learning new skills, and solving problems in a similar way to humans – whereas machine learning is a subset of AI that enables intelligent systems to autonomously **learn new things from data.**

Instead of programming machine learning algorithms to perform tasks, you can feed them examples of **labeled data** (known as **training data**), which helps them make calculations, process data, and identify patterns automatically.



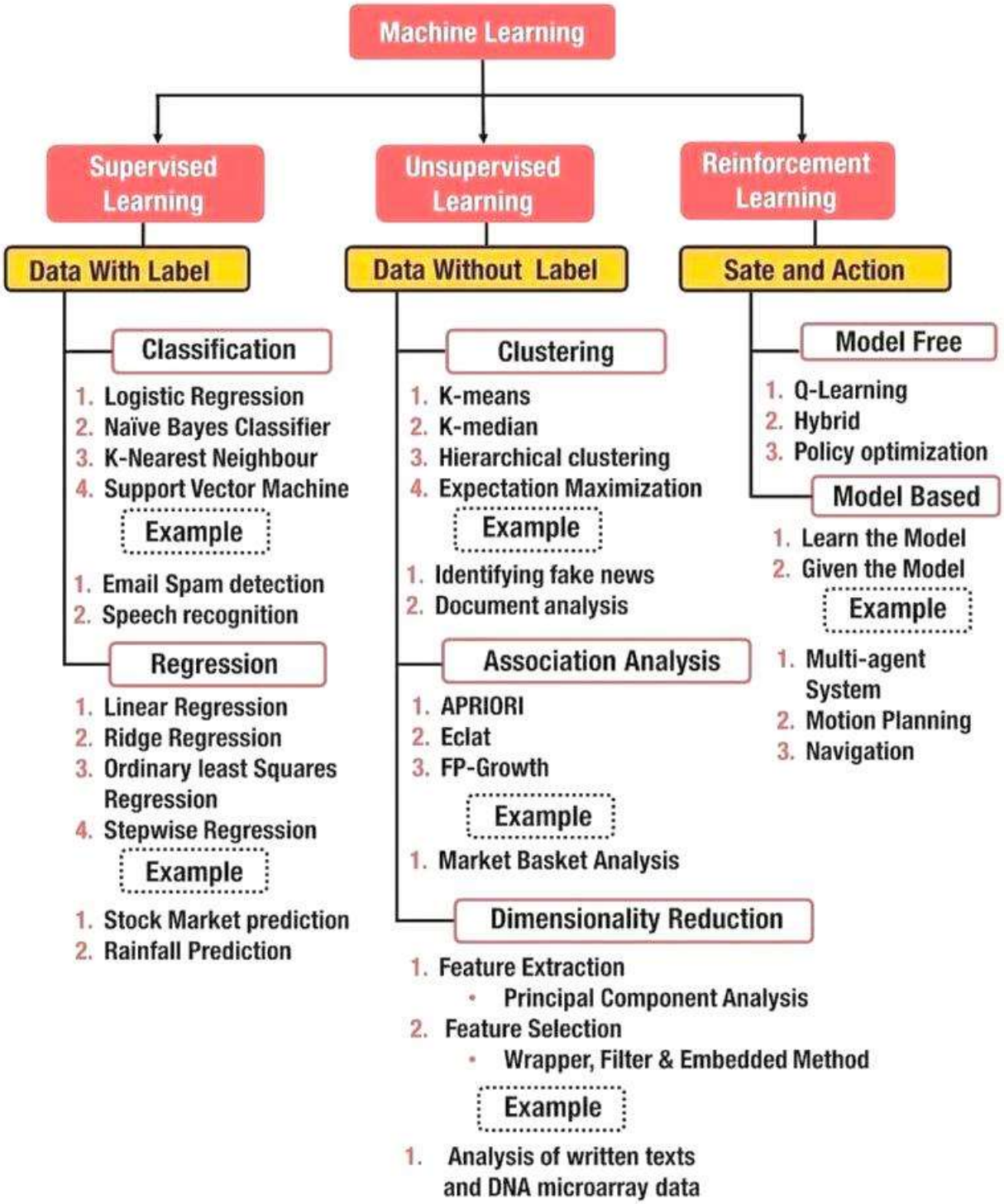
Machine Learning Methods

There are different machine learning methods, the most common of which are:

Supervised Learning

Unsupervised Learning

Reinforcement Learning


Machine Learning
Supervised Learning
Unsupervised Learning
Reinforcement Learning
Data With Label
Data Without Label
Sate and Action
Classification
1. Logistic Regression
2. Naïve Bayes Classifier
3. K-Nearest Neighbour
4. Support Vector Machine
Example
1. Email Spam detection
2. Speech recognition
Regression
1. Linear Regression
2. Ridge Regression
3. Ordinary least Squares Regression
4. Stepwise Regression
Example
1. Stock Market prediction
2. Rainfall Prediction
Clustering
1. K-means
2. K-median
3. Hierarchical clustering
4. Expectation Maximization
Example
1. Identifying fake news
2. Document analysis
Association Analysis
1. APRIORI
2. Eclat
3. FP-Growth
Example
1. Market Basket Analysis
Dimensionality Reduction
1. Feature Extraction
• Principal Component Analysis
2. Feature Selection
• Wrapper, Filter & Embedded Method
Example
1. Analysis of written texts and DNA microarray data
Model Free
1. Q-Learning
2. Hybrid
3. Policy optimization
Model Based
1. Learn the Model
2. Given the Model
Example
1. Multi-agent System
2. Motion Planning
3. Navigation

Supervised Learning

Supervised learning algorithms make predictions based on labeled training data. Each training sample includes an input and a desired output. A supervised learning algorithm analyzes this sample data and makes an inference – basically, an educated guess when determining the labels for unseen data.

This is the most common and popular approach to machine learning. It's "supervised" because these models need to be fed manually tagged sample data so that they can learn from it. For example, if you want to automatically detect spam, you'll need to feed a machine learning algorithm examples of emails that you'd classify as spam and those that are important.

classification

In classification tasks, the output value is a category with a finite number of options. For example, with a sentiment analysis model, you can classify data as positive, negative, or neutral.

Let's say you want to analyze support conversations to understand your client's emotions: are they happy or frustrated after contacting your customer service team? A sentiment analysis classifier can automatically tag responses for you.

Regression

In regression tasks, the expected result is a continuous number. This model is used to predict quantities, such as the probability an event will happen. Predicting the value of a property in a specific neighborhood, or the spread of COVID19 in a particular region are examples of regression problems.

Unsupervised learning

Unsupervised learning algorithms uncover insights and relationships in unlabeled data. In this case, models are fed input data but the desired outcomes are unknown, so they have to make inferences based on circumstantial evidence, without any guidance or training.

One of the most common types of unsupervised learning is clustering, which consists of grouping similar data. This method is mostly used for exploratory analysis and can help you detect hidden patterns or trends.

For example, the marketing team of an e-commerce company can use clustering to improve customer segmentation. Given a set of income and spending data, a machine learning model can identify groups of customers with similar behaviors.

Reinforcement learning

Reinforcement learning (RL) is concerned with how a software agent (or computer program) ought to act in a situation to maximize the reward.

In short, reinforced machine learning models attempt to determine the best possible path they should take in a given situation. They do this through trial and error. Since there is no training data, machines learn from their own mistakes and choose the actions that lead to the best solution or maximum reward.

This machine learning method is mostly used in robotics and gaming. Video games demonstrate a clear relationship between actions and results, and can measure success by keeping score. Therefore, they're a great way to improve reinforcement learning algorithms.

Machine Learning Workflow

The workflow for ML begins with gathering data from different resources or sensors. The second step is cleaning data from errors and correlation for generating homogenous data. The model generation is an important process that is performed with correct calculations to get a suitable model. Gaining insights from the outcomes is the next step after arriving at the model that must be evaluated and checked. The last step is to look at the information as a whole and arrive at a suitable decision.