

# Introduction 2 Machine Learning

## Unit-1

Prof. Rajesh Pradhan

After end of this presentation we will able to learn...

01

Overview of Human  
Learning and  
Machine Learning

02

Types of Machine  
Learning

03

Applications of  
Machine Learning

04

Tools and  
Technology For  
Machine Learning

05

Q&A

06

Conclusions

+++

# 01

## Overview of Human Learning and Machine Learning

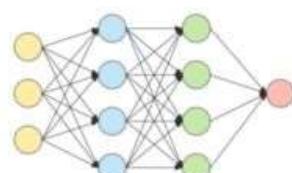
### Human Learning



Intelligence



### Machine Learning



Learning materials



Data



Learning skills



Skillearn

- Learning by creating tests
- Interleaving learning
- Learning by ignoring
- ...

# Human Learning Vs Machine Learning



**Human Learning**



**Machine Learning**

## Human Learning Vs Machine Learning

Definition:

- Human learning is the process by which individuals acquire knowledge, skills, and attitudes through experience, observation, and interaction with their environment.
- Machine learning is a subset of artificial intelligence that involves the use of algorithms and statistical models to enable machines to learn from data without being explicitly programmed.

# **Human Learning Vs Machine Learning**

## **Input:**

Human learning requires sensory input, such as sight, sound, touch, taste, and smell, to gather information about the world.

Machine learning relies on data, which can be structured or unstructured, to train the algorithms and models.

# **Human Learning Vs Machine Learning**

## **Adaptability:**

Humans can adapt to new situations and environments, and modify their behavior accordingly.

Machine learning models are designed to adapt to changes in the data and adjust their predictions or decisions accordingly.



## **Human Learning Vs Machine Learning**

Creativity:

Human learning allows for creativity and innovation, as individuals can generate new ideas and approaches based on their experiences and knowledge.

Machine learning is limited to the data it has been trained on and can only make predictions based on that data.

## **Human Learning Vs Machine Learning**

Bias:

Human learning can be biased based on personal experiences, beliefs, and social conditioning.

Machine learning can also be biased if the data used to train the models is biased.



# **Human Learning Vs Machine Learning**

## **Interpretability:**

Humans can explain the reasoning behind their decisions and thought processes.

Machine learning models can be difficult to interpret, as they may rely on complex algorithms and neural networks.

# **Human Learning Vs Machine Learning**

## **Time and Efficiency:**

Human learning can be time-consuming and requires a lot of practice and repetition to master a skill.

Machine learning can process large amounts of data quickly and make predictions or decisions in real-time.



## **Human Learning Vs Machine Learning**

### **Emotions:**

Human learning can be influenced by emotions such as fear, anxiety, and stress.

Machine learning models do not have emotions and make decisions based solely on data.

## **Human Learning Vs Machine Learning**

### **Collaboration:**

Human learning can involve collaboration with others, such as teachers, mentors, and peers.

Machine learning can also involve collaboration, as multiple models can be combined to improve performance.



# **Human Learning Vs Machine Learning**

**Continual Improvement:**

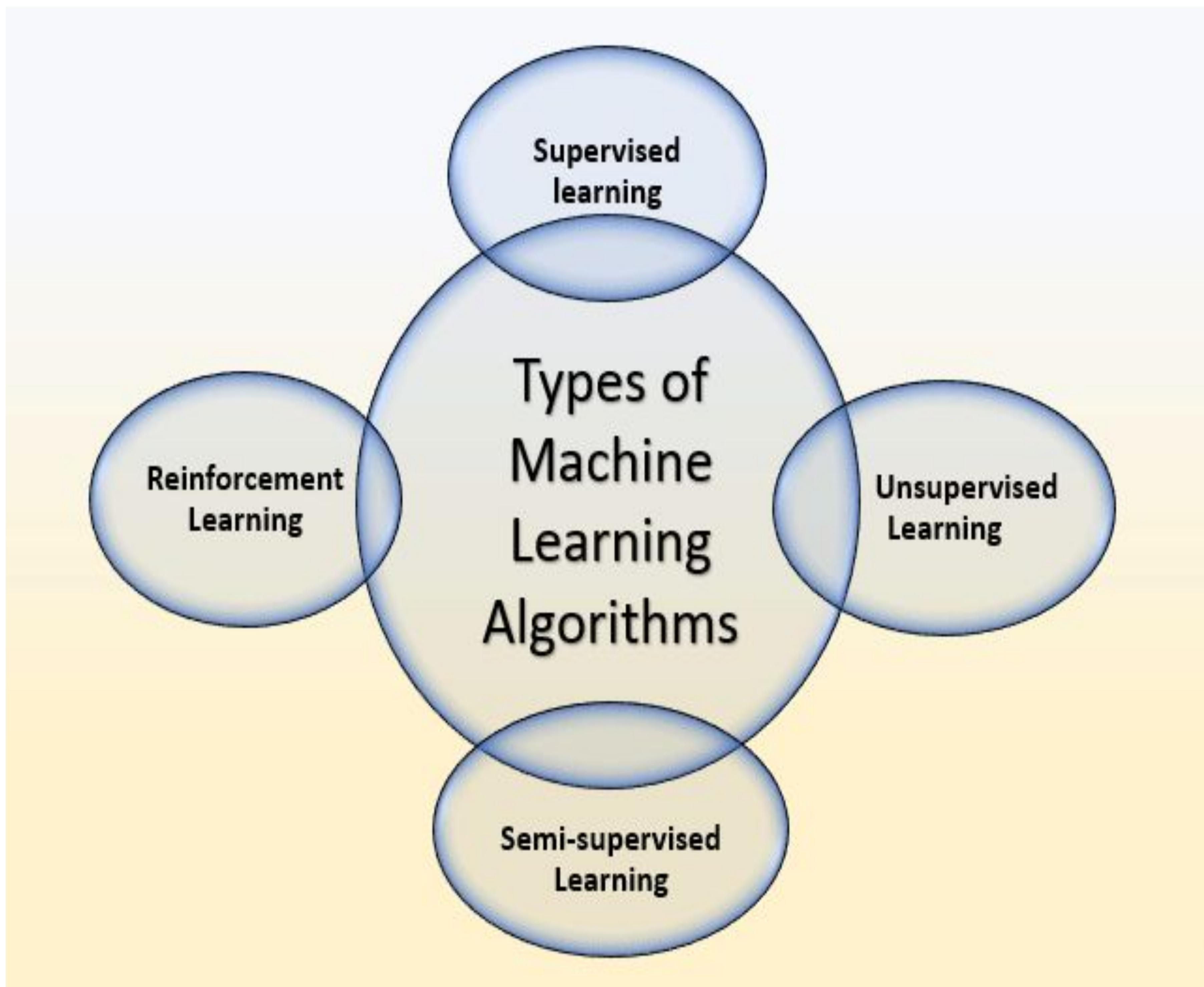
Humans can continue to learn and improve throughout their lifetime.

Machine learning models require updates and retraining to improve their performance.

## **Notes**

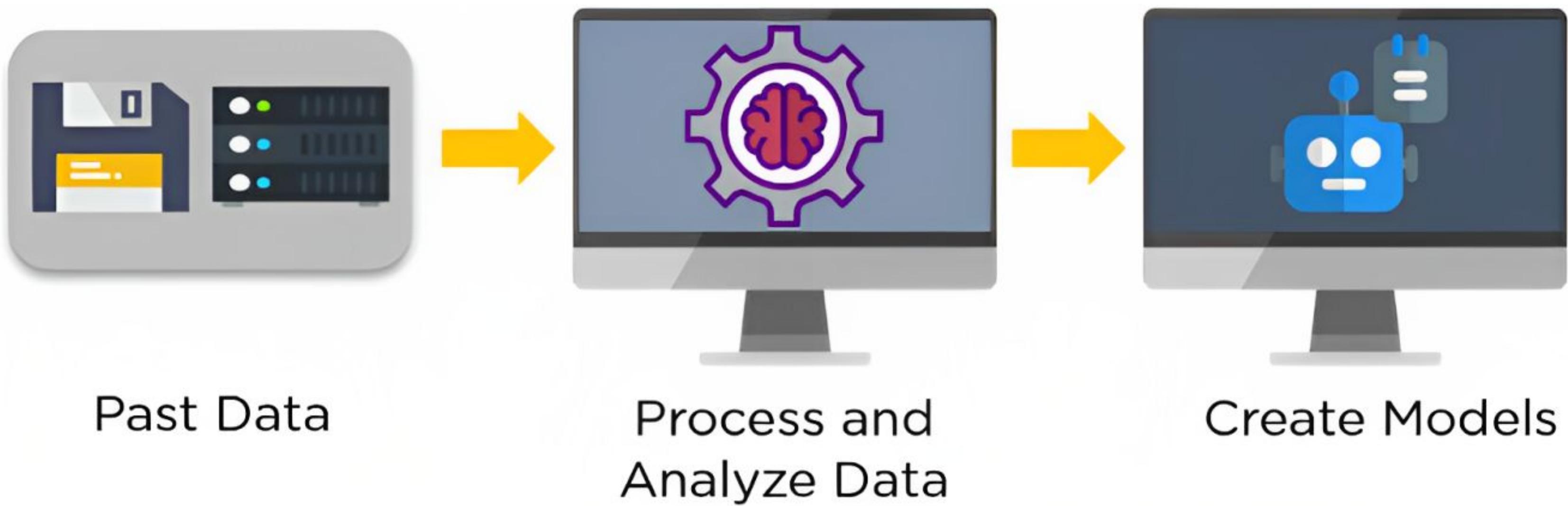
# Types of Machine Learning

Prof. Rajesh Pradhan



# What is Machine learning ?

- Machine learning is an **application of Artificial Intelligence** that enables systems to learn from vast volumes of data and solve specific problems.
- It uses computer **algorithms** that improve their efficiency automatically through experience.

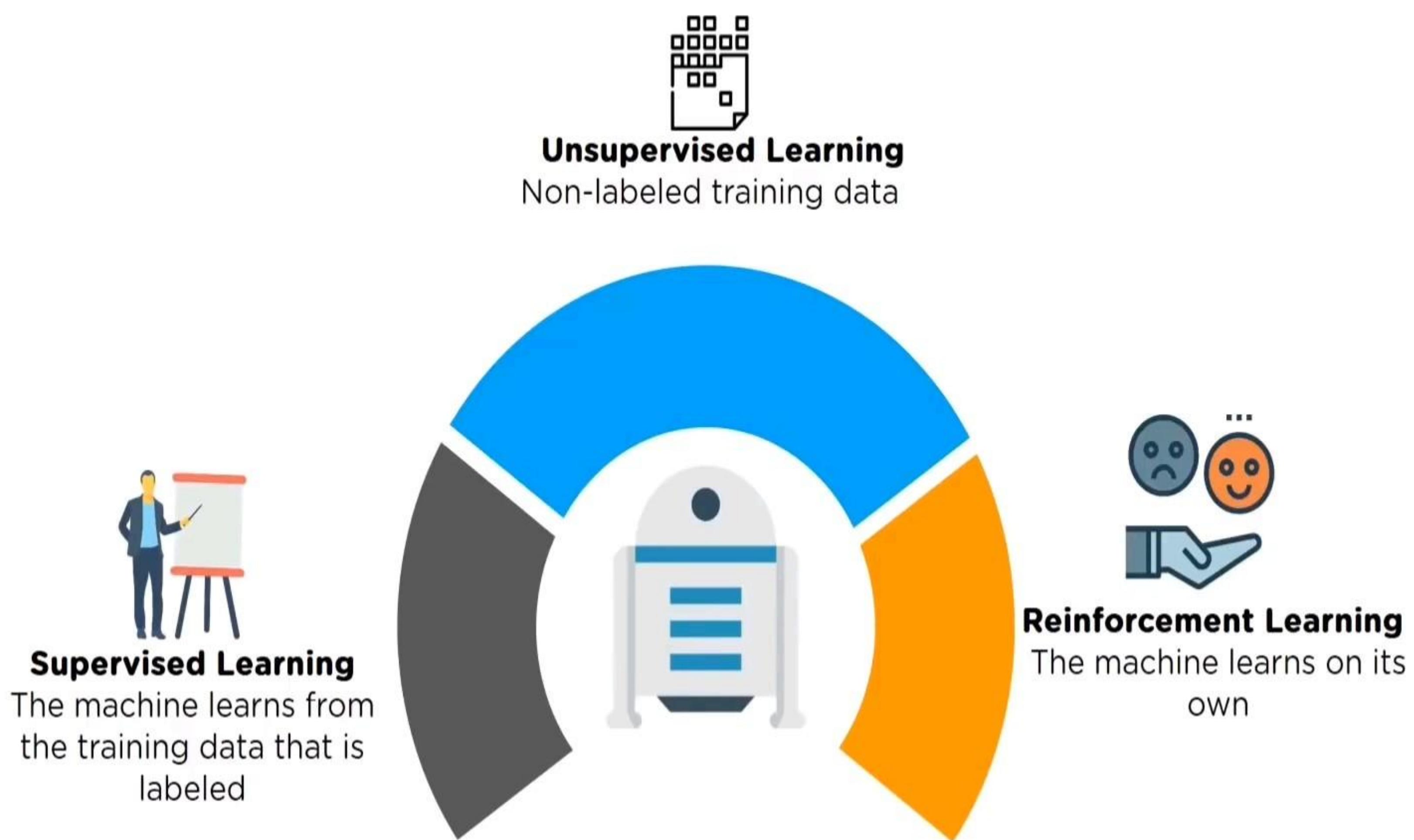


- There are three types of machine learning:

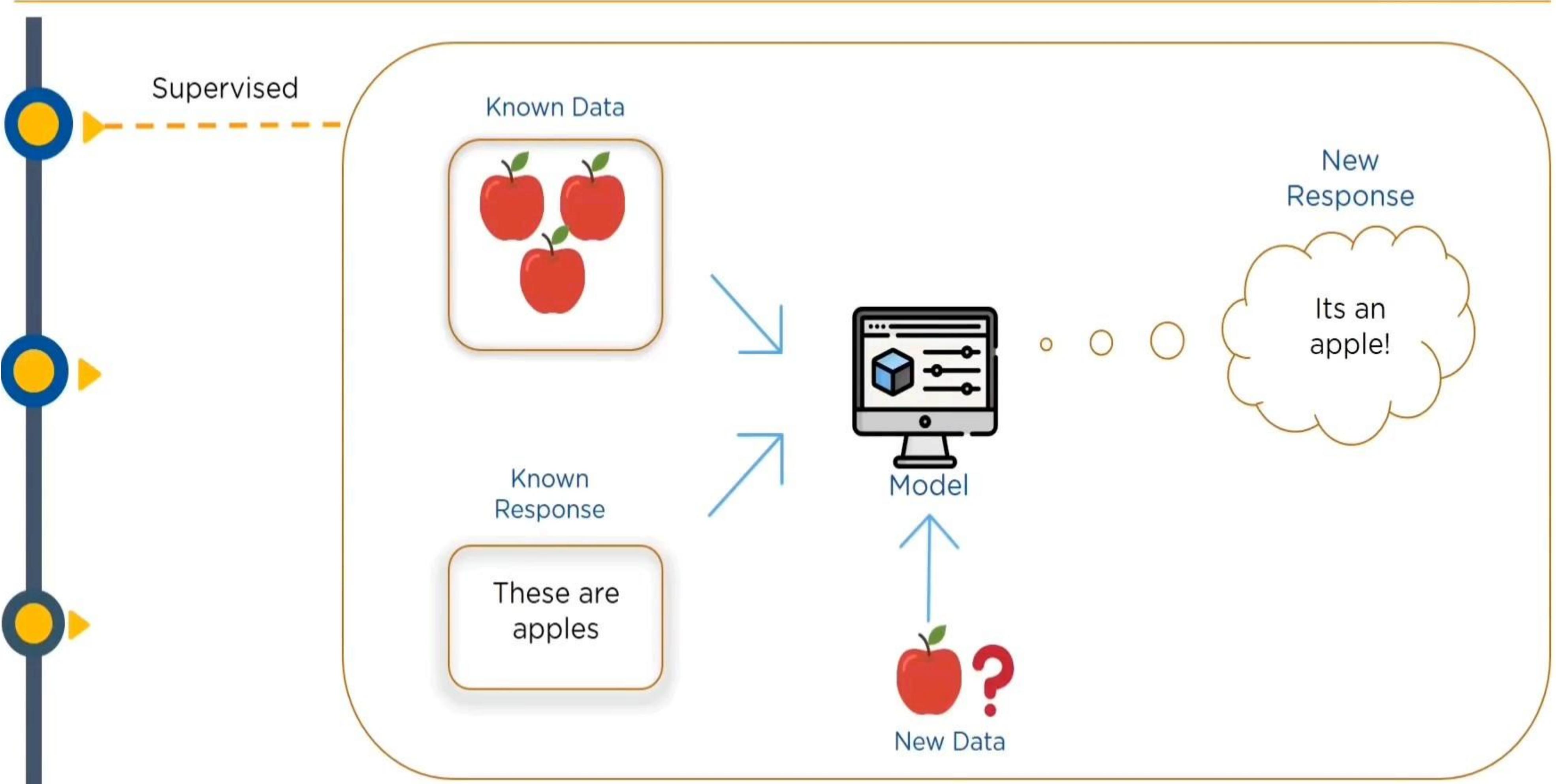
## Types of Machine Learning



# Types of Machine Learning

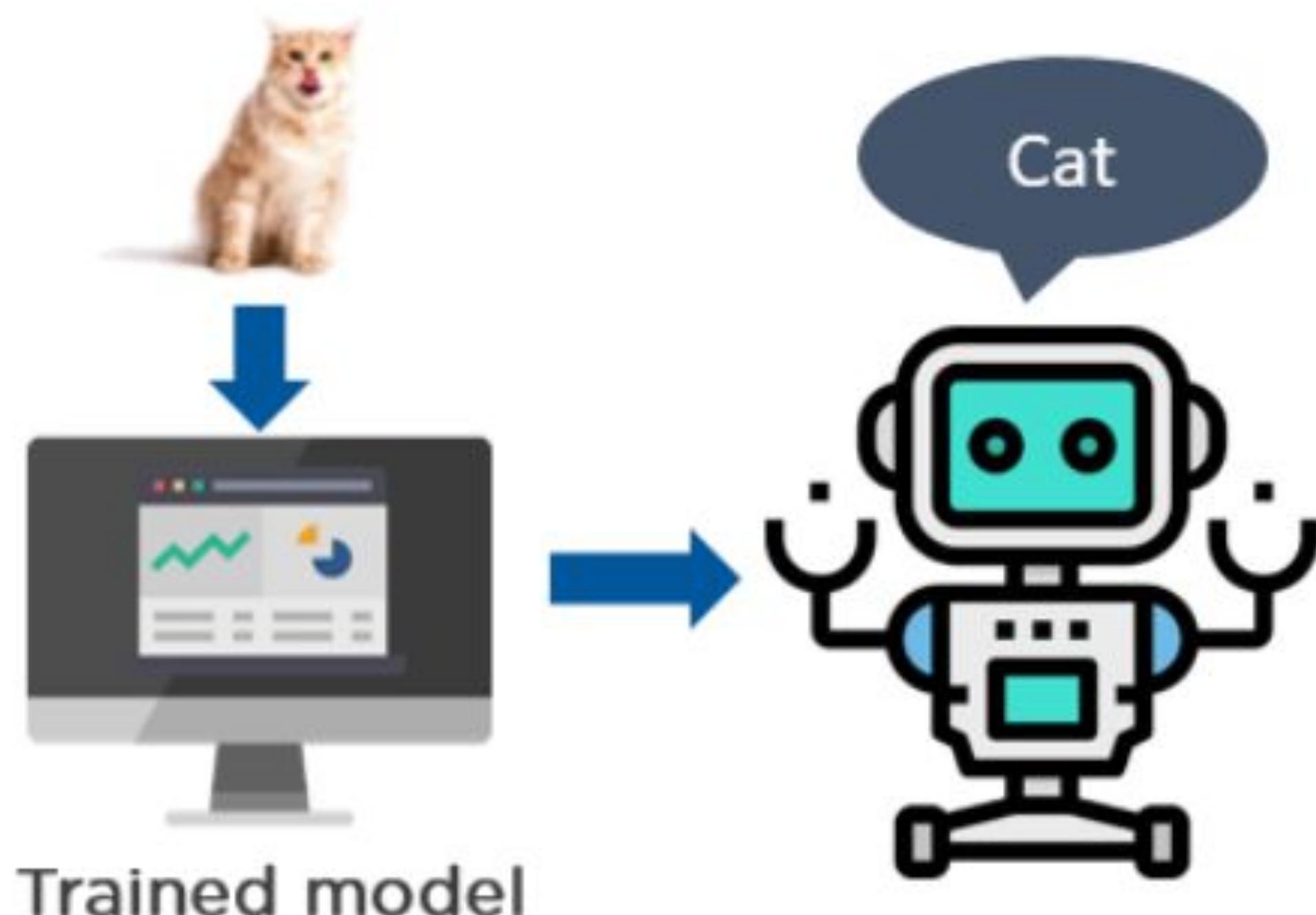


# Types of Machine Learning



# Supervised machine learning ?

- Supervised learning is a type of machine learning that uses **labeled data** to train machine learning models. In labeled data, the output is already known. The model just needs to map the inputs to the respective outputs.
- An example of supervised learning is to train a system that identifies the image of an animal.
- Attached below, you can see that we have our trained model that identifies the picture of a cat.



# **ALGORITHMS:**

Some of the most popularly used supervised learning algorithms are:

- Linear Regression
- Logistic Regression
- Support Vector Machine
- K Nearest Neighbor
- Decision Tree
- Random Forest
- Naive Bayes

# **WORKING:**

- Supervised learning algorithms take labeled inputs and map them to the known outputs, which means you already know the target variable.
- Now, let's focus on the training process for the supervised learning method.
- Supervised Learning methods need external supervision to train machine learning models. Hence, the name supervised. They need guidance and additional information to return the desired result.



# APPLICATIONS:

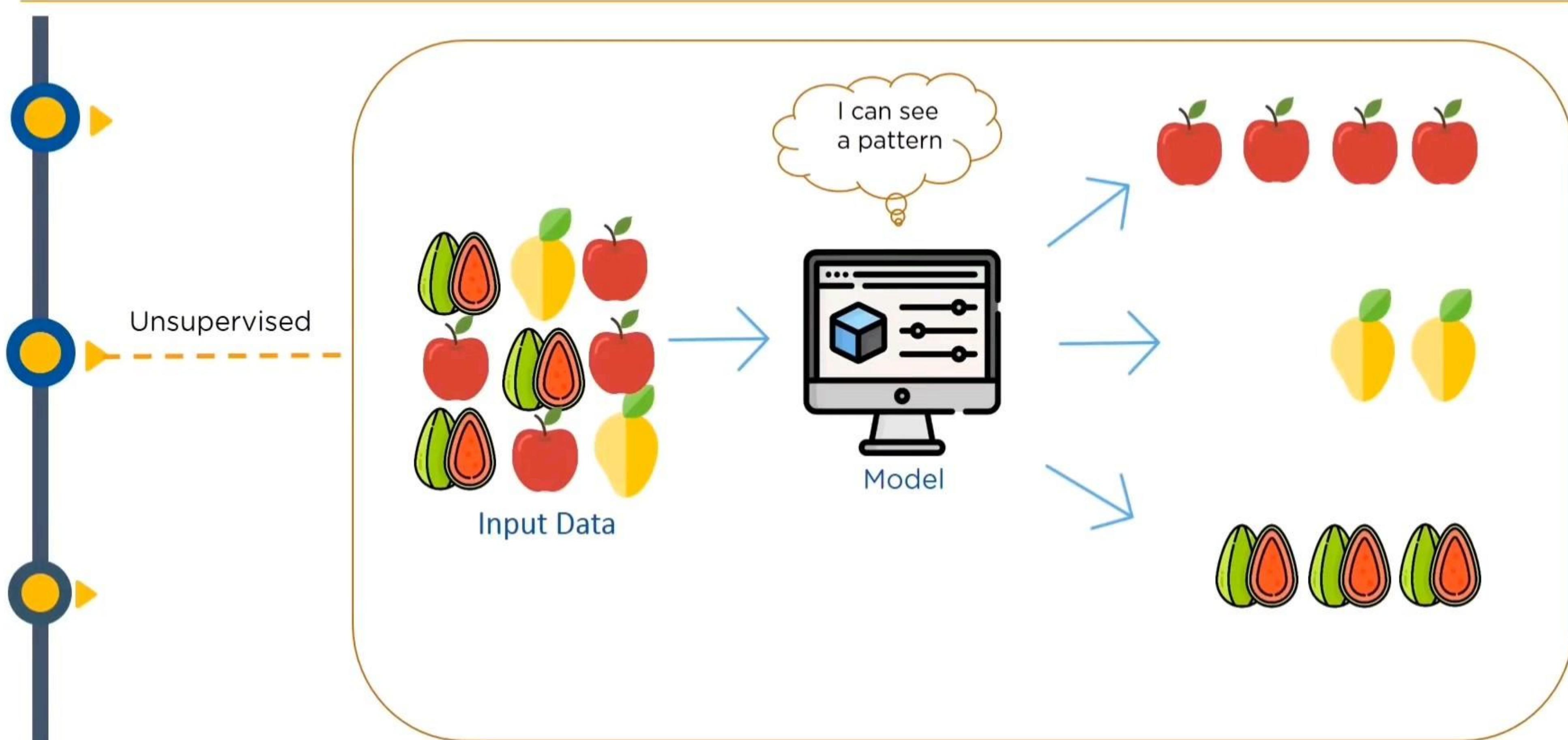
Supervised learning algorithms are generally used for solving classification and regression problems.



Few of the top supervised learning applications are weather prediction, sales forecasting, stock price analysis.

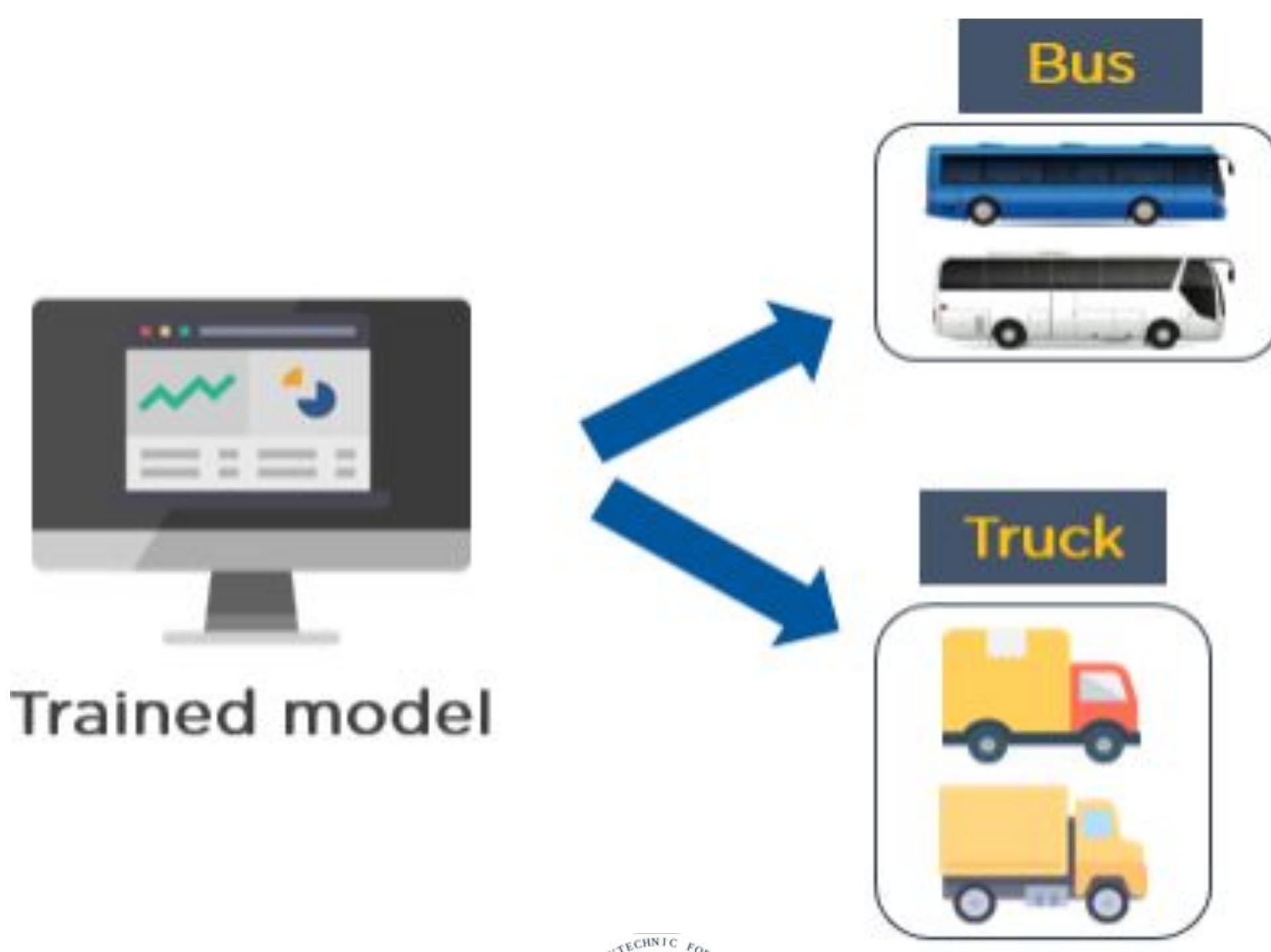


## Types of Machine Learning



# Unsupervised machine learning

- ❑ Unsupervised learning is a type of machine learning that **uses unlabeled data** to train machines. Unlabeled data doesn't have a fixed output variable. The model learns from the data, discovers the patterns and features in the data, and returns the output.
- ❑ Depicted below is an example of an unsupervised learning technique that uses the images of vehicles to classify if it's a bus or a truck. The model learns by identifying the parts of a vehicle, such as a length and width of the vehicle, the front, and rear end covers, roof hoods, the types of wheels used, etc. Based on these features, the model classifies if the vehicle is a bus or a truck



# ALGORITHMS :

Selecting the right algorithm depends on the type of problem you are trying to solve. Some of the common examples of unsupervised learning are:

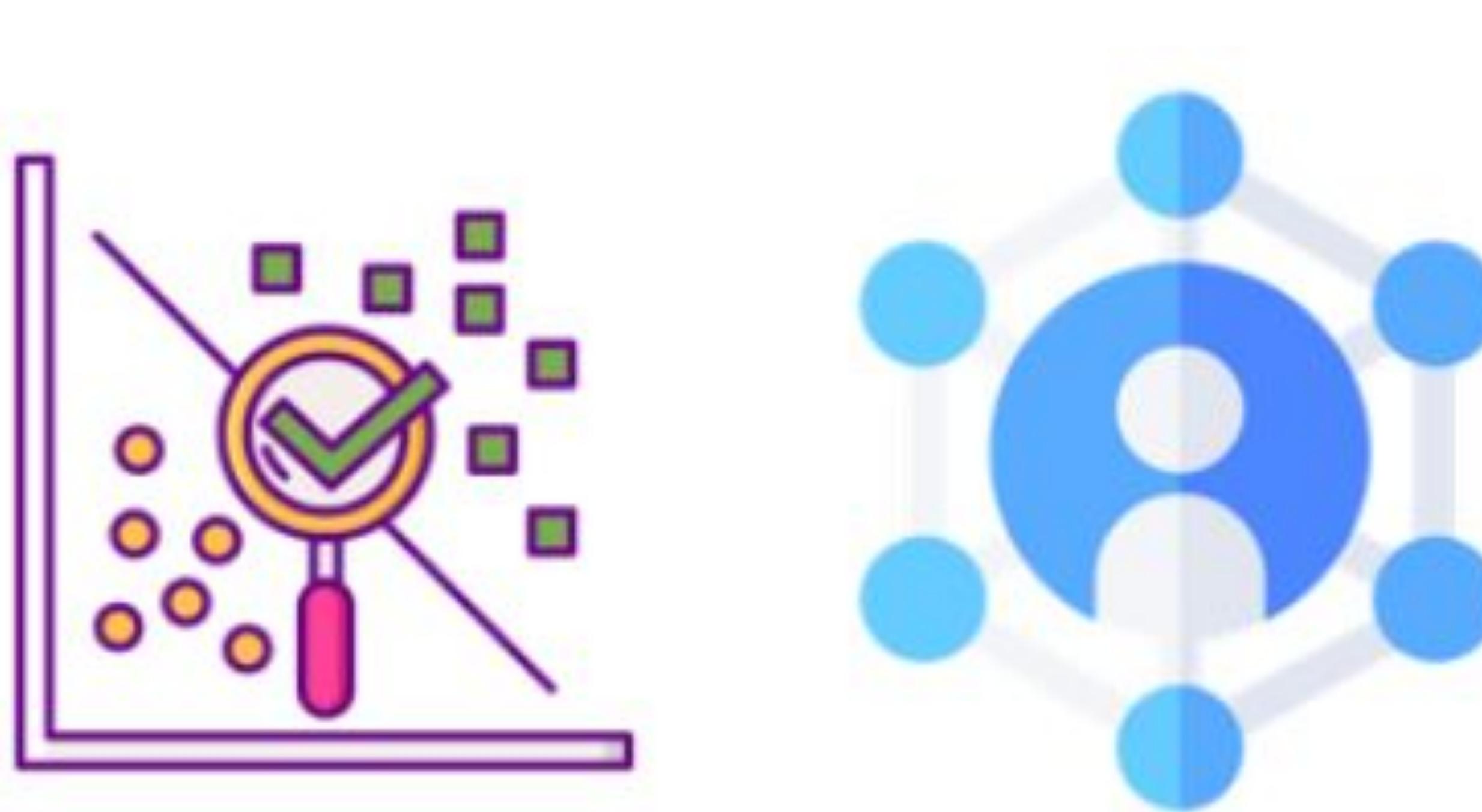
- K Means Clustering
- Hierarchical Clustering
- DBSCAN
- Principal Component Analysis

# WORKING :

- Unsupervised learning finds patterns and understands the trends in the data to discover the output. So, the model tries to label the data based on the features of the input data.
- The training process used in unsupervised learning techniques does not need any supervision to build models. They learn on their own and predict the output.

# APPLICATIONS :

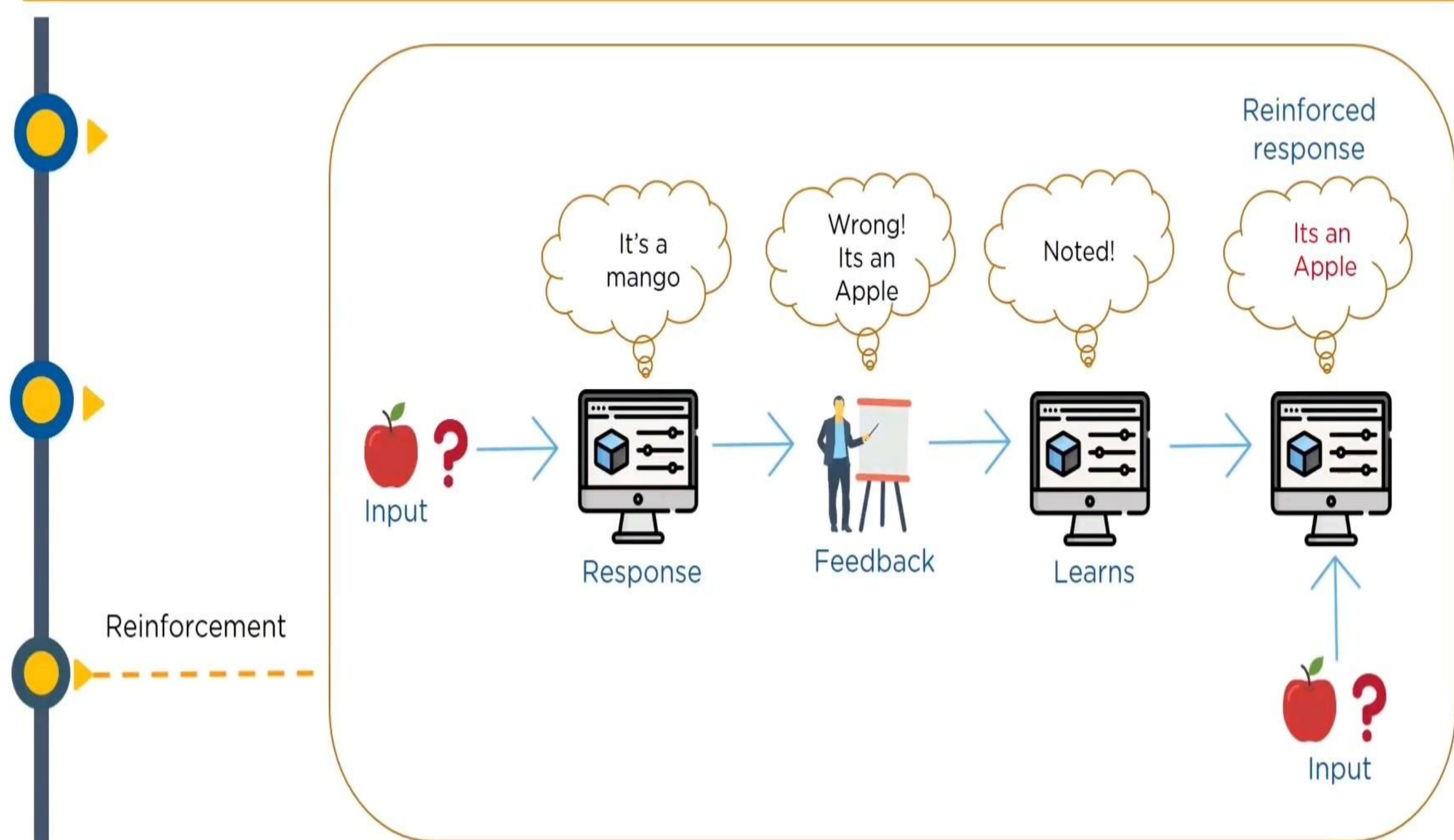
Unsupervised learning is used for **solving clustering and association problems.**



One of the applications of unsupervised learning is **customer segmentation**. Based on customer behavior, likes, dislikes, and interests, you can segment and cluster similar customers into a group. Another example where unsupervised learning algorithms are used is used churn rate analysis.

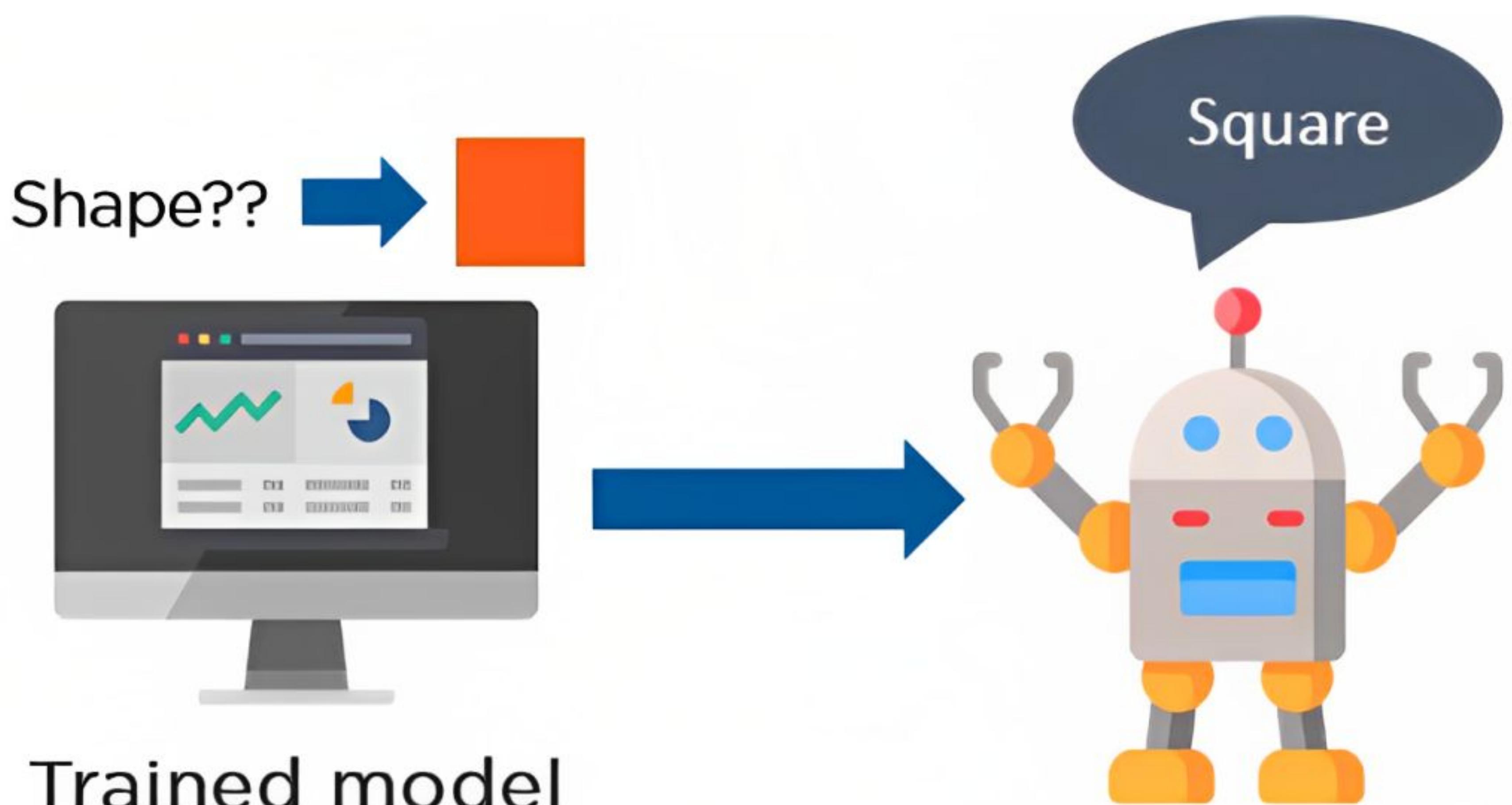


## Types of Machine Learning



# Reinforcement machine learning

- ❑ Reinforcement Learning trains a machine to take suitable actions and maximize its rewards in a particular situation.
- ❑ It uses an agent and an environment to produce actions and rewards. The agent has a start and an end state. But, there might be different paths for reaching the end state, like a maze. In this learning technique, there is no predefined target variable.
- ❑ An example of reinforcement learning is to train a machine that can identify the shape of an object, given a list of different objects. In the example shown, the model tries to predict the shape of the object, which is a square in this case.



# ALGORITHMS :

Some of the important reinforcement learning algorithms are:

- Q-learning
- Sarsa
- Monte Carlo
- Deep Q network

## WORKING:

- Reinforcement learning follows **trial and error methods to get the desired result**. After accomplishing a task, the agent receives an award. An example could be to train a dog to catch the ball. If the dog learns to catch a ball, you give it a reward, such as a biscuit.
- Reinforcement Learning methods *do not need any external supervision to train models*.
- Reinforcement learning problems are reward-based. For every task or for every step completed, there will be a reward received by the agent. If the task is not achieved correctly, there will be some penalty added

## APPLICATIONS:

Reinforcement learning algorithms are widely used in the **gaming industries to build games**. It is also used to train robots to do human tasks.



# Semi-Supervised learning

- **Semi-Supervised learning is a type of Machine Learning algorithm that lies between Supervised and Unsupervised machine learning.**
- It represents the intermediate ground between Supervised (With Labelled training data) and Unsupervised learning (with no labelled training data) algorithms and uses the combination of labelled and unlabeled datasets during the training period.
- Although Semi-supervised learning is the middle ground between supervised and unsupervised learning and operates on the data that consists of a few labels, it mostly consists of unlabeled data.
- As labels are costly, but for corporate purposes, they may have few labels. It is completely different from supervised and unsupervised learning as they are based on the presence & absence of labels.



# Semi-Supervised learning

- To overcome the drawbacks of supervised learning and unsupervised learning algorithms, the concept of **Semi-supervised learning** is introduced.
- The main aim of **semi-supervised learning** is to effectively use all the available data, rather than only labelled data like in supervised learning.
- Initially, similar data is clustered along with an unsupervised learning algorithm, and further, it helps to label the unlabeled data into labelled data.
- It is because labelled data is a comparatively more expensive acquisition than unlabeled data.



# Semi-Supervised learning

- We can imagine these algorithms with an example. Supervised learning is where a student is under the supervision of an instructor at home and college.
- Further, if that student is self-analysing the same concept without any help from the instructor, it comes under unsupervised learning. Under semi-supervised learning, the student has to revise himself after analyzing the same concept under the guidance of an instructor at college.

## Advantages :

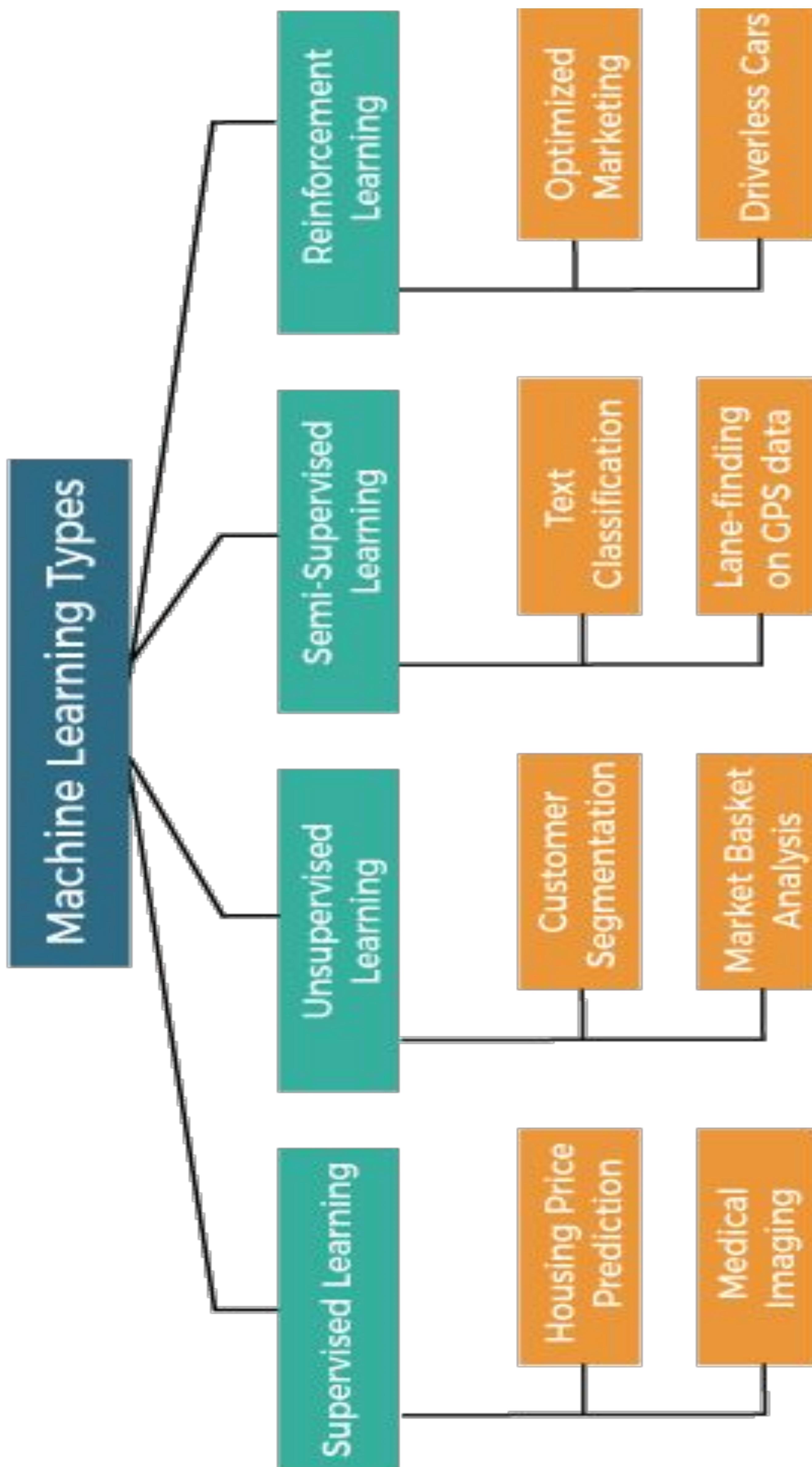
- It is simple and easy to understand the algorithm.
- It is highly efficient.
- It is used to solve drawbacks of Supervised and Unsupervised Learning algorithms.

## Disadvantages :

- Iterations results may not be stable.
- We cannot apply these algorithms to network-level data.
- Accuracy is low.



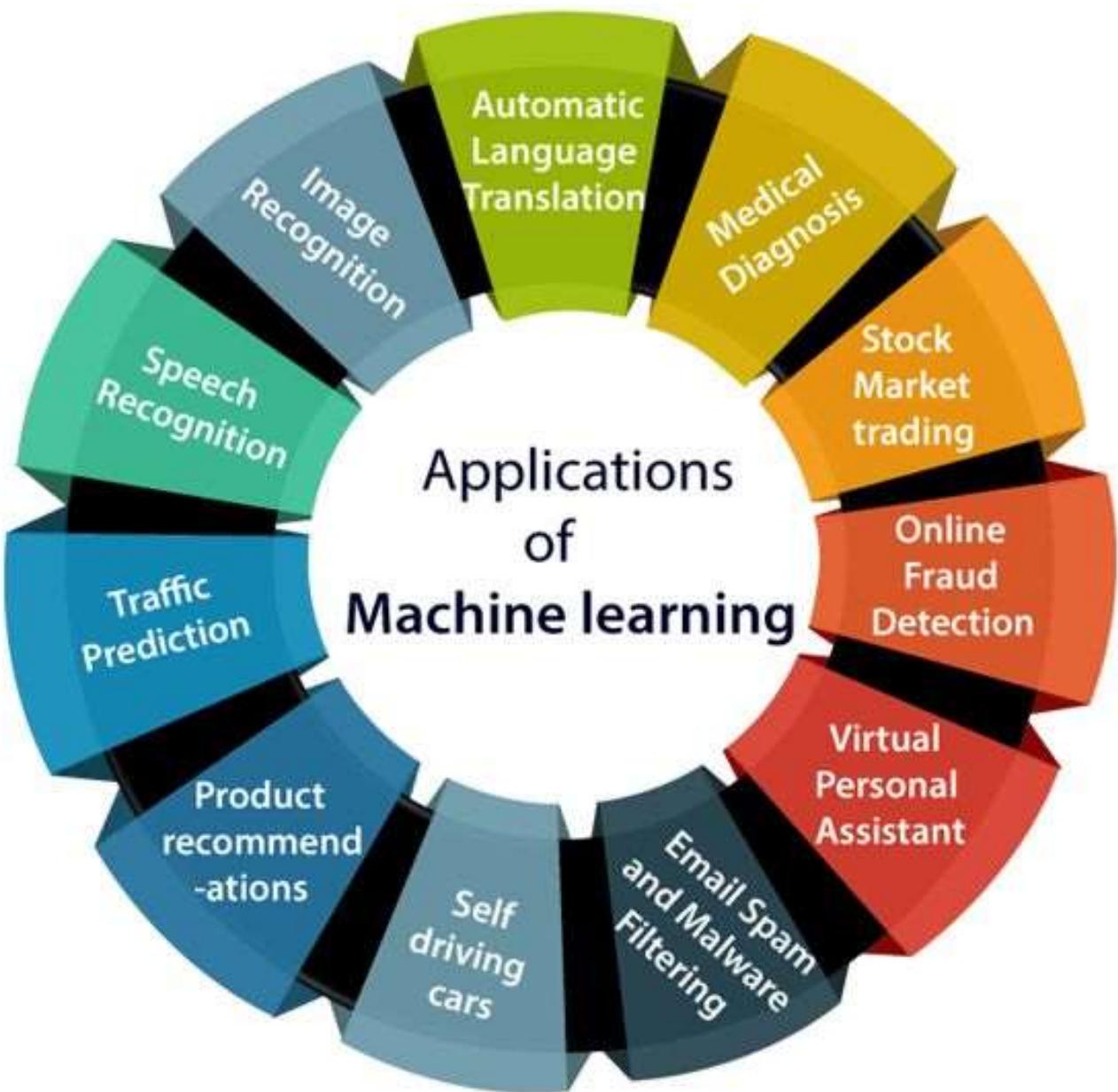
# Conclusion :



# References :

- <https://www.simplilearn.com/tutorials/machine-learning-tutorial/types-of-machine-learning>
- <https://www.javatpoint.com/types-of-machine-learning>

## Notes



**Prof. Rajesh Pradhan**

# 1. Traffic Alerts (Maps)

- Now, **Google Maps** is probably **THE** app we use whenever we go out and require assistance in directions and traffic.
- The other day I was traveling to another city and took the expressway and Maps suggested: "**Despite the Heavy Traffic, you are on the fastest route**". But, How does it know that?



- Everyone using maps is providing their location, average speed, the route in which they are traveling which in turn helps Google collect massive Data about the traffic, which makes them predict the upcoming traffic and adjust your route according to it.



## 2. Social Media (Facebook)

- Social media platforms use machine learning algorithms and approaches to create some attractive and excellent features.
- For instance, Facebook notices and records your activities, chats, likes, and comments, and the time you spend on specific kinds of posts.
- **Machine learning** learns from your own experience and makes friends and page suggestions for your profile.

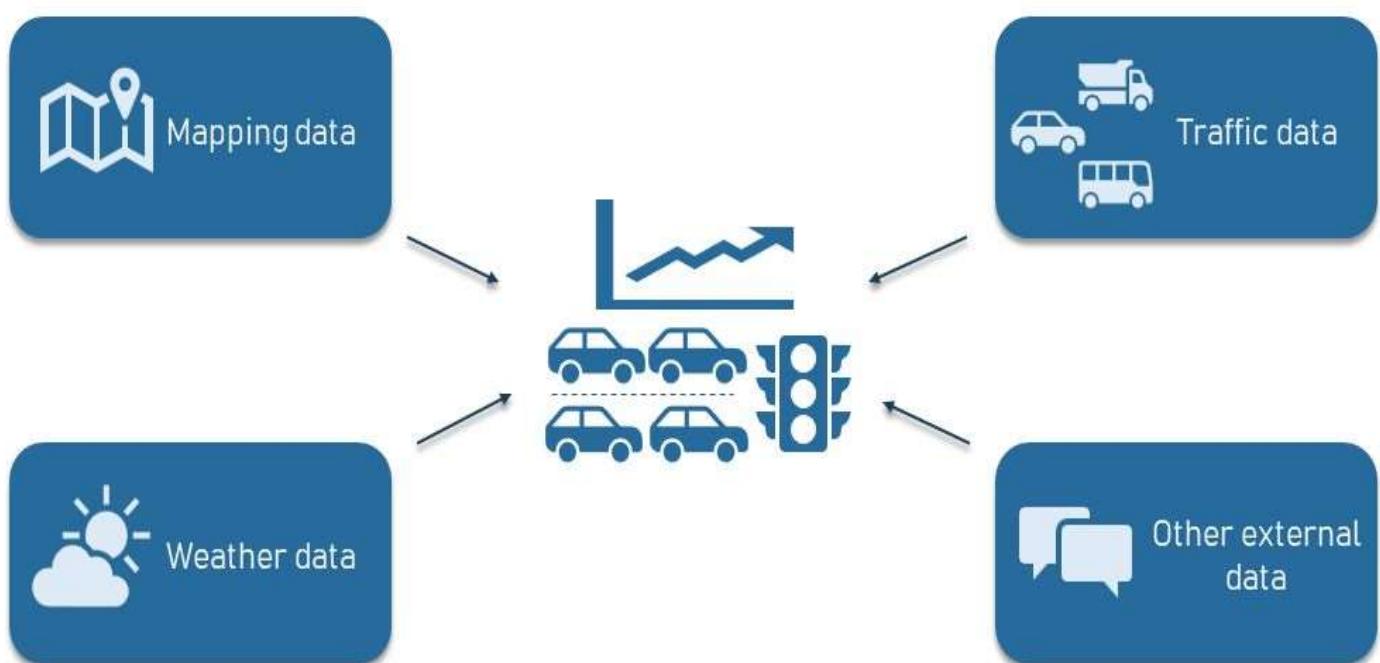


- One of the most common applications of Machine Learning is **Automatic Friend Tagging Suggestions** in Facebook or any other social media platform.
- Facebook uses **face detection** and **Image recognition** to automatically find the face of the person which matches its Database and hence suggests us to tag that person based on DeepFace.

### 3. Traffic Prediction :

- If we want to visit a new place, we take help of Google Maps, which shows us the correct path with the shortest route and predicts the traffic conditions.
- It predicts the traffic conditions such as whether traffic is cleared, slow-moving, or **heavily congested with the help of two way :**
  - a. **Real Time location** of the vehicle form Google Map app and sensors.
  - b. **Average time has taken** on past days at the same time.

#### DATA NEEDED FOR TRAFFIC PREDICTION



# 4. Product Recommendations:

- Machine learning is widely used by various e-commerce and entertainment companies such as **Amazon**, **Netflix**, etc., for product recommendation to the user.
- Whenever we search for some product on Amazon, then we started getting an advertisement for the same product while internet surfing on the same browser and this is because of machine learning.



- Google understands the user interest using various machine learning algorithms and suggests the product as per customer interest.
- As similar, when we use Netflix, we find some recommendations for entertainment series, movies, etc., and this is also done with the help of machine learning.

## 5. Self-Driving Cars:

- One of the most exciting applications of machine learning is self-driving cars.
- Machine learning plays a significant role in self-driving cars.
- Tesla, the most popular car manufacturing company is working on self-driving car.
- It is using unsupervised learning method to train the car models to detect people and objects while driving.



## 6. Email Spam and Malware Filtering:

- Whenever we receive a new email, it is filtered automatically as important, normal, and spam.
- We always receive an important mail in our inbox with the important symbol and spam emails in our spam box, and the technology behind this is Machine learning.



**Below are some spam filters used by Gmail:**

- **Content Filter**
- **Header filter**
- **General blacklists filter**
- **Rules-based filters**
- **Permission filters**



Some machine learning algorithms such as **Multi-Layer Perceptron**, **Decision tree**, and **Naïve Bayes classifier** are used for email spam filtering and malware detection.

# 7. Virtual Personal Assistant:

- We have various virtual personal assistants such as **Google assistant, Alexa, Cortana, Siri.**
- As the name suggests, they help us in finding the information using our voice instruction.
- These assistants can help us in various ways just by our voice instructions such as Play music, call someone, Open an email, Scheduling an appointment, etc.



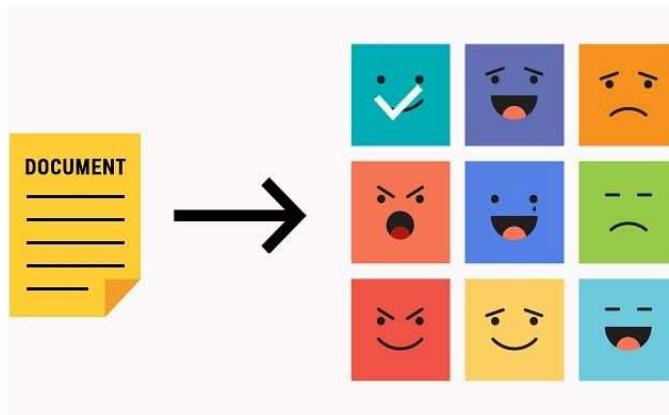
## 8. Online Fraud Detection:

- Machine learning is making our online transaction safe and secure by detecting fraud transaction.
- Whenever we perform some online transaction, there may be various ways that a fraudulent transaction can take place such as **fake accounts**, **fake ids**, and **steal money** in the middle of a transaction.
- So to detect this, **Feed Forward Neural network** helps us by checking whether it is a genuine transaction or a fraud transaction.

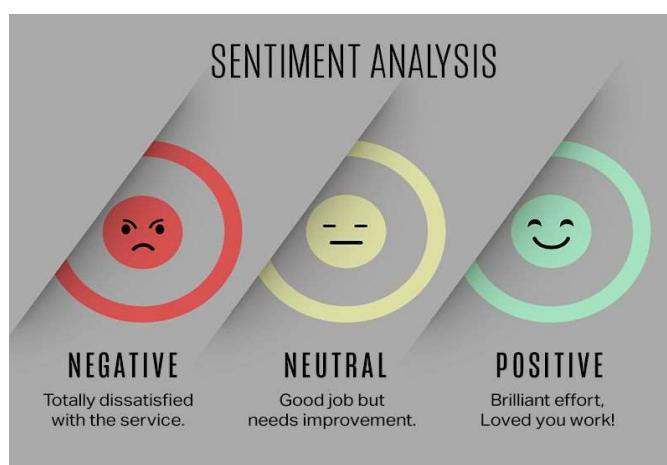


# 9. Sentiment Analysis:

- Sentiment analysis is one of the most necessary applications of machine learning.
- Sentiment analysis is a real-time machine learning application that determines the emotion or opinion of the speaker or the writer.



- For instance, if someone has written a review or email (or any form of a document), a sentiment analyzer will instantly find out the actual thought and tone of the text.
- This sentiment analysis application can be used to analyze a review based website, decision-making applications, etc.



# 10. Medical Diagnosis:

- In medical science, machine learning is used for diseases diagnoses.
- With this, medical technology is growing very fast and able to build 3D models that can predict the exact position of lesions in the brain.
- It helps in finding brain tumors and other brain-related diseases easily.



# References

1. [Applications of Machine Learning - Javatpoint](#)
2. <https://www.edureka.co/blog/machine-learning-applications/>
3. <https://www.simplilearn.com/tutorials/machine-learning-tutorial/machine-learning-applications>

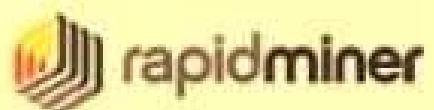
# Notes

# **Tools and Technology for Machine Learning**

**Prof. Rajesh  
Pradhan**

# Most Popular Machine Learning Software Tools

將軍



Open Learning with  
WEKA



# #1) Scikit-learn

- Scikit-learn is for machine learning development in python.
- It provides a library for the Python programming language.



## Features:

- It helps in data mining and data analysis.
- It provides models and algorithms for Classification, Regression, Clustering, Dimensional reduction, Model selection, and Pre-processing.

## Pros:

- Easily understandable documentation is provided.
- Parameters for any specific algorithm can be changed while calling objects

## Tool Cost/Plan Details: Free

## #2) PyTorch

- PyTorch is a Torch based, Python machine learning library.
- The torch is a Lua based computing framework, scripting language, and machine learning library.



### Features:

- It helps in building neural networks through Autograd Module.
- It provides a variety of optimization algorithms for building neural networks.
- PyTorch can be used on cloud platforms.
- It provides distributed training, various tools, and libraries.

### Pros:

- It helps in creating computational graphs.
- Ease of use because of the hybrid front-end.

### Tool Cost/Plan Details: Free

## #3) TensorFlow

- TensorFlow provides a **JavaScript library** that helps in machine learning.
- APIs will help you to build and train the models.



### Features:

- Helps in training and building your models.
- You can run your existing models with the help of TensorFlow.js which is a model converter.
- It helps in the neural network.

### Pros:

- You can use it in two ways, i.e. by script tags or by installing through NPM.
- It can even help for human pose estimation.

### Cons:

- It is difficult to learn.

### Tool Cost/Plan Details: Free

## #4) Weka



Machine Learning Group at the University of Waikato

Project      **Software**      Book      Courses      Publications      People      Related

# Weka 3: Data Mining Software in Java

- Clustering
- Visualization and
- Association rules mining.

### Pros:

- Provides online courses for training.
- Easy to understand algorithms.
- It is good for students as well.

### Cons:

- Not much documentation and online support are available.

### Tool Cost/Plan Details: Free

## #5) KNIME

- KNIME is a tool for data analytics, reporting and integration platform.
- Using the data pipelining concept, it combines different components for machine learning and data mining.



### Features:

- It can integrate the code of programming languages like C, C++, R, Python, Java, JavaScript etc.
- It can be used for business intelligence, financial data analysis, and CRM.

### Pros:

- It can work as a SAS alternative.
- It is easy to deploy and install.
- Easy to learn.

### Cons:

- Difficult to build complicated models.
- Limited visualization and exporting capabilities.

### Tool Cost/Plan Details: Free

## #6) Colab

- Google Colab is a cloud service which supports Python.
- It will help you in building the machine learning applications using the libraries of PyTorch, Keras, TensorFlow, and OpenCV.



### Features:

- It helps in machine learning education.
- Assists in machine learning research.

### Pros:

- You can use it from your google drive.

### Tool Cost/Plan Details: Free

# #7) Apache Mahout

- Apache Mahout helps mathematicians, statisticians, and data scientists for executing their algorithms.



## Features:

- It provides algorithms for Pre-processors, Regression, Clustering, Recommenders, and Distributed Linear Algebra.
- Java libraries are included for common math operations.
- It follows Distributed linear algebra framework.

## Pros:

- It works for large data sets.
- Simple
- Extensible

## Cons:

- Needs more helpful documentation.
- Some algorithms are missing.

**Tool Cost/Plan Details:** Free

## #8) Accord.Net

- Accord.Net provides machine learning libraries for image and audio processing.



### Features:

#### It provides algorithms for:

- Numerical linear algebra.
- Numerical optimization
- Statistics
- Artificial Neural networks.
- Image, audio, & signal processing.
- It also provides support for graph plotting & visualization libraries.

#### Pros:

- Libraries are made available from the source code and also through executable installer & NuGet package manager.

#### Cons:

- It supports only .Net supported languages.

#### Tool Cost/Plan Details: Free

# #9) Shogun

- Shogun provides various algorithms and data structures for machine learning. These machine learning libraries are used for research and education.



## Features:

- It provides support vector machines for regression and classification.
- It helps in implementing Hidden Markov models.
- It offers support for many languages like – Python, Octave, R, Ruby, Java, Scala, and Lua.

## Pros:

- It can process large data-sets.
- Easy to use.
- Provides good customer support.
- Offers good features and functionalities.

## Tool Cost/Plan Details: Free

# #10) Keras.io

- Keras is an API for neural networks. It helps in doing quick research and is written in Python.



## Features:

- It can be used for easy and fast prototyping.
- It supports convolution networks.
- It assists recurrent networks.
- It supports a combination of two networks.
- It can be run on the CPU and GPU.

## Pros:

- User-friendly
- Modular
- Extensible

## Cons:

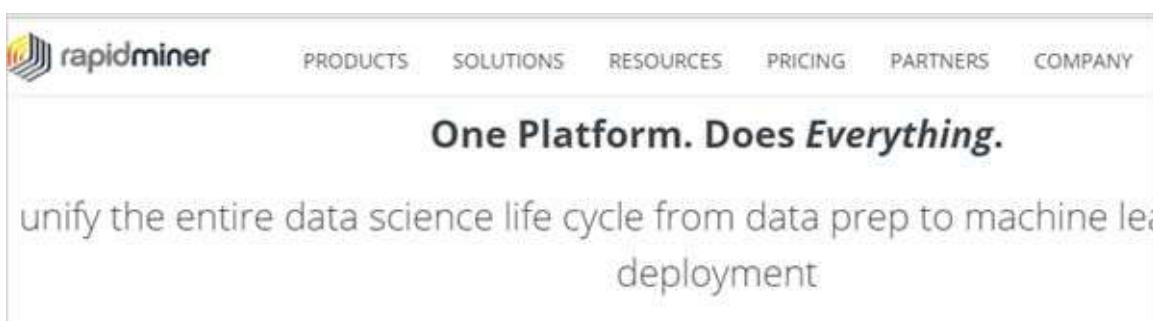
- In order to use Keras, you must need TensorFlow, Theano, or CNTK.

**Tool Cost/Plan Details:** Free



# #11) Rapid Miner

- Rapid Miner provides a platform for **machine learning, deep learning**, data preparation, text mining, and predictive analytics.
- It can be used for research, education and application development.



## Features:

- Through GUI, it helps in designing and implementing analytical workflows.
- It helps with data preparation.
- Result Visualization.
- Model validation and optimization.

## Pros:

- Extensible through plugins.
- Easy to use.
- No programming skills are required.



## ● Conclusion

- . Here we have explored machine learning and the top machine learning software in detail.
- Selection of the tool depends on your requirement for the algorithm, your expertise level, and the price of the tool.
- Machine learning library should be easy to use. Most of these libraries are free except Rapid Miner.
- TensorFlow is more popular in machine learning, but it has a learning curve.
- Scikit-learn and PyTorch are also popular tools for machine learning and both support Python programming language. Keras.io and TensorFlow are good for neural networks.



# Comparison Chart

	Platform	cost	Written in language	Algorithms or Features
Scikit Learn	Linux, Mac OS, Windows	Free.	Python, Cython, C, C++	Classification Regression Clustering Preprocessing Model Selection Dimensionality reduction.
PyTorch	Linux, Mac OS, Windows	Free	Python, C++, CUDA	Autograd Module Optim Module nn Module
TensorFlow	Linux, Mac OS, Windows	Free	Python, C++, CUDA	Provides a library for dataflow programming



	<b>Platform</b>	<b>cost</b>	<b>Written in language</b>	<b>Algorithms or Features</b>
Weka	Linux, Mac OS, Windows	Free	Java	Data preparation Classification Regression Clustering Visualization Association rules mining
KNIME	Linux, Mac OS, Windows	Free	Java	Can work with large data volume. Supports text mining & image mining through plugins
Colab	Cloud Service	Free	-	Supports libraries of PyTorch, Keras, TensorFlow, and OpenCV



	<b>Platform</b>	<b>cost</b>	<b>Written in language</b>	<b>Algorithms or Features</b>
Apache Mahout	Cross-platform	Free	Java Scala	Preprocessors Regression Clustering Recommenders Distributed Linear Algebra.
Accors.Net	Cross-platform	Free	C#	Classification Regression Distribution Clustering Hypothesis Tests & Kernel Methods Image, Audio & Signal. & Vision
Shogun	Windows Linux UNIX Mac OS	Free	C++	Regression Classification Clustering Support vector machines. Dimensionality reduction Online learning etc.



	<b>Platform</b>	<b>cost</b>	<b>Written in language</b>	<b>Algorithms or Features</b>
Keras.io	Cross-platform	Free	Python	API for neural networks
Rapid Miner	Cross-platform	Free plan Small: \$2500 per year. Medium: \$5000 per year. Large: \$10000 per year.	Java	Data loading & Transformation Data preprocessing & visualization.

# References

1. <https://www.softwaretestinghelp.com/machine-learning-tools/>
2. <https://www.javatpoint.com/machine-learning-tools>

# Notes