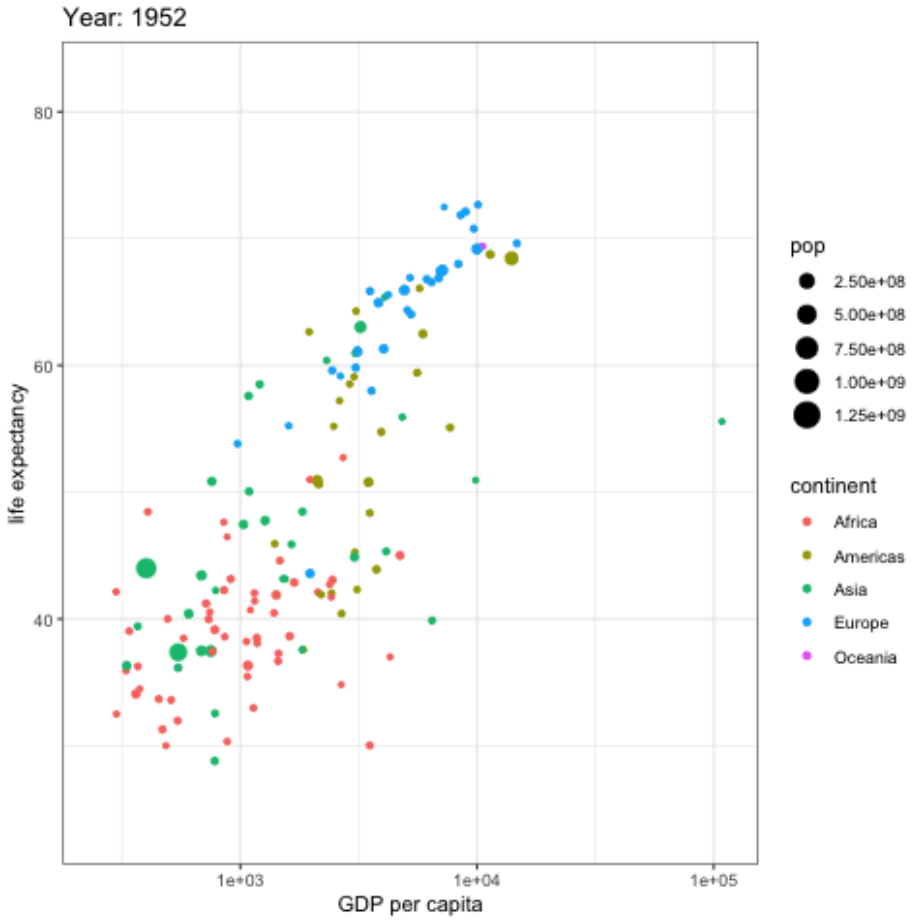
Machine Learning

With Python Programming !
By Sumit Kumar Shukla



Topics Covered in the Session

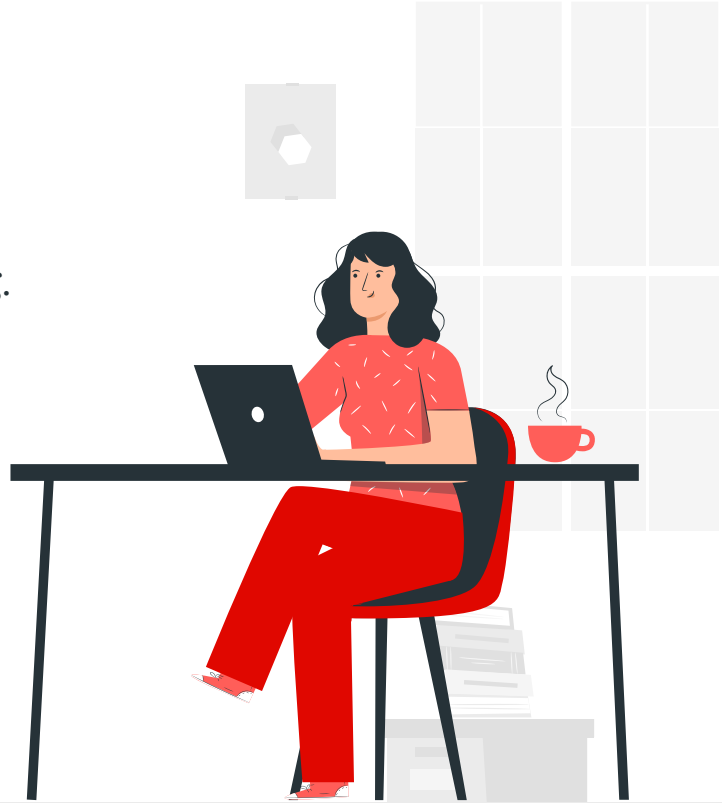
What is Machine Learning and its Evolutions ?

How Machine Learning Works on ?

Supervised, Unsupervised and Reinforcement Learning.

Use – Cases of Machine Learning

Project to Train a Model using Machine Learning Algorithms .



01 What is Machine Learning ?

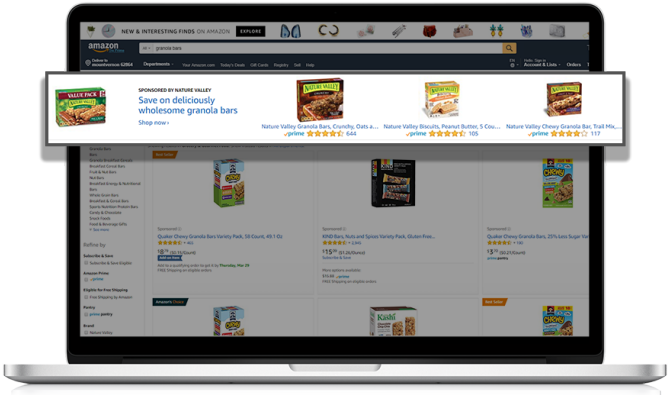
What is Machine Learning ?

Machine Learning is a concept which allows the machine to learn from examples and experience, and that too without being explicitly programmed.

So instead of you writing the code, what you do is you feed data to the generic algorithm, and the algorithm/ machine builds the logic based on the given data.

Situation 1

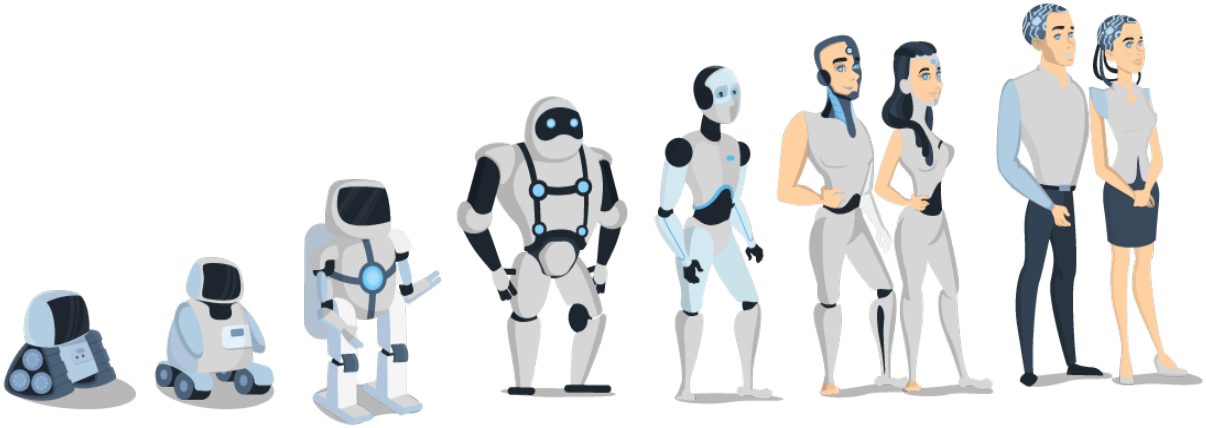
Have you ever shopped online? So while checking for a product, did you noticed when it recommends for a product similar to what you are looking for?



Situation 2

Did you ever get a call from any bank or finance company asking you to take a loan or an insurance policy?

What is Machine Learning ? : Evolutions of Machines



In today's world, these machines or the robots have to be programmed before they start following your instructions. But what if the machine started learning on their own from their experience, work like us, feel like us, do things more accurately than us? These things sound fascinating, Right? Well, just remember this is just the beginning of the new era.

02 How Machine Learning works on ?

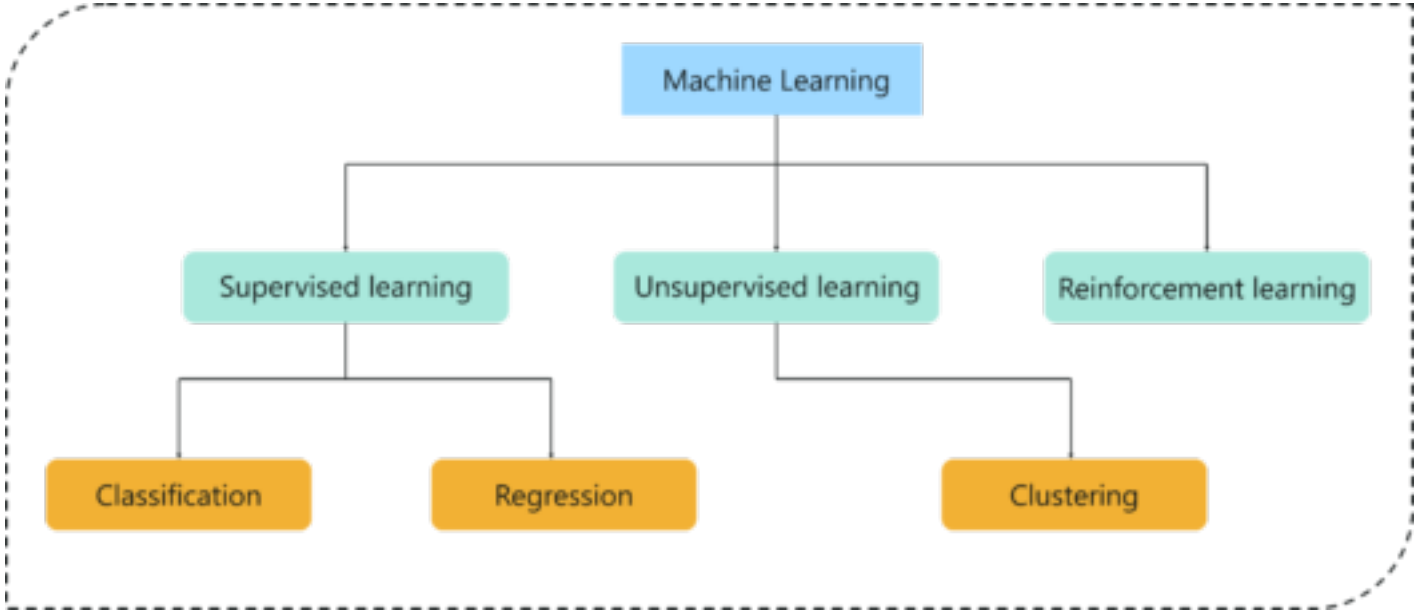
How Machine Learning Works on ?

Machine Learning algorithm is trained using a training data set to create a model. When new input data is introduced to the ML algorithm, it makes a prediction on the basis of the model.

03 Types of Machine Learning

How Machine Learning Works on ?

Machine learning is sub-categorized to three types:



Lets Understand it with an example of a Mango

Task: How will you choose the best mangoes?

What if you have to write a code for it?

As a Human Written Code: Now, imagine you were asked to write a computer program to choose your mangoes (or oranges). You might write the following rules/algorithm:

if it is bright yellow **and** size is big **and** sold by: mango is sweet.
if (soft): mango is juicy

You would use these rules to choose the mangoes.

Conclusion as a human:

But every time you make a new observation from your experiments, you have to modify the list of rules manually.
You have to understand the details of all the factors affecting the quality of mangoes. If the problem gets complicated enough, it might get difficult for you to make accurate rules by hand that covers all possible types of mangoes. This will take a lot of research and effort and not everyone has this amount of time.
This is where Machine Learning comes into the picture

Training Phase

Training Phase

You take a randomly selected specimen of mangoes from the market (**training data**), make a table of all the physical characteristics of each mango, like color, size, shape, grown in which part of the country, sold by which vendor, etc (**features**), along with the sweetness, juiciness, ripeness of that mango (**output variables**). You feed this data to the machine learning algorithm (**classification/regression**), and it learns a model of the correlation between an average mango's physical characteristics, and its quality.

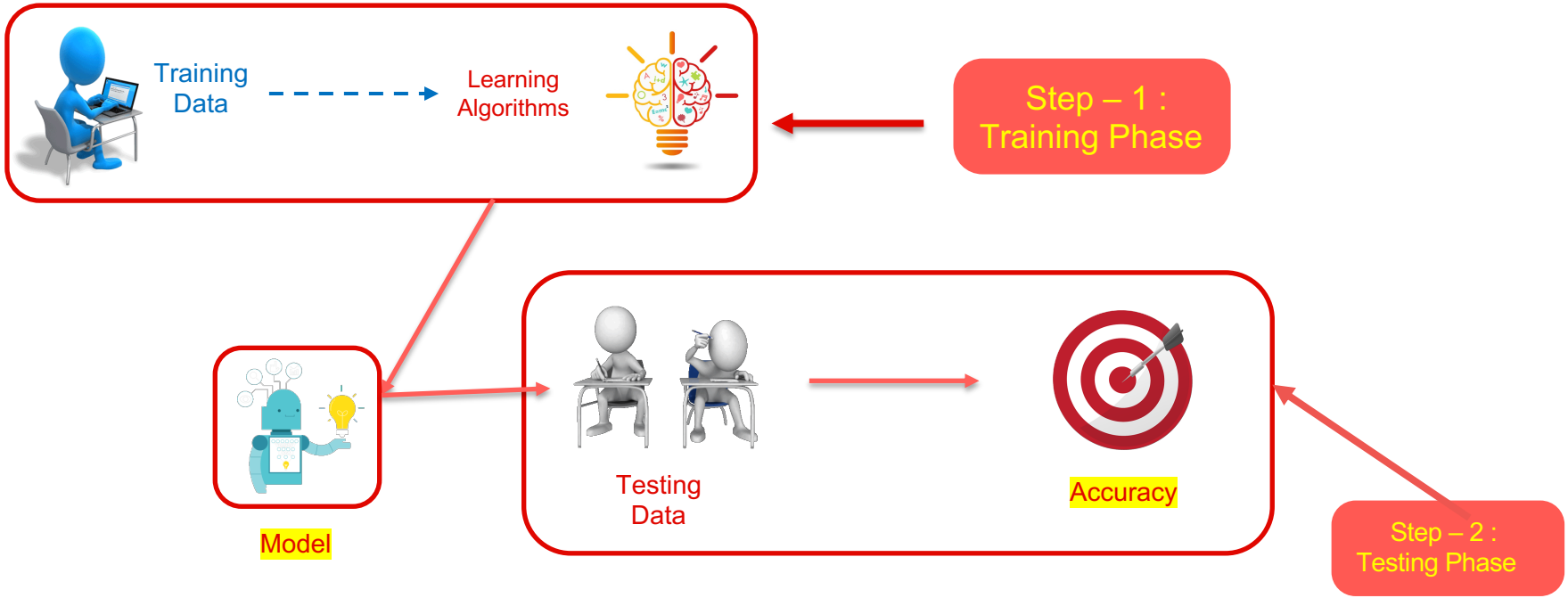
Testing Phase

Testing Phase

Next time when you go shopping, you will measure the characteristics of the mangoes which you are purchasing(**test data**)and feed it to the Machine Learning algorithm. It will use the model which was computed earlier to predict if the mangoes are sweet, ripe and/or juicy. The algorithm may internally use the rules, similar to the one you manually wrote earlier (for eg, a **decision tree**). Finally, you can now shop for mangoes with great confidence, without worrying about the details of how to choose the best mangoes.

Types of Machine Learning – Supervised Learning

Supervised learning is the one where you have input variables (x) and an output variable (Y) and you use an algorithm to learn the mapping function from the input to the output.



Supervised Learning

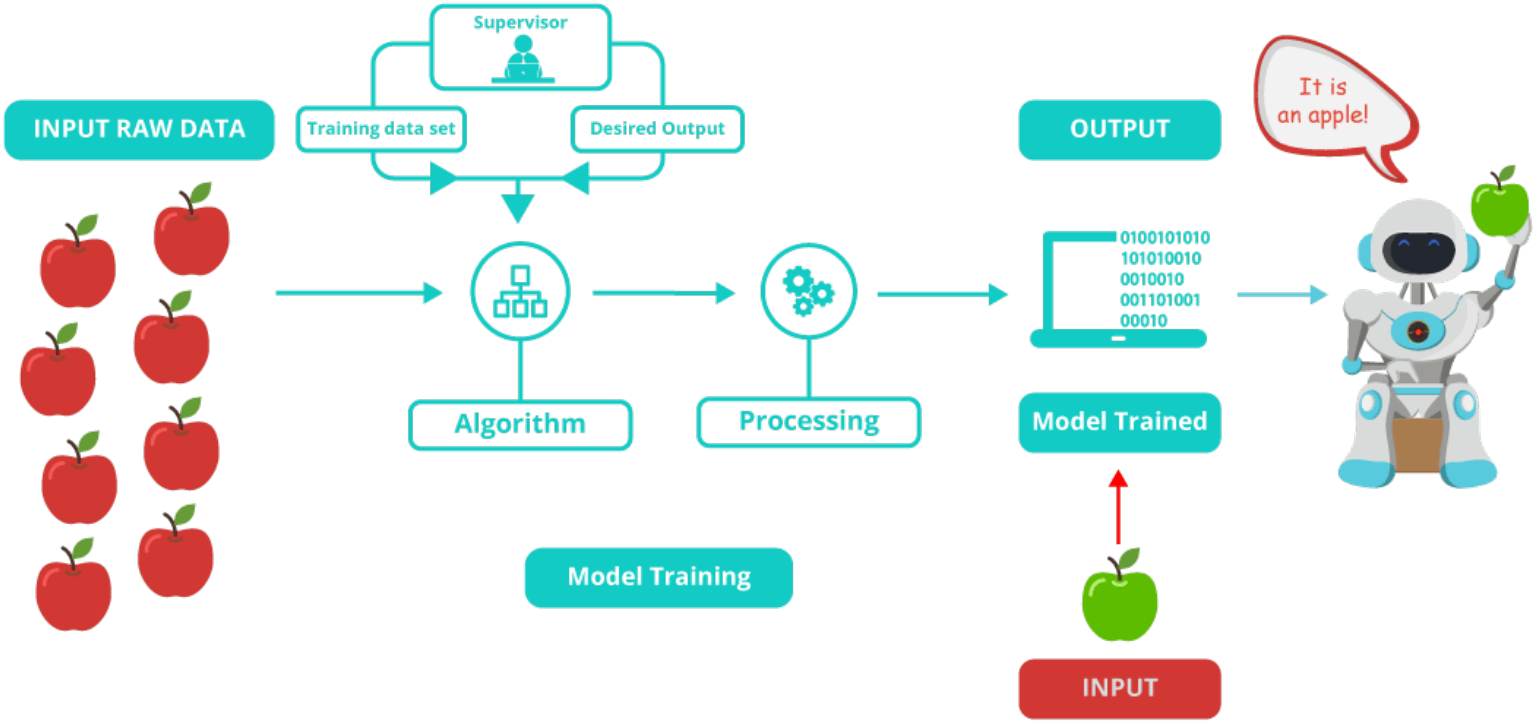
Supervised learning is the one where you have input variables (x) and an output variable (Y) and you use an algorithm to learn the mapping function from the input to the output. it,

$$Y = f(X)$$

The goal is to approximate the mapping function so well that whenever you get some new input data (x), the machine can easily predict the output variables (Y) for that data.

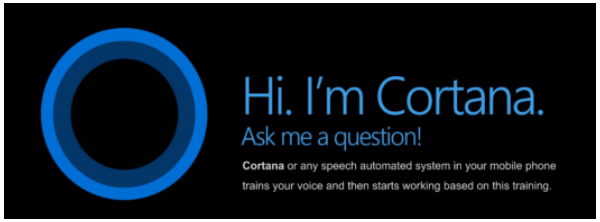
Supervised Learning is the one, where you can consider the learning is guided by a teacher. Think We have a dataset which acts as a teacher and its role is to train the model or the machine. Once the model gets trained it can start making a prediction or decision when new data is given to it.

Supervised Learning



Cortana

Cortana or any speech automated system in your mobile phone trains your voice and then starts working based on this training. This is an application of Supervised Learning



Weather Apps

Predicts the upcoming weather by analyzing the parameters for a given time on some prior knowledge (when its sunny, temperature is higher; when its cloudy, humidity is higher, etc.).

Biometric Attendance

In **Biometric Attendance** you can train the machine with inputs of your biometric identity – it can be your thumb, iris or ear-lobe, etc. Once the machine is trained it can validate your future input and can easily identify you.

Types of Machine Learning – Unsupervised Learning

- Unsupervised Learning is the Training of a model using information that is neither classified or labelled.
- This model can be used to cluster the input data in classes on the basis of their statistical properties.

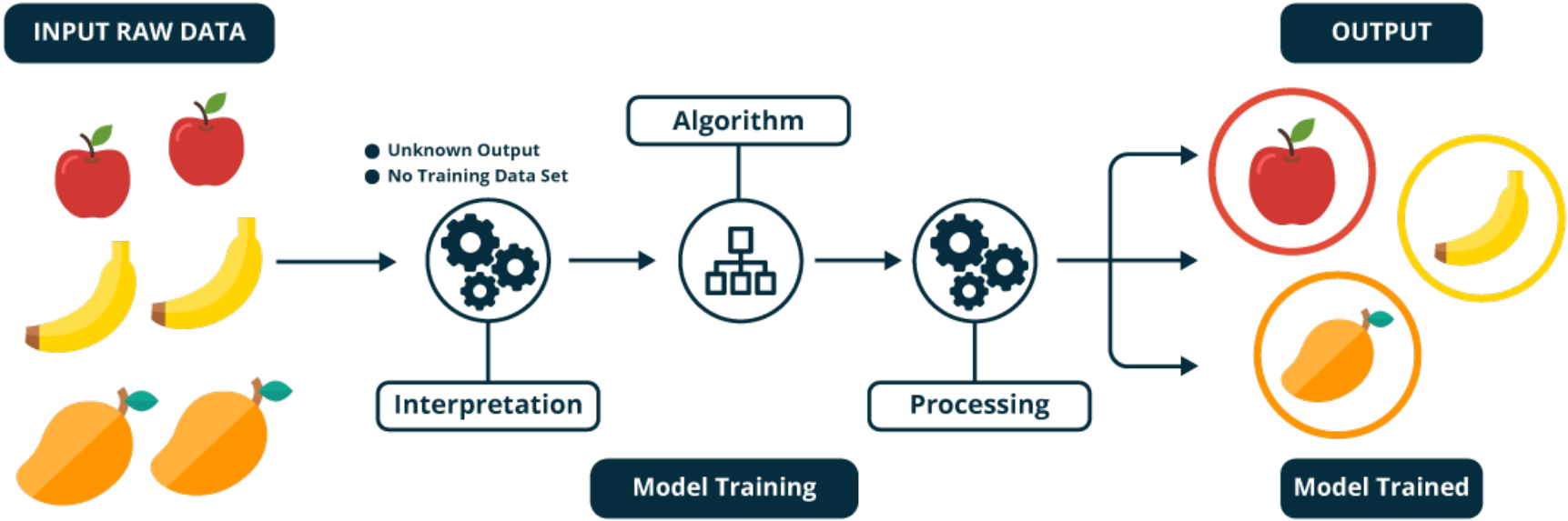
Unsupervised Learning

Mathematically, Unsupervised learning is where you only have input data (X) and no corresponding output variables. The goal for unsupervised learning is to model the underlying structure or distribution in the data in order to learn more about the data.

Using the unsupervised learning algorithms you can detect patterns based on the typical characteristics of the input data. Clustering can be considered as an example of machine learning task that uses the unsupervised learning approach

The model learns through observation and finds structures in the data. Once the model is given a dataset, it automatically finds patterns and relationships in the dataset by creating clusters in it. What it cannot do is add labels to the cluster, like it cannot say this a group of apples or mangoes, but it will separate all the apples from mangoes.

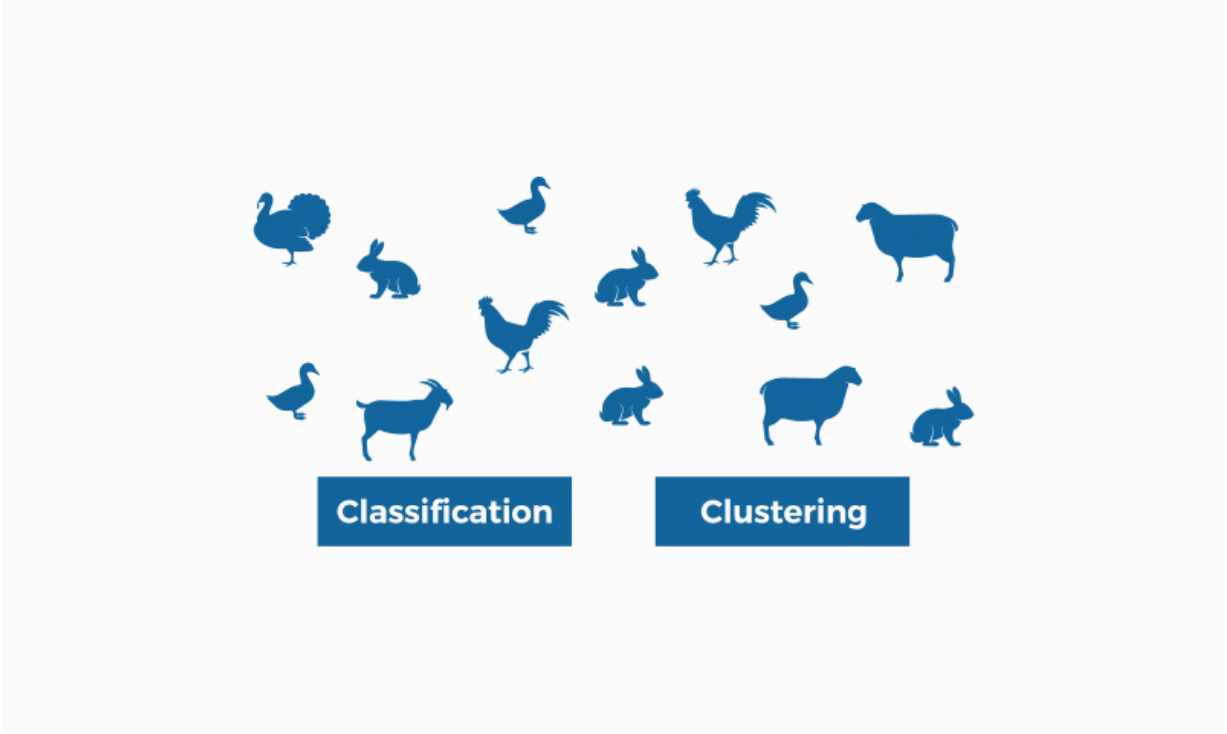
Unsupervised Learning



Supervised vs Unsupervised Learning

Parameter	Supervised Learning	Unsupervised Learning
Dataset	Labelled Dataset	Unlabeled Dataset
Method of Learning	Guided Learning	Algorithms learn by itself using dataset
Complexity	Simpler Method	Computationally Complex
Accuracy	More Accurate	Less Accurate

Classification vs Clustering



A friend invites you to his party where you meet totally strangers. Now you will classify them using unsupervised learning (no prior knowledge) and this classification can be on the basis of gender, age group, dressing, educational qualification or whatever way you would like. Since you didn't have any prior knowledge about people and so you just classified them "on-the-go".

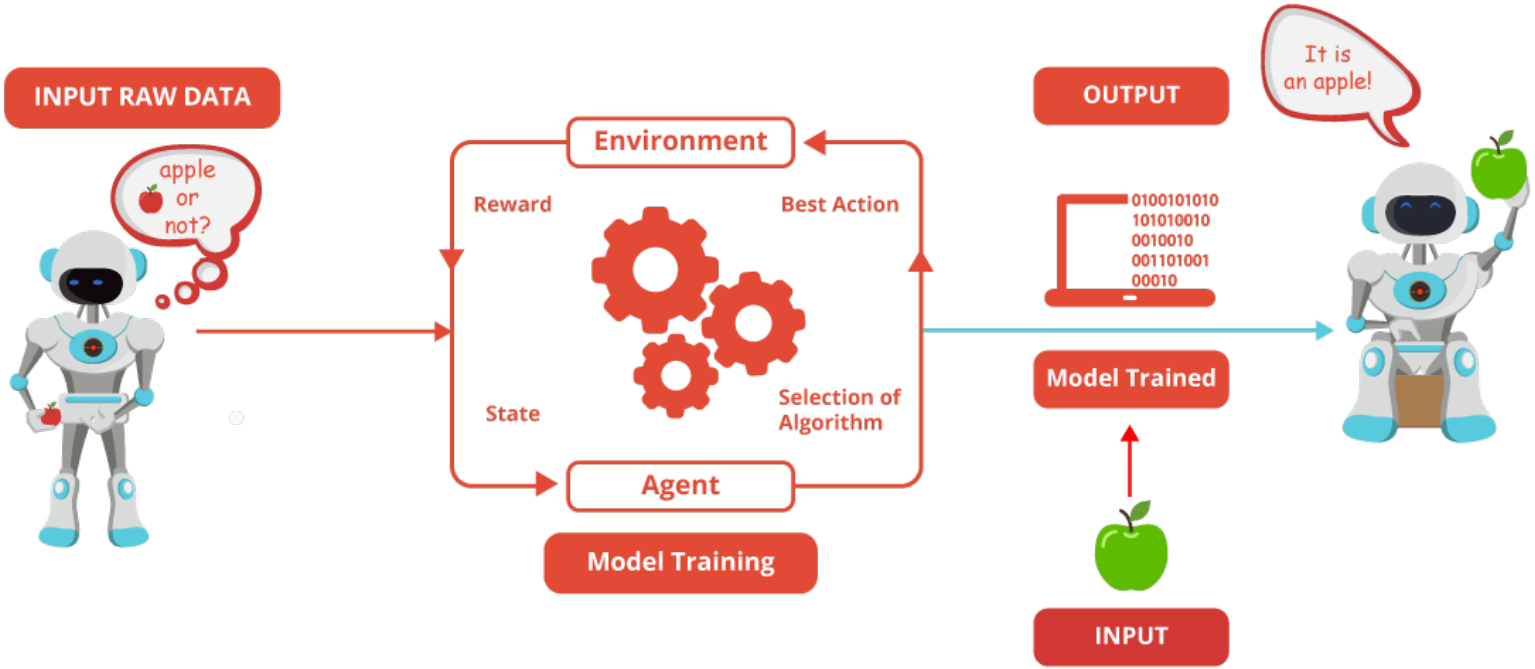
Let's suppose you have never seen a Football match before and by chance watch a video on internet, now you can classify players on the basis of different criterion like Players wearing the same sort of kits are in one class, Players of one style are in one class (players, goalkeeper, referee), or on the basis of playing style(attacker or defender) or whatever way you would observe, you can classify it.

Reinforcement Learning

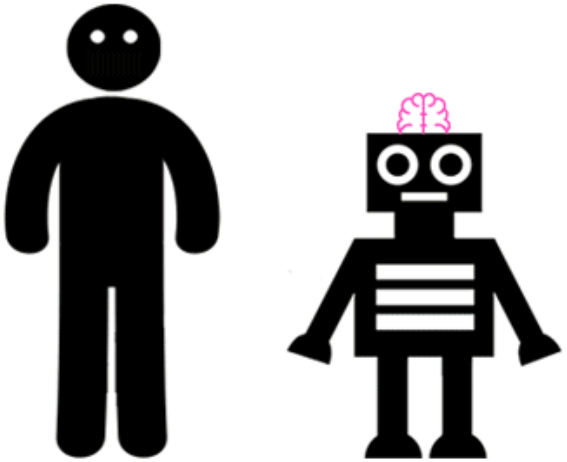
It is the ability of an agent to interact with the environment and find out what is the best outcome. It follows the concept of hit and trial method. The agent is rewarded or penalized with a point for a correct or a wrong answer, and on the basis of the positive reward points gained the model trains itself. And again once trained it gets ready to predict the new data presented to it.

Reinforcement learning can be thought of as a hit and trial method of learning. The machine gets a Reward or Penalty point for each action it performs. If the option is correct, the machine gains the reward point or gets a penalty point in case of a wrong response.

Reinforcement Learning



Reinforcement Learning



Reinforcement Learning

The reinforcement learning algorithm is all about the interaction between the environment and the learning agent. The learning agent is based on exploration and exploitation.

Exploration is when the learning agent acts on trial and error and Exploitation is when it performs an action based on the knowledge gained from the environment. The environment rewards the agent for every correct action, which is the reinforcement signal. With the aim of collecting more rewards obtained, the agent improves its environment knowledge to choose or perform the next action.

Let see how Sumit trained his dog using reinforcement training?

Sumit divided the training of his dog into four stages.
In the first part, Sumit gave meat to the dog, and in response to the meat, the dog started salivating.
In the next stage he created a sound with a bell, but this time the dogs did not respond anything.
In the third stage, he tried to train his dog by using the bell and then giving them food. Seeing the food the dog started salivating.
Eventually, the dogs started salivating just after hearing the bell, even if the food was not given as the dog was reinforced that whenever the master will ring the bell, he will get the food.