UNIT 1

INTRODUCTION TO MACHINE LEARNING

1. Machine Learning

- Machine Learning **allows machine to learn** and **make decisions smartly**.
- In Machine Learning, machines can learn from the data provided or their own experience. It depends upon the type of machine learning.
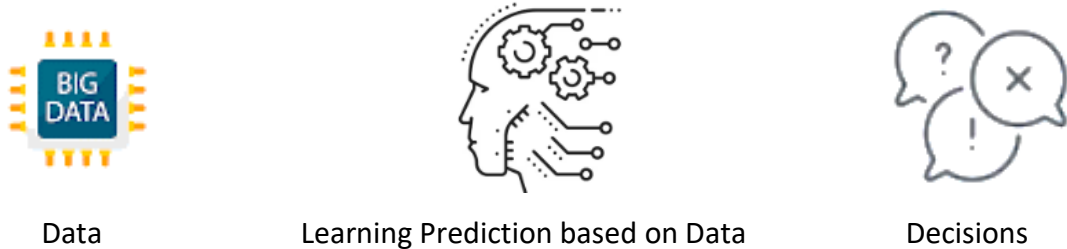
Data	Learning Prediction based on Data	Decisions

Figure 1.1 Machine Learning Work.

2 x 1 = 2
2 x 2 = 4
2 x 3 = 6
2 x 4 = ?   i.e., data patterns

- Machine learning analyzes patterns in data and predicts unknown values based on learned patterns.

  2x + 2 = ? (i.e., called ML Model)
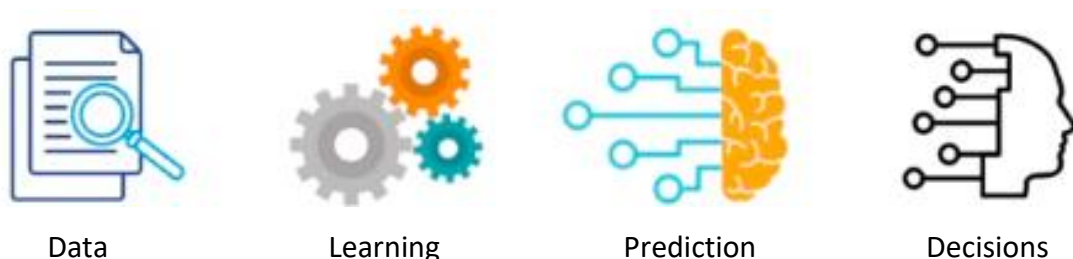
- Machine learning is completed in four steps:

Data	Learning	Prediction	Decisions

Figure 1.2 Machine Learning Steps.

2. Types of Machine Learning

2.1. Supervised

- Work under supervision (here, supervisor means labeled of data)
- Teacher teaches

- Labeled data means the machine or algorithm learns from labelled data with a predefined output or target variable.
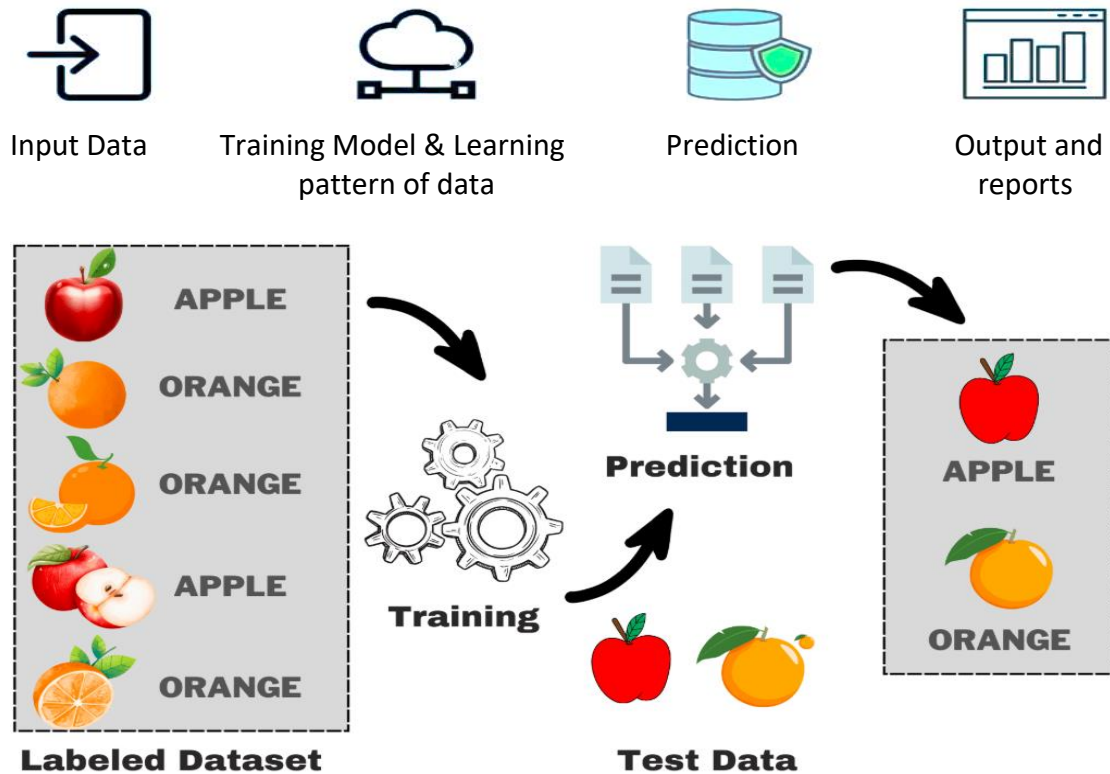- Prediction
- Outcome

Input Data   Training Model & Learning pattern of data   Prediction   Output and reports

Figure 2.1.1 Supervised Learning.

2.1.1. Types of Supervised

2.1.1.1 Classification

- If the unknown value/quantity to be predicted is a **categorical variable**, the process is called classification.

2.1.1.2 Regression

- If the unknown value/quantity to be predicted is a **numeric variable**, the process is called regression.

2.1.2. Supervised Learning Algorithms

1. Logistic Regression
2. K-Nearest Neighbors (K-NN)
3. Support Vector Machine (SVM)
4. Kernel SVM

5. Naive Bayes

6. Decision Tree Classification

7. Random Forest Classification

8. Many more…

2.2. Unsupervised

- No supervision

- No teacher

- Self-learning

- Find pattern by itself

- No labelling of data means machine/algorithm learn from unlabeled data without any predefine output or target variable.
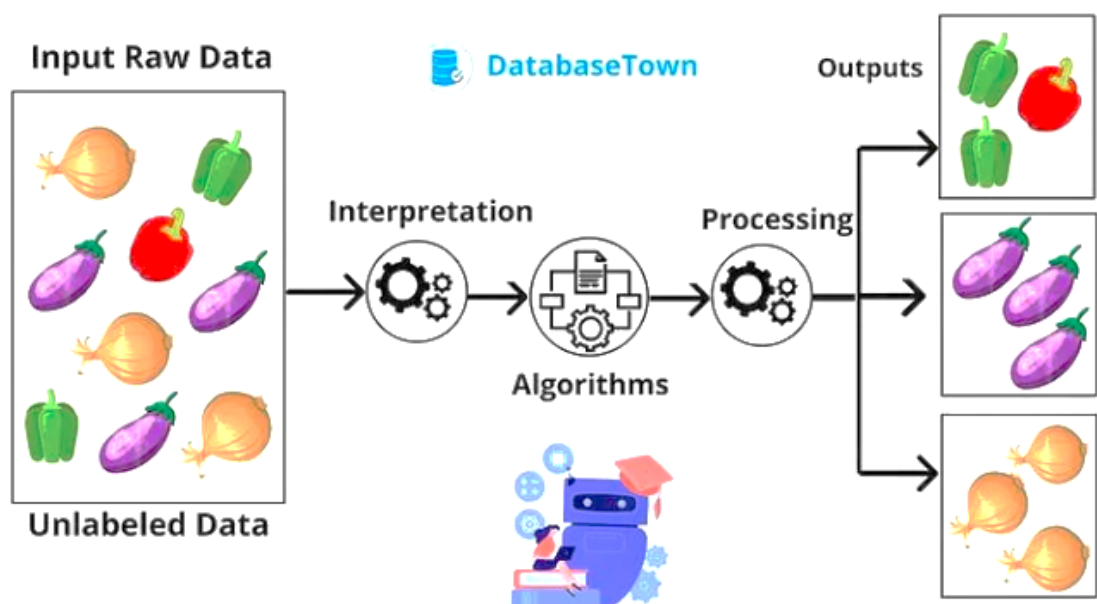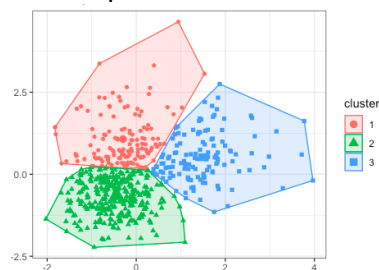

| Input Data | Training Model & Learning pattern of data | Prediction | Output and reports |

Figure 2.2.1 Unsupervised Learning.

2.2.1. Unsupervised Learning Algorithms

1. K-Means Clustering

2. Hierarchical Clustering

3. Probabilistic Clustering (key keywords of Probabilistic Clustering are Probability, likelihood, mixture model, latent variables, soft clustering, membership probability, expectation–maximization (EM), Gaussian Mixture Model (GMM), density estimation, uncertainty.)

4. Many more…

2.3.   Semisupervised

- Mixture of supervised and unsupervised.
- Some data is labelled and most isn't.

| Input Data | Training Model & Learning pattern of data | Prediction | Output and reports |

Figure 2.3.1 Semisupervised Learning.

2.4.   Reinforcement

- Hit and Trail learning
- Algorithms learn from mistakes
- Reward and Punishment rule (Drive rules and make policies)
- Prediction based on rewards and punishment (i.e., autonomous driving cars, reinforcement learning mostly used in gaming industry, 3d animation, etc.)
- Depends on feedback

| Input Data | Training Model & Learning | Prediction | Output and |

Figure 2.4.1 Reinforcement Learning.

2.4.4. Reinforcement Learning Algorithms

1. Model-Free Reinforcement Learning

- Policy Optimization
- Q-Learning
2. Model-Based Reinforcement Learning
   - Learn the Model
   - Given the Model
3. Many more…