Traditional Programming

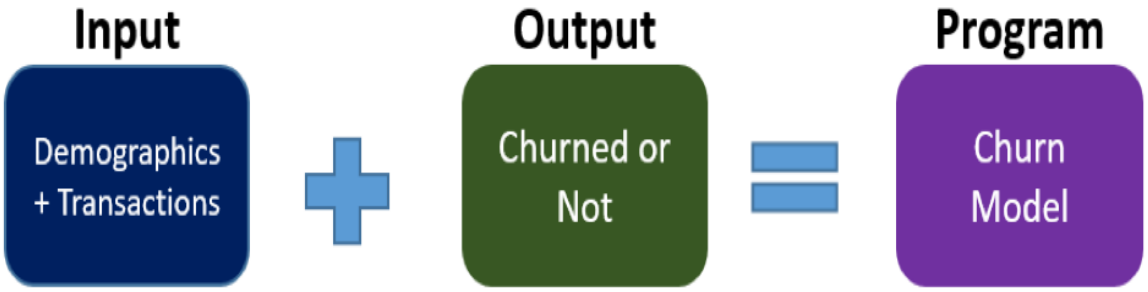
Traditional programming is a manual process—meaning a person (programmer) creates the program. But without anyone programming the logic, one has to manually formulate or code rules.

In machine learning, on the other hand, the algorithm automatically formulates the rules from the data.

Machine Learning

Unlike traditional programming, machine learning is an automated process. It can increase the value of your embedded analytics in many areas, including data prep, natural language interfaces, automatic outlier detection, recommendations, and causality and significance detection. All of these features help speed user insights and reduce decision bias.

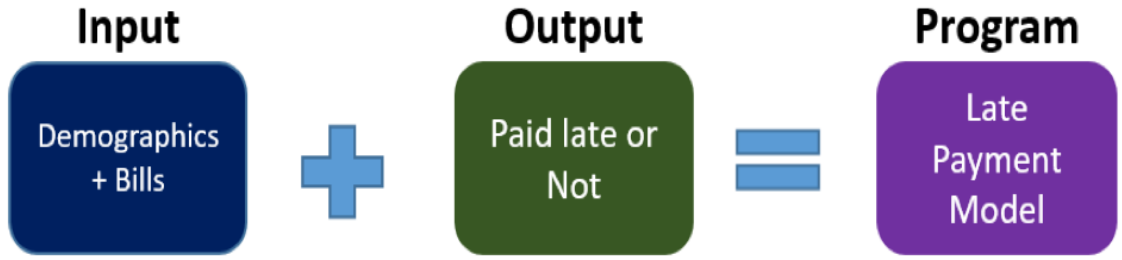
For example, if you feed in customer demographics and transactions as input data and use historical customer churn rates as your output data, the algorithm will formulate a program that can predict if a customer will churn or not. That program is called a **predictive model**.



You can use this model to predict business outcomes in any situation where you have input and historical output data:

1. Identify the business question you would like to ask.
2. Identify the historical input.
3. Identify the historically observed output (i.e., data samples for when the condition is true and for when it's false).

For instance, if you want to predict who will pay the bills late, identify the input (customer demographics, bills) and the output (pay late or not), and let the machine learning use this data to create your model.



As you can see, machine learning can turn your business data into a financial asset. You can point the algorithm at your data so it can learn powerful rules that can be used to predict future outcomes. It's no wonder predictive analytics is now the number one capability on product roadmaps

What is Machine Learning? A Friendly Introduction for Aspiring Data Scientists and Managers

Machine learning is ubiquitous in the industry these days. Organizations around the world are scrambling to integrate machine learning into their functions and new opportunities for aspiring data scientists are growing multifold.

But we have noticed a huge gap between what the industry needs and what's on offer right now. Quite a large number of people are not clear about what machine learning is.

By end of this page, you will not only understand what is machine learning but also it's different types, its ever-growing list of applications, the latest machine learning developments, the top experts in machine learning, among various other things.

This is your one-stop destination for understanding machine learning!

Topics we will cover

What is Machine Learning?

Machine Learning is the science of teaching machines how to learn by themselves. Now, you might be thinking – why on earth would we want machines to learn by themselves? Well – it has a lot of benefits.

Machines can do high-frequency repetitive tasks with high accuracy without getting bored.

For example – the task of mopping and cleaning the floor. When a human does the task – the quality of outcome would vary. We get exhausted/bored after a few hours of work and the chances of getting sick also impact the outcome.

Depending on the place – it could also be hazardous or risky for a human.

On the other hand, if we can teach machines to detect whether the floor needs cleaning and mopping and how much cleaning is required based on the condition of the floor and the type of the floor – machines would perform the same job far better. They can go on to do that job without getting tired or sick!

This is what Machine Learning aims to do – enable machines to learn on their own. In order to answer the questions like:

- Whether the floor needs cleaning and mopping?
- How long does the floor need to be cleaned?

Machines need a way to think and this is precisely where machine learning models help. The machines capture data from the environment and feed it to the machine learning model. The model then uses this data to predict things like:

- Whether the floor needs cleaning or not, or
- For how long does it need to be cleaned, and so on.

How do machines learn?

Sadly, things which are usually intuitive to humans can be very difficult for machines. You only need to demonstrate cleaning and mopping to a human a few times – before they can perform it on their own.

But, that is not the case with machines. We need to collect a lot of data along with the desired outcomes in order to teach machines to perform specific tasks. **This is where machine learning comes into play.**

Machine Learning would help the machine understand the kind of cleaning, the intensity of cleaning, and duration of cleaning based on the conditions and nature of the floor.

Applications of Machine Learning in day-to-day life

Now that you get the hang of it, you might be asking what are some of the examples of machine learning and how does it affect our life? Unless you have been living under a rock – your life is already heavily impacted by machine learning.

Let us look at a few examples where we use the outcome of machine learning already:

- Smartphones detecting faces while taking photos or unlocking themselves
- Facebook, LinkedIn or any other social media site recommending your friends and ads you might be interested in
- Amazon recommending you the products based on your browsing history
- Banks using Machine Learning to detect Fraud transactions in real-time

The applications of machine learning are immense. You can read this article for a comprehensive list of applications driven by machine learning, which we use in our day-to-day life:

Why is Machine Learning getting so much attention recently?

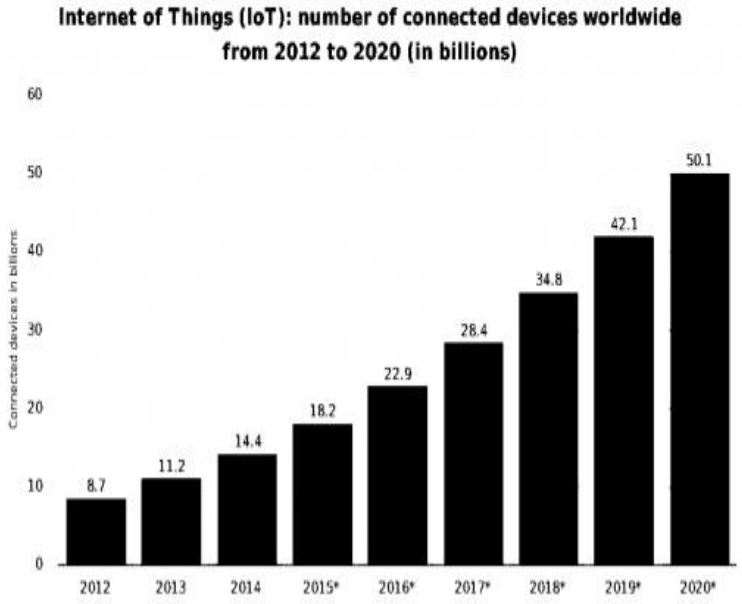
Sounds exciting! But this idea of teaching machines has been around for a while. Remember Asimov's Three Laws of robotics? Machine Learning ideas and research have been around for decades. However, there has been a lot of action and buzz recently.

The obvious question is why is this happening now when machine learning has been around for several decades?

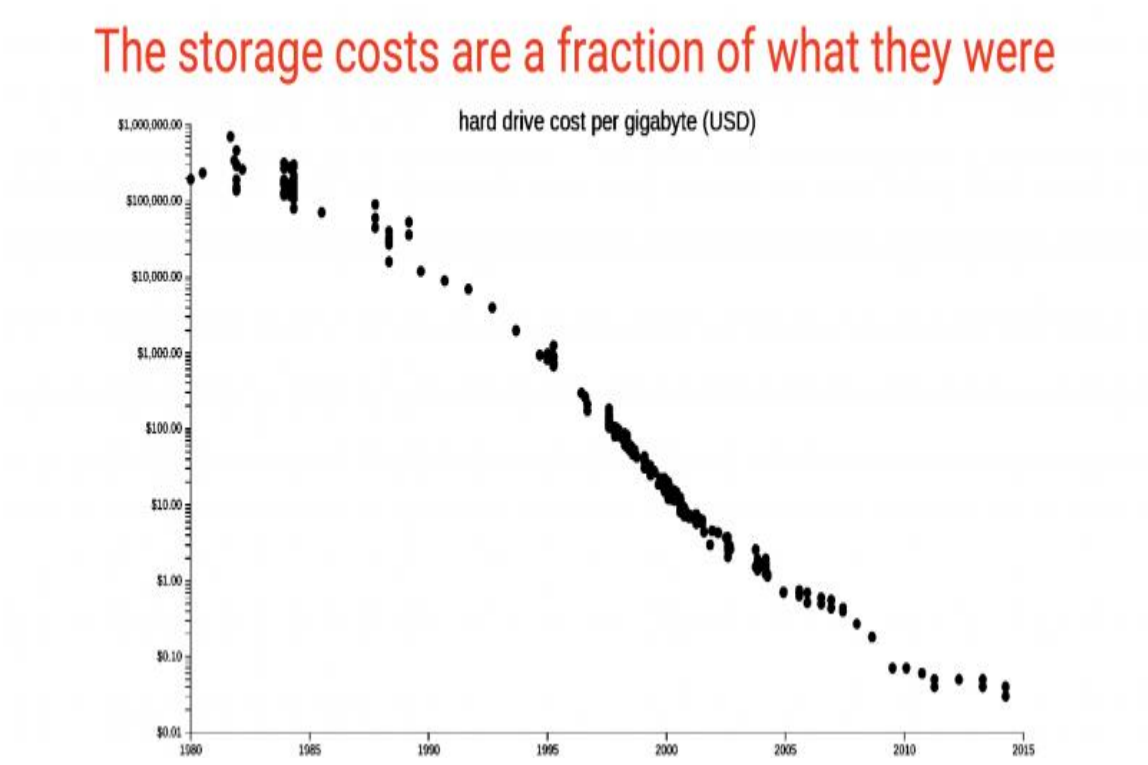
This development is driven by a few underlying forces:

- The amount of data generation is increasing significantly with a reduction in the cost of sensors **(Force 1)**
    - Every time you take an action on any website, including Facebook and YouTube – you create data for these companies
    - All connected devices including fitness bands, smartwatches, and connected equipment are generating data

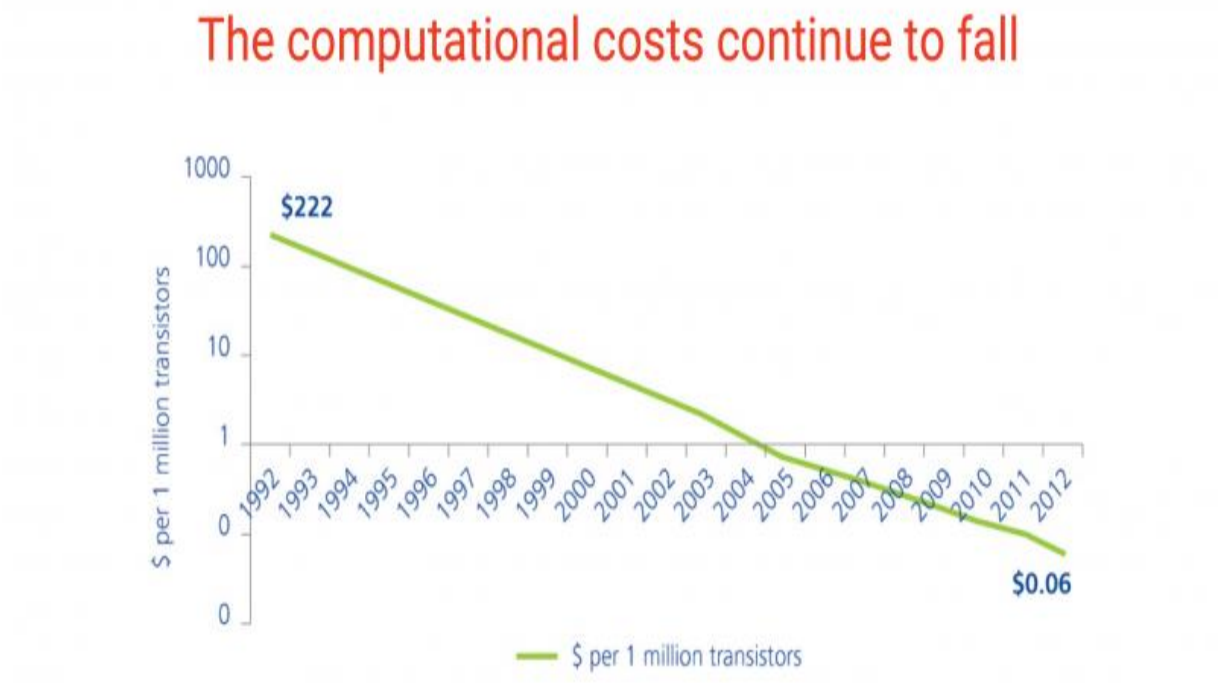
There will be 50 Bn connected devices by 2020



- The cost of storing this data has reduced significantly **(Force 2)**.



- The cost of computing has come down significantly **(Force 3)**.



- Cloud has democratized Compute for the masses **(Force 4)**.

These 4 forces combine to create a world where we are not only creating more data, but we can store it cheaply and run huge computations on it. This was was not possible before, even though machine learning techniques and algorithms were well known.

How is machine learning different from automation?

If you are thinking that machine learning is nothing but a new name of automation – you would be wrong.

Most of the automation which has happened in the last few decades has been rule-driven automation. For example – automating flows in our mailbox needs us to define the rules. These rules act in the same manner every time. On the other hand, machine learning helps machines learn by past data and change their decisions/performance accordingly.

Spam detection in our mailboxes is driven by machine learning. Hence, it continues to evolve with time.

The only relation between the two things is that machine learning enables better automation.

What tools are used in Machine Learning?

There are several tools and languages being used in machine learning. The exact choice of the tool depends on your need and scale of operations. But, here are the most commonly used tools in machine learning:

- Languages:
  - R
  - Python
  - SAS
  - Julia
  - Java
  - Javascript
  - Scala
- Databases:
  - SQL
  - Oracle
  - Hadoop
- Visualization tools:
  - D3.js
  - Tableau
  - QlikView
- Other tools commonly used:
  - Excel
  - Powerpoint

Check out the below articles expounding on a few of these popular tools (these are great for making your ultimate choice!):

What are the kind of problems which can be solved using machine learning?

Machine Learning problems can be divided into 3 broad classes:

- **Supervised Machine Learning:** When you have past data with outcomes (labels in machine learning terminology) and you want to predict the outcomes for the future – you would use Supervised Machine Learning algorithms. Supervised Machine Learning problems can again be divided into 2 kinds of problems:
    - **Classification Problems:** When you want to classify outcomes into different classes. For example – whether the floor needs cleaning/mopping is a classification problem. The outcome can fall into one of the classes – Yes or No. Similarly, whether a customer would default on their loan or not is a classification problem which is of high interest to any Bank
    - **Regression Problem:** When you are interested in answering how much – these problems would fall under the Regression umbrella. For example – how much cleaning needs to be done is a Regression problem. Or what is the expected amount of default from a customer is a Regression problem

Imagine that you own a company and to address each of its problems, you wish to develop a machine learning algorithm.

Problem 1: For each customer account, you'd like to have a software to check the account and decide if it has been compromised (hacked).

Problem 2: You have a large stock of similar goods. You wish to know that in the next three months how many of these goods will sell.

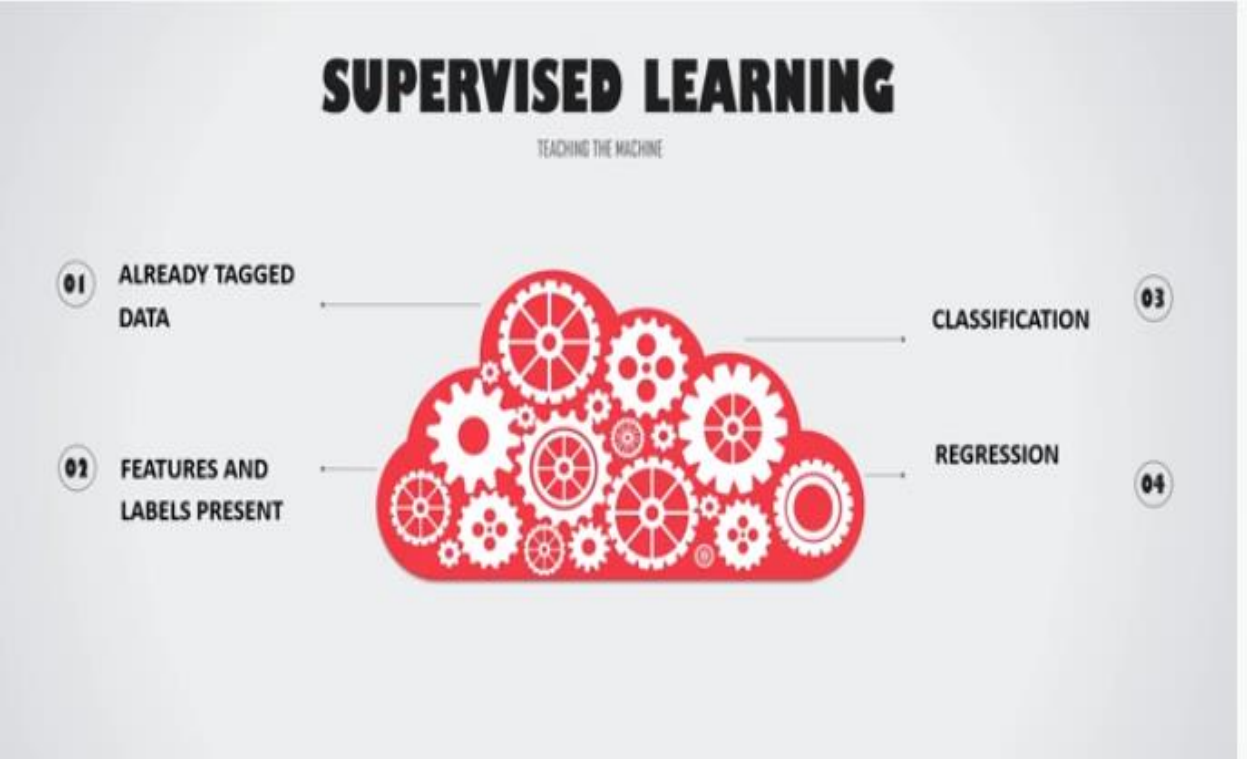
You have the following options:

(a) Option A: First problem is regression problem and second problem is a classification problem.

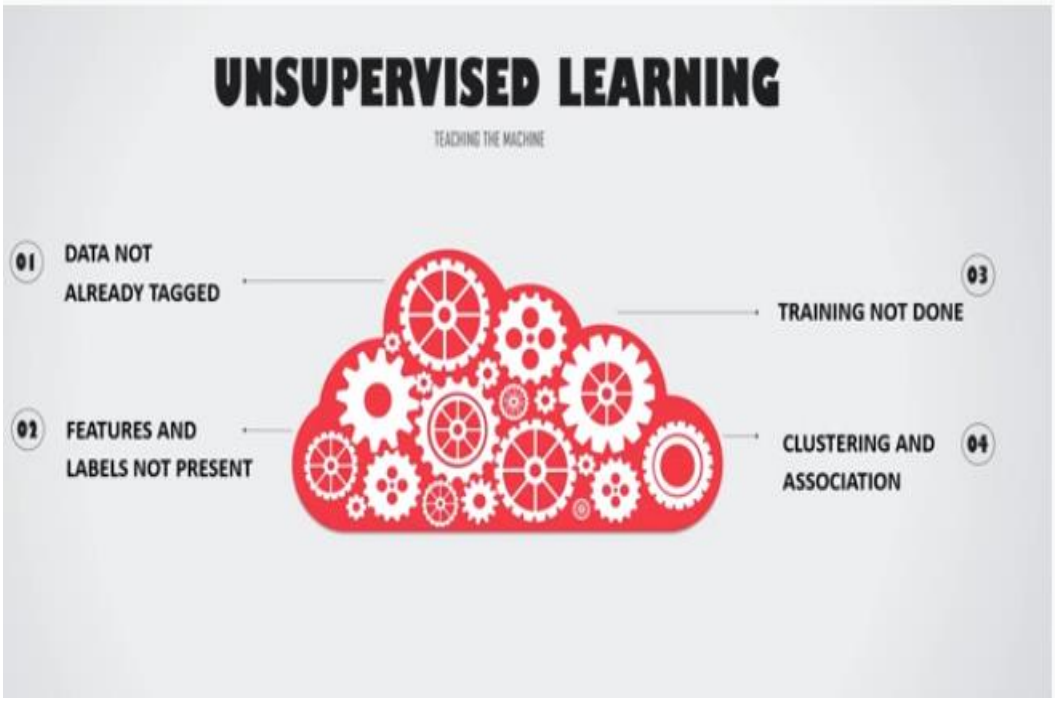
(b) Option B: Both are classification problems.

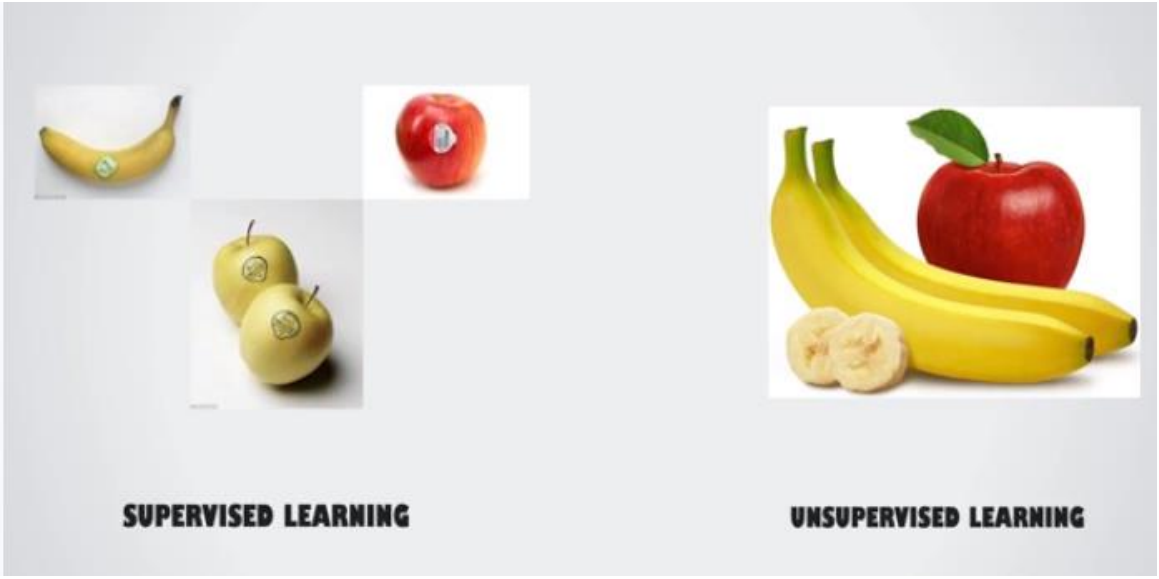
(c) Option C: Both are regression problems.

(d) Option D: First problem is a classification problem and second problem as a regression problem.

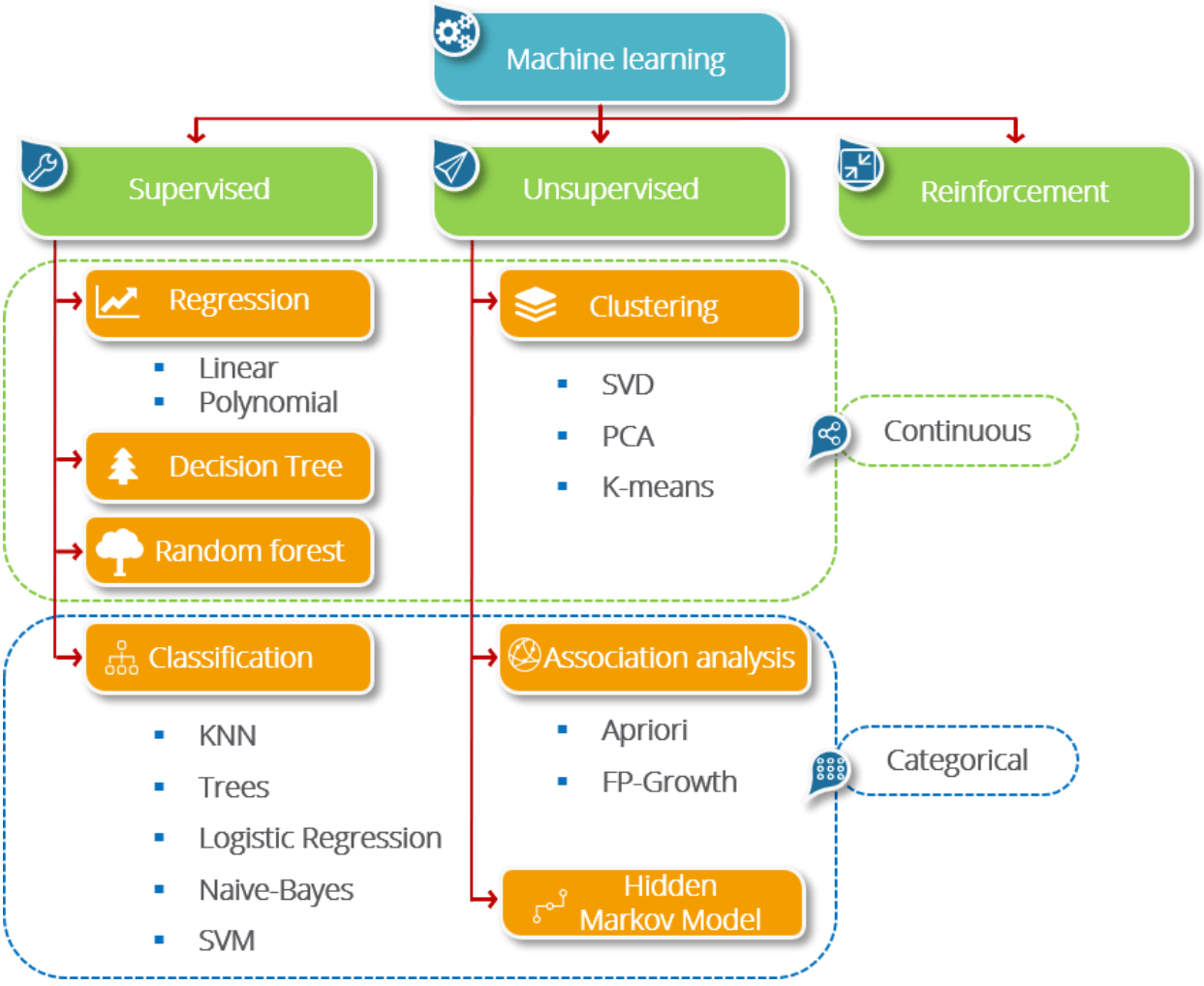


- **Unsupervised Machine Learning:** There are times when you don't want to exactly predict an Outcome. You just want to perform a segmentation or clustering. For example – a bank would want to have a segmentation of its customers to understand their behavior. This is an Unsupervised Machine Learning problem as we are not predicting any outcomes here

- 
UNSUPERVISED LEARNING
TEACHING THE MACHINE
01
DATA NOT
ALREADY TAGGED
02
FEATURES AND
LABELS NOT PRESENT
03
TRAINING NOT DONE
04
CLUSTERING AND
ASSOCIATION


SUPERVISED LEARNING
UNSUPERVISED LEARNING

- **Reinforcement Learning:** Reinforcement Learning is said to be the hope of true artificial intelligence. And it is rightly said so because the potential that Reinforcement Learning possesses is immense. It is a slightly complex topic as compared to traditional machine learning but an equally crucial one for the future.



What are the Different algorithms used in Machine Learning?

- Supervised Learning
  - Linear Regression
  - Logistic Regression
  - k-nearest neighbors
  - Decision Trees
  - Random Forest
  - Gradient Boosting Machines

    - XGBoost
    - Support Vector Machines (SVM)
    - Neural Networks
- Unsupervised Learning
    - k means clustering
    - Hierarchical clustering
    - Neural Network
- Reinforcement Learning

For a high-level understanding of these algorithms, you can watch this video:

For knowing more about these popular algorithms along with their codes – you can look at this article:

How much data is required to train a machine learning model?

There is no simple answer to this question. It depends on the problem you are trying to solve, the cost of collecting incremental data and the benefits coming from incremental data. But here are some guidelines:

- In general – you would want to collect as much data as possible. If the cost of collecting the data is not very high – this ends up working fine
- If the cost of capturing the data is high, then you would need to do a cost-benefit analysis based on the expected benefits coming from machine learning models
- The data being captured should be representative of the behavior/environment you expect the model to work on

What kind of data is required to train a machine learning model?

> *Everything which you see, hear and do is data. All you need is to capture that in the right manner.*

Data is omnipresent these days. From logs on websites and smartphones to health devices – we are in a constant process of creating data. In fact, 90% of the data in this Universe has been created in the last 18 months.

Data can broadly be classified into three types:

1. **Structured Data:** Structured data typically refers to data stored in a tabular format in databases in organizations. This includes data about customers, interactions with them and several other attributes, which flow through the IT infrastructure of Enterprises

   Roll Name Marks

   1 A 20

   2 b 30

2. **Semi Structured Data: The data which are not in a tabular format but have to follow there own structure. The data in form of JSON (Java Script object Notation)or XML(Xentisible Mark up Language) are the semi structure data mainly returns by the API(Application Programing Interface)**

   Values here are in the form of KeyValue Pair

   Name Gender Age Eductionq jobexp

   Name Gender age noofmatches palyed nof goals

   Name Gender Age noofmovies nohits noofflops

[{“roll”:1,”name”:”A”,”marks”:20},{“roll”:2,”name”:”b”,”marks”:30}]

3. **Unstructured Data:** Unstructured Data includes all the data which gets captured, but is not stored in the form of tables in enterprises. For example – letters of communication from customers or tweets and pictures from customers. It also includes images and voice records.

Machine Learning models can work on both Structured as well as Unstructured Data. However, you need to convert unstructured data to structured data first.

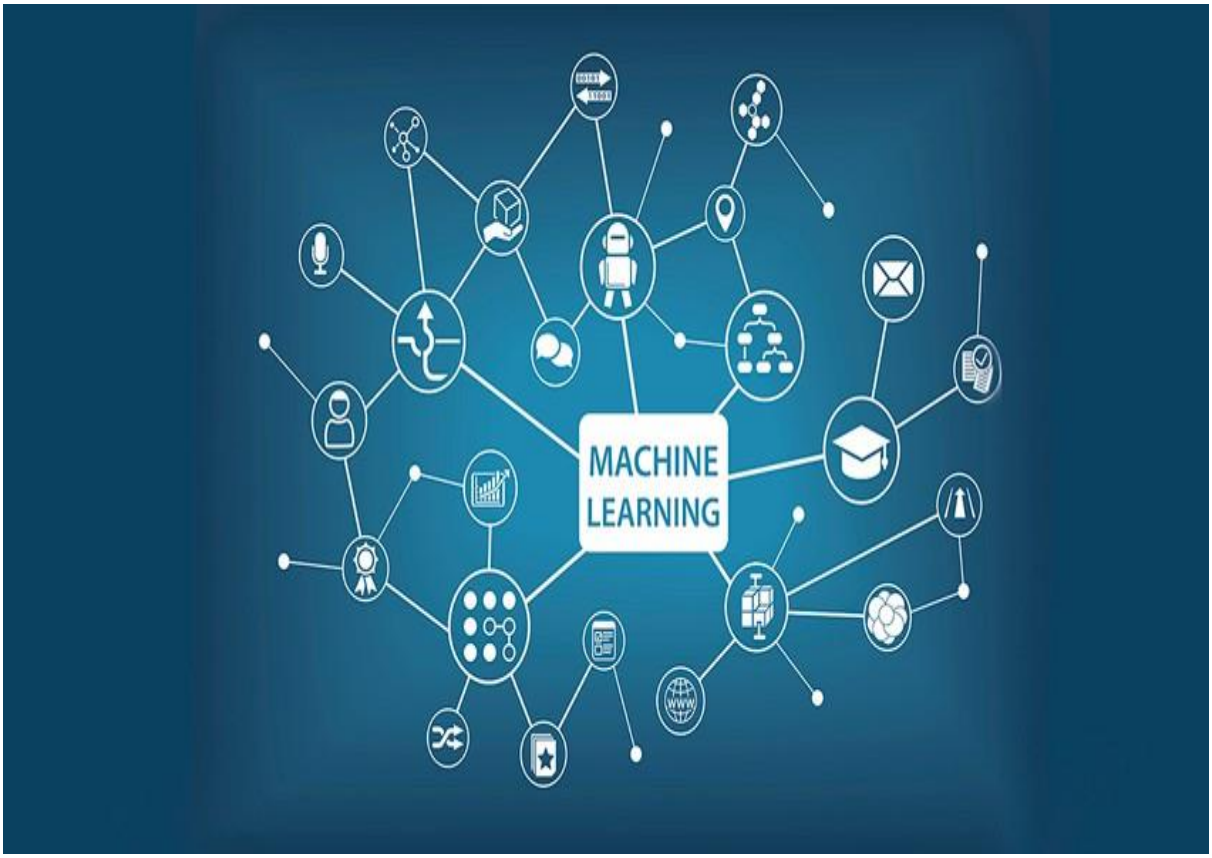
What are the steps involved in building machine learning models?

Any machine learning model development can broadly be divided into six steps:

- **Problem definition** involves converting a Business Problem to a machine learning problem
- **Hypothesis generation** is the process of creating a possible business hypothesis and potential features for the model
- **Data Collection** requires you to collect the data for testing your hypothesis and building the model

- **Data Exploration(Analysis & Visualization)** and cleaning helps you remove outliers, missing values and then **transform** the data into the required format
- Modeling is where you actually build the **machine learning models**
- Once built, you will **deploy the models**

Machine Learning For Beginners



Machine learning was defined in 90's by ***Arthur Samuel*** described as the," ***it is a field of study that gives the ability to the computer for self-learn without being explicitly programmed***", that means imbuing knowledge to machines without hard-coding it.

“A computer algorithm/program is said to learn from performance measure P and experience E with some class of tasks T if its performance at tasks in T, as measured by P, improves with experience E.” *-Tom M. Mitchell.*

Machine learning is mainly focused on the development of computer programs which can teach themselves to grow and change when exposed to new data. Machine learning studies algorithms for self-learning to do stuff. It can process massive data faster with the learning algorithm. For instance, it will be interested in learning to complete a task, make accurate predictions, or behave intelligently.

Why we need Machine Learning:-

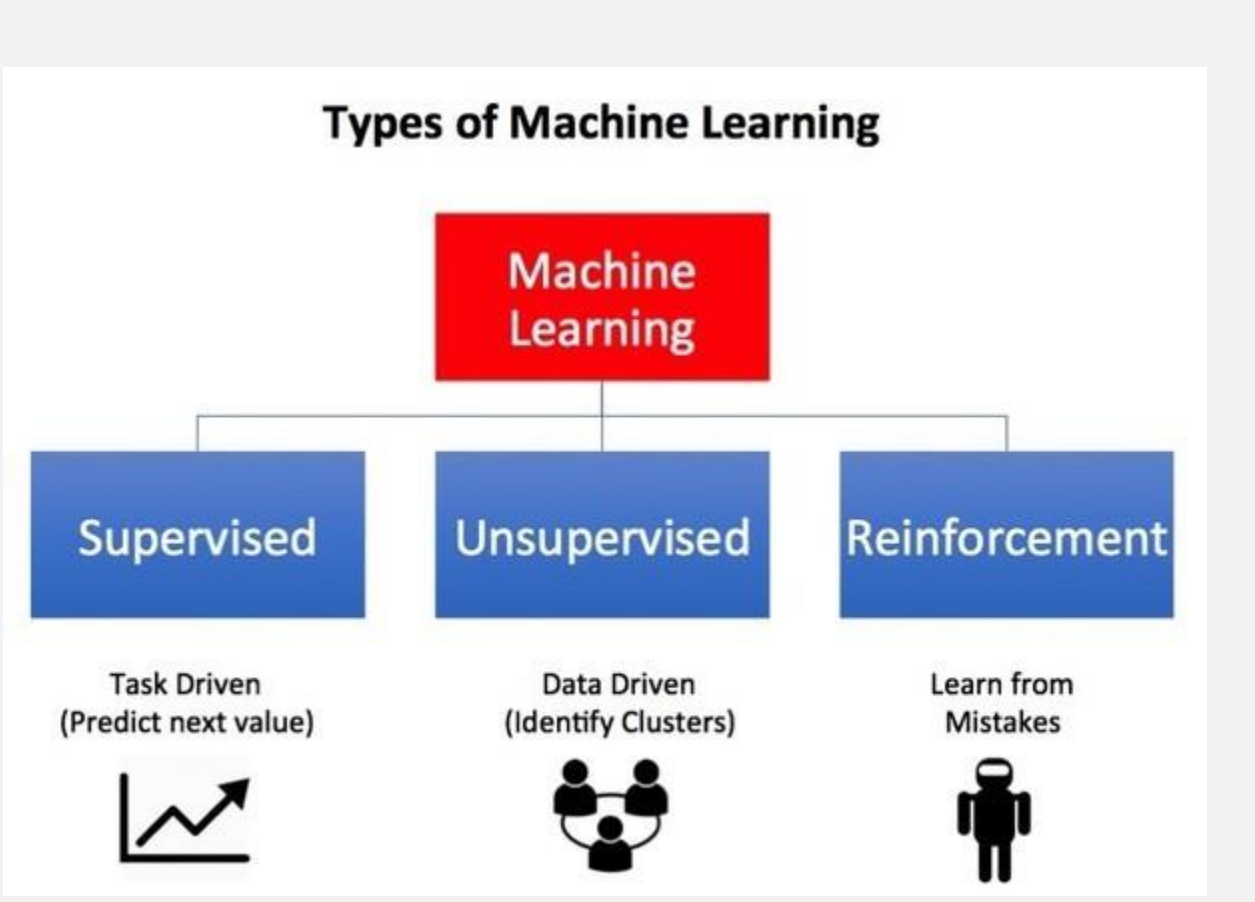
Data is growing day by day, and it is impossible to understand all of the data with higher speed and higher accuracy. More than 80% of the data is unstructured that is audios, videos, photos, documents, graphs, etc. Finding patterns in data on planet earth is impossible for human brains. The data has been very massive, the time taken to compute would increase, and this is where Machine Learning comes into action, to help people with significant data in minimum time.

Machine Learning is a sub-field of AI. Applying AI, we wanted to build better and intelligent machines. It sounds similar to a new

child learning from itself. So in the machine learning, a new capability for computers was developed. And now machine learning is present in so many segments of technology, that we don't even realise it while using it.

Types of Machine Learning:-

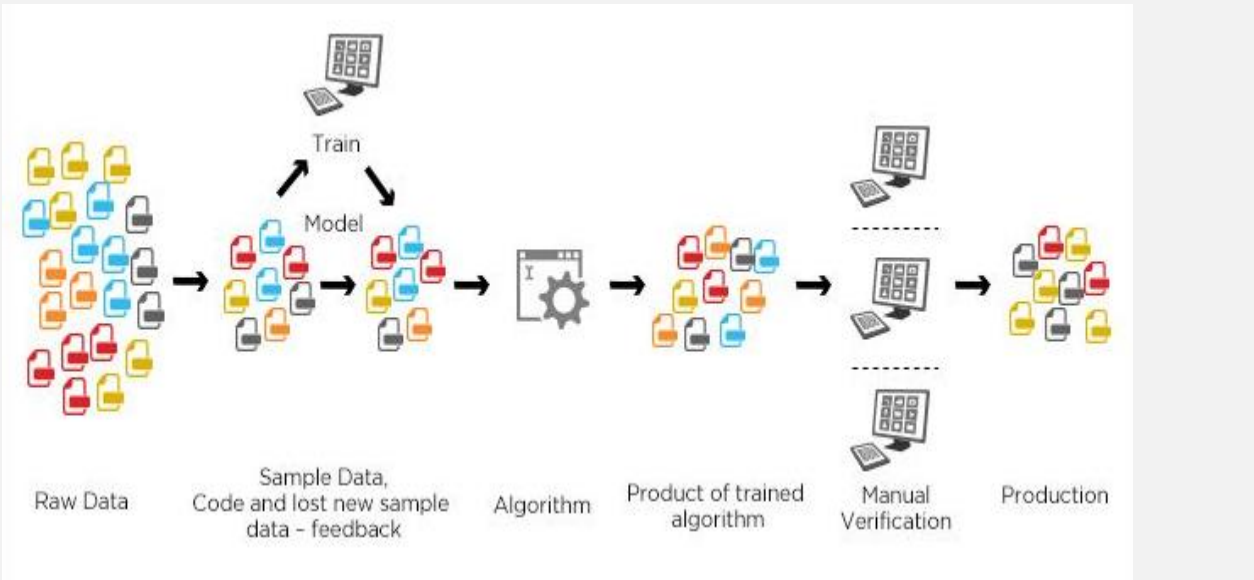
Machine Learning mainly divided into three categories, which are as follows-



Types of Machine Learning

1.Supervised Learning:-

Supervised Learning is the first type of machine learning, in which ***labelled*** data used to train the algorithms. In supervised learning, algorithms are trained using marked data, where the input and the output are known. We input the data in the learning algorithm as a set of inputs, which is called as Features, denoted by X along with the corresponding outputs, which is indicated by Y, and the algorithm learns by comparing its actual production with correct outputs to find errors. It then modifies the model accordingly. The raw data divided into two parts. The first part is for training the algorithm, and the other region used for test the trained algorithm.



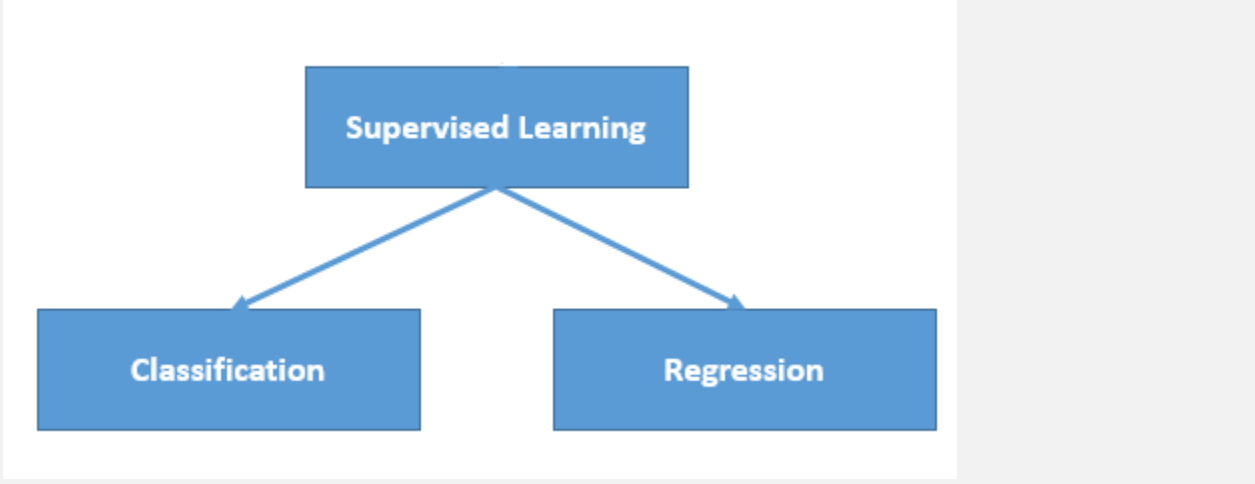
Supervised Machine Learning

Supervised learning uses the data patterns to predict the values of additional data for the labels. This method will commonly use in applications where historical data predict likely upcoming events.

Ex:- It can anticipate when transactions are likely to be fraudulent or which insurance customer is expected to file a claim.

Types of Supervised Learning:-

The Supervised Learning mainly divided into two parts which are as follows-



Types of Supervised Learning

1.1.Regression:-

Regression is the type of Supervised Learning in which labelled data used, and this data is used to make predictions in a continuous form. The output of the input is always ongoing, and the graph is linear. Regression is a form of predictive modelling technique which investigates the relationship between a dependent variable[***Outputs***] and independent variable[***Inputs***]. This technique used for forecasting the weather, time series modelling, process optimisation. Ex:- One of the examples of the

regression technique is House Price Prediction, where the price of the house will predict from the inputs such as No of rooms, Locality, Ease of transport, Age of house, Area of a home.

Types of Regression Algorithms:-

There are many Regression algorithms are present in machine learning, which will use for different regression applications. Some of the main regression algorithms are as follows-

1.1.1.Simple Linear Regression:-

In simple linear regression, we predict scores on one variable from the ratings on a second variable. The variable we are forecasting is called the criterion variable and referred to as Y. The variable we are basing our predictions on is called the predictor variable and denoted to as X.

1.1.2.Multiple Linear Regression:-

Multiple linear regression is one of the algorithms of regression technique, and it is the most common form of linear regression analysis. As a predictive analysis, the multiple linear regression is used to explain the relationship between one dependent variable with two or more than two independent variables. The independent variables can be continuous or categorical.

1.1.3.Polynomial Regression:-

Polynomial regression is another form of regression in which the maximum power of the independent variable is more than 1. In this regression technique, the best fit line is not a straight line instead it is in the form of a curve.

1.1.4.Support Vector Regression:-

Support Vector Regression can be applied not only to regression problems, but it also used in the case of classification. It contains all the features that characterise maximum margin algorithm. Linear learning machine mapping leans a non-linear function into high dimensional kernel-induced feature space. The system capacity was controlled by parameters that do not depend on the dimensionality of feature space.

1.1.5.Ridge Regression:-

Ridge Regression is one of the algorithms used in Regression technique. It is a technique for analysing multiple regression data that suffer from multicollinearity. By the addition of a degree of bias to the regression calculates, it reduces the standard errors. The net effect will be to give calculations that are more reliable.

1.1.6.Lasso Regression:-

Lasso regression is a type of linear regression that uses shrinkage. Shrinkage is where data values shrunk towards a central point, like the mean. The lasso procedure encourages simple, sparse models (i.e. models with fewer parameters). This particular type of

regression is well-suited for models showing high levels of multicollinearity or when you want to automate certain parts of model selection, like variable selection/parameter elimination.

1.1.7.ElasticNet Regression:-

Elastic net regression combined L1 norms (LASSO) and L2 norms (ridge regression) into a penalised model for generalised linear regression, and it gives it sparsity (L1) and robustness (L2) properties.

1.1.8.Bayesian Regression:-

Bayesian regression allows a reasonably natural mechanism to survive insufficient data or poorly distributed data. It will enable you to put coefficients on the prior and the noise so that the priors can take over in the absence of data. More importantly, you can ask Bayesian regression which parts (if any) of its fit to the data are it confident about, and which parts are very uncertain.

1.1.9.Decision Tree Regression:-

Decision tree builds a form like a tree structure from regression models. It breaks down the data into smaller subsets and while an associated decision tree developed incrementally at the same time. The result is a tree with decision nodes and leaf nodes.

1.1.10.Random Forest Regression:-

Random Forest is also one of the algorithms used in regression technique, and it is very flexible, easy to use machine learning algorithm that produces, even without hyper-parameter tuning. Also, this algorithm widely used because of its simplicity and the fact that it can use for both regression and classification tasks. The forest it builds, is an ensemble of Decision Trees, most of the time trained with the “bagging” method.

1.2.Classification:-

Classification is the type of Supervised Learning in which labelled data can use, and this data is used to make predictions in a non-continuous form. The output of the information is not always continuous, and the graph is non-linear. In the classification technique, the algorithm learns from the data input given to it and then uses this learning to classify new observation. This data set may merely be bi-class, or it may be multi-class too. Ex:- One of the examples of classification problems is to check whether the email is spam or not spam by train the algorithm for different spam words or emails.

Types of Classification Algorithms:-

There are many Classification algorithms are present in machine learning, which used for different classification applications. Some of the main classification algorithms are as follows-

1.2.1.Logistic Regression/Classification:-

Logistic regression falls under the category of supervised learning; it measures the relationship between the dependent variable which is categorical with one or more than one independent variables by estimating probabilities using a logistic/sigmoid function. Logistic regression can generally use where the dependent variable is Binary or Dichotomous. It means that the dependent variable can take only two possible values like “Yes or No”, “Living or Dead”.

1.2.2.K-Nearest Neighbours:-

KNN algorithm is one of the most straightforward algorithms in classification, and it is one of the most used learning algorithms. A majority vote of an object is classified by its neighbours, with the purpose being assigned to the class most common among its k nearest neighbours. It can also use for regression — output is the value of the object (predicts continuous values). This value is the average (or median) of the benefits of its k nearest neighbours.

1.2.3.Support Vector Machines:-

A Support Vector Machine is a type of Classifier, in which a discriminative classifier formally defined by a separating hyperplane. The algorithm outputs an optimal hyperplane which categorises new examples. In two dimensional space, this hyperplane is a line dividing a plane into two parts wherein each class lay on either side.

1.2.4.Kernel Support Vector Machines:-

Kernel-SVM algorithm is one the algorithms used in classification technique, and it is mathematical functions set that defined as the kernel. The purpose of the core is to take data as input and transform it into the required form. Different SVM algorithms use different types of kernel functions. These functions can be different types. For example linear and nonlinear functions, polynomial functions, radial basis function, and sigmoid functions.

1.2.5.Naive Bayes:-

Naive Bayes is a type of Classification technique, which based on Bayes' Theorem with an assumption of independence among predictors. In simple terms, a Naive Bayes classifier assumes that the presence of a particular feature in a class is unrelated to the presence of any other function. Naive Bayes model is accessible to build and particularly useful for extensive datasets.

1.2.6.Decision Tree Classification:-

Decision tree makes classification models in the form of a tree structure. An associated decision tree incrementally developed and at the same time It breaks down a large data-set into smaller subsets. The final result is a tree with decision nodes and leaf nodes. A decision node (e.g., Root) has two or more branches. Leaf node represents a classification or decision. The first decision node

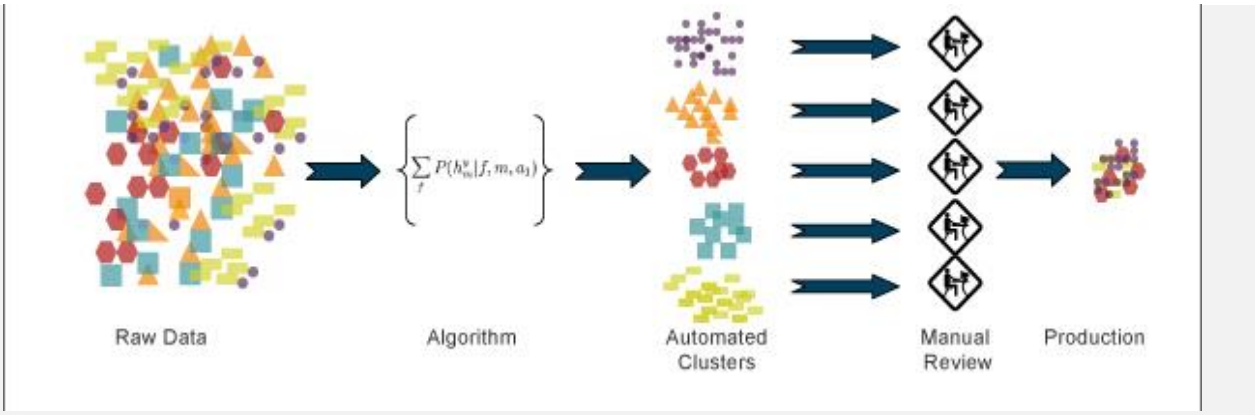
in a tree which corresponds to the best predictor called root node. Decision trees can handle both categorical and numerical data.

1.2.7.Random Forest Classification:-

Random Forest is a supervised learning algorithm. It creates a forest and makes it somehow casual. The wood it builds is an ensemble of Decision Trees, it most of the time the decision tree algorithm trained with the “bagging” method, which is a combination of learning models increases the overall result.

2.Unsupervised Learning:-

Unsupervised Learning is the second type of machine learning, in which unlabeled data are used to train the algorithm, which means it used against data that has no historical labels. What is being showing must figure out by the algorithm. The purpose is to explore the data and find some structure within. In unsupervised learning the data is unlabeled, and the input of raw information directly to the algorithm without pre-processing of the data and without knowing the output of the data and the data can not divide into a train or test data. The algorithm figures out the data and according to the data segments, it makes clusters of data with new labels.



Unsupervised Machine Learning

This learning technique works well on transactional data. For example, it can identify segments of customers with similar attributes who can then be treated similarly in marketing campaigns. Or it can find the primary qualities that separate customer segments from each other. These algorithms are also used to segment text topics, recommend items and identify data outliers.

Types of Unsupervised Learning:-

The Unsupervised Learning mainly divided into two parts which are as follows-

2.1.Clustering:-

Clustering is the type of Unsupervised Learning in which unlabeled data used, and it is the process of grouping similar entities together, and then the grouped data is used to make clusters. The goal of this unsupervised machine learning technique

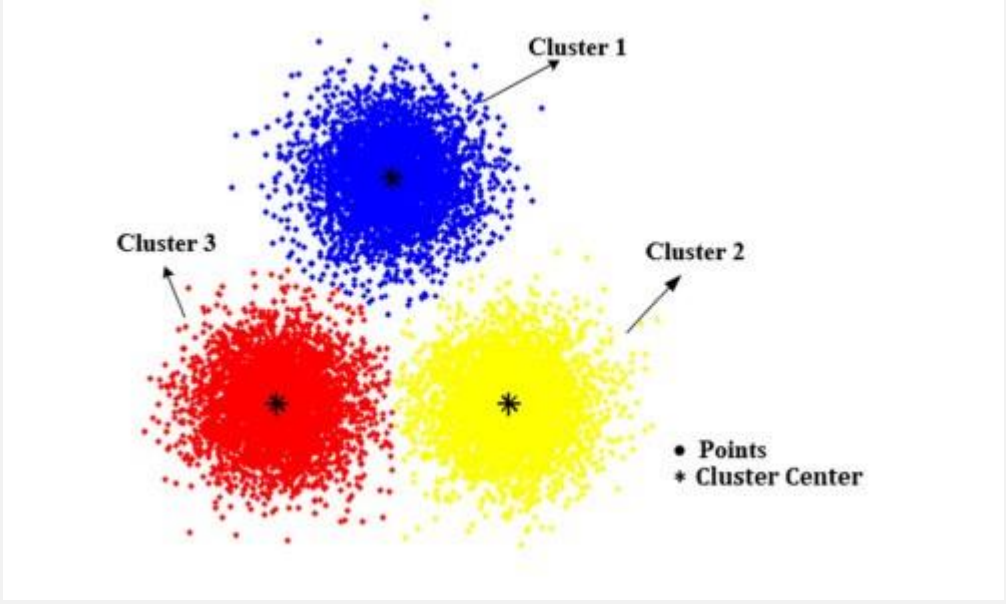
is to find similarities in the data point and group similar data points together and to figures out that new data should belong to which cluster.

Types of Clustering Algorithms:-

There are many Clustering algorithms are present in machine learning, which is used for different clustering applications. Some of the main clustering algorithms are as follows-

2.1.1.K-Means Clustering:-

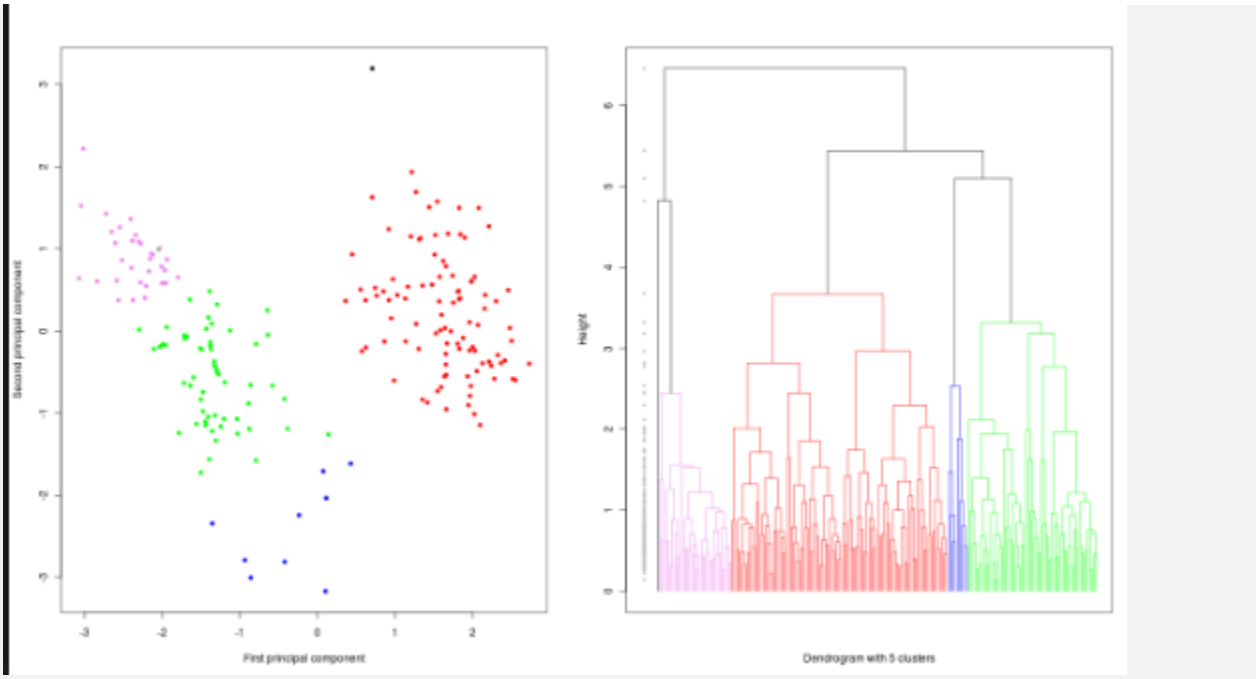
K-Means clustering is one of the algorithms of Clustering technique, in which similar data grouped in a cluster. K-means is an iterative clustering algorithm that aims to find local maxima in each iteration. It starts with K as the input which is how many groups you want to see. Input k centroids in random locations in your space. Now, with the use of the Euclidean distance method calculate the distance between data points and centroids, and assign data point to the cluster which is close to it. Recalculate the cluster centres as a mean of data points attached to it. Repeat until no further changes occur.



K-Means Clustering showing 3 clusters

2.1.2.Hierarchical Clustering:-

Hierarchical clustering is one of the algorithms of Clustering technique, in which similar data grouped in a cluster. It is an algorithm that builds the hierarchy of clusters. This algorithm starts with all the data points assigned to a bunch of their own. Then two nearest groups are merged into the same cluster. In the end, this algorithm terminates when there is only a single cluster left. Start by assign each data point to its bunch. Now find the closest pair of the group using Euclidean distance and merge them into the single cluster. Then calculate the distance between two nearest clusters and combine until all items clustered into a single cluster.



2.2.Dimensionality Reduction:-

Dimensionality Reduction is the type of Unsupervised Learning, in which the dimensions of the data is reduced to remove the unwanted data from the input. This technique is used to remove the undesirable features of the data. It relates to the process of converting a set of data having large dimensions into data with carries same data and small sizes. These techniques used while solving machine learning problems to obtain better features.

Types of Dimensionality Reduction Algorithms:-

There are many Dimensionality reduction algorithms are present in machine learning, which applied for different dimensionality reduction applications. Some of the main dimensionality reduction algorithms are as follows-

2.2.1.Principal Component Analysis:-

Principal Component Analysis is one of the algorithms of Dimensionality Reduction, in this technique, it transformed into a new set of variables from old variables, which are the linear combination of real variables. Specific new set of variables are known as principal components. As a result of the transformation, the first primary component has the most significant possible variance, and each following element has the highest potential difference under the constraint that it is orthogonal to the above ingredients. Keeping only the first m < n components reduces the data dimensionality while retaining most of the data information,

2.2.2.Linear Discriminant Analysis:-

The linear discriminant analysis is one of the algorithms of Dimensionality Reduction in which it also creates linear combinations of your original features. However, unlike PCA, LDA doesn't maximise explained variance. Instead, it optimises the separability between classes. LDA can improve the predictive performance of the extracted features. Furthermore, LDA offers variations to tackle specific roadblocks.

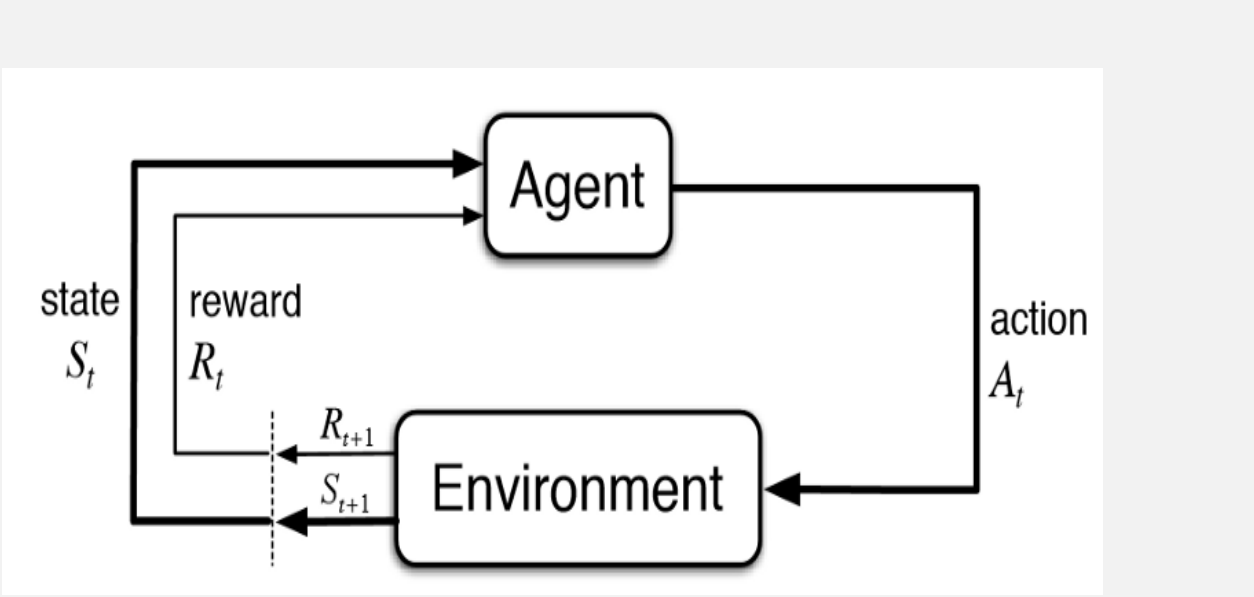
2.2.3.Kernel Principal Component Analysis:-

Kernel Principal Component Analysis is one of the algorithms of Dimensionality Reduction, and the variables which are transformed into variables of the new set, which are the non-linear combination of original variables means the nonlinear version of

PCA, called as Kernel Principal Component Analysis (KPCA). It is capable of capturing part of the high order statistics, thus provides more information from the original dataset.

3.Reinforcement Learning:-

Reinforcement Learning is the third type of machine learning in which no raw data is given as input instead reinforcement learning algorithm have to figures out the situation on their own. The reinforcement learning frequently used for robotics, gaming, and navigation. With reinforcement learning, the algorithm discovers through trial and error which actions yield the most significant rewards. This type of training has three main components which are the agent which can describe as the learner or decision maker, the environment which described as everything the agent interacts with and actions which represented as what the agent can do.



Reinforcement Learning

The objective is for the agent to take actions that maximise the expected reward over a given measure of time. The agent will reach the goal much quicker by following a good policy. So the purpose of reinforcement learning is to learn the best plan.

Types of Reinforcement Learning Algorithms:-

There are many Reinforcement Learning algorithms are present in machine learning, which applied for different reinforcement learning applications. Some of the main algorithms are as follows-

3.1.Q-Learning:-

Q-learning is one of the algorithms of Reinforcement Learning, in which an agent attempts to learn the optimal strategy from its history of communication with the environment. A record of an agent is a sequence of state-action-rewards. Q-learning learns an optimal policy no matter which procedure the agent is following as long as there is no restriction on the plenty of times it tries an action in any state. Because it learns an optimal policy no matter which strategy it is carrying out, it is called an off-policy method.

3.2.SARSA [State Action Reward State Action]:-

SARSA is one of the algorithms of Reinforcement Learning, in which it determines it refreshed to the action values. It's a minor difference between the SARSA and Q-learning implementations, but it causes a profound effect. The SARSA method takes another parameter, action2, which is the action that was made by the agent

from the second state. It allows the agent to find the future reward value explicitly. Next, that followed, rather than assuming that the optimal action will use and that the most significant reward.

3.3.Deep Q-Network:-

Deep Q-Network is one of the algorithms of Reinforcement Learning, although Q-learning is a very robust algorithm, its main flaw is lack of generality. If you view Q-learning as renewing numbers in a two-dimensional array (Action Space * State Space), it, in fact, follows the dynamic programming. It indicates that for states that the Q-learning agent has not seen before, it has no clue which action to take. In other words, a Q-learning agent cannot estimate value for unseen states. To deal with this problem, DQN gets rid of the two-dimensional array by introducing Neural Network.

3.4.Markov Decision Processes:-

Markov Decision Process is one of the algorithms of Reinforcement Learning, in which it contains *A set of possible world states S. *A set of Models. *A set of possible actions A. *A real-valued reward function R(s, a). *A policy the solution of Markov Decision Process. To achieve a goal, the Markov Decision Process is used it is a straightforward framing of the problem of learning from interaction. The agent was selecting actions and the environment responding to these actions, and the agent and the

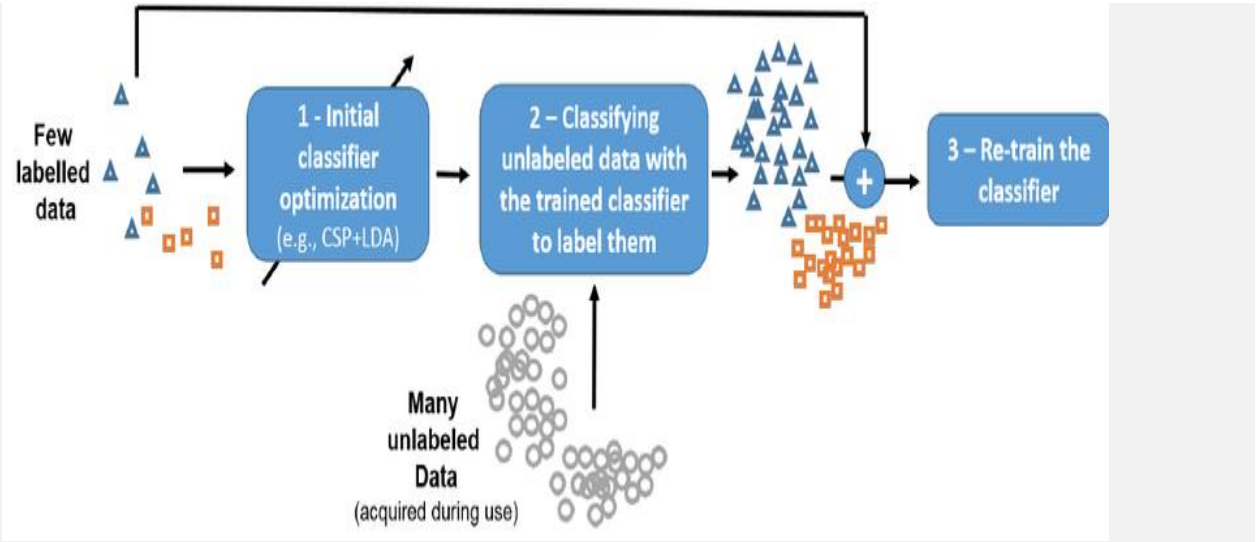
environment interact continually and presenting new situations to the agent.

3.5.DDPG[Deep Deterministic Policy Gradient]:-

Deep Deterministic Policy Gradient is one of the algorithms of Reinforcement Learning, in which it relies on the actor-critic design with two eponymous components, actor, and critic. An actor is utilised to tune the parameter $\boldsymbol{\theta}$ for the policy function, i.e. decide the best action for a specific state. The ideas of separate target network and experience replay are also borrowed from DQN. The seldom performs exploration for operations is another issue for DDPG. A solution for this is adding noise to the parameter space or the action space.

4.Semi-Supervised Learning:-

Semi-Supervised Learning is the fourth type of Machine Learning, in which both types of raw data used. Semi-supervised learning is a hybrid of supervised and unsupervised machine learning. The Semi-supervised learning used for the same purposes as supervised learning, where it employs both labelled and unlabeled data for training typically a small amount of labelled data with a significant amount of unlabeled data. This type of learning can use with methods such as classification, regression, and prediction.

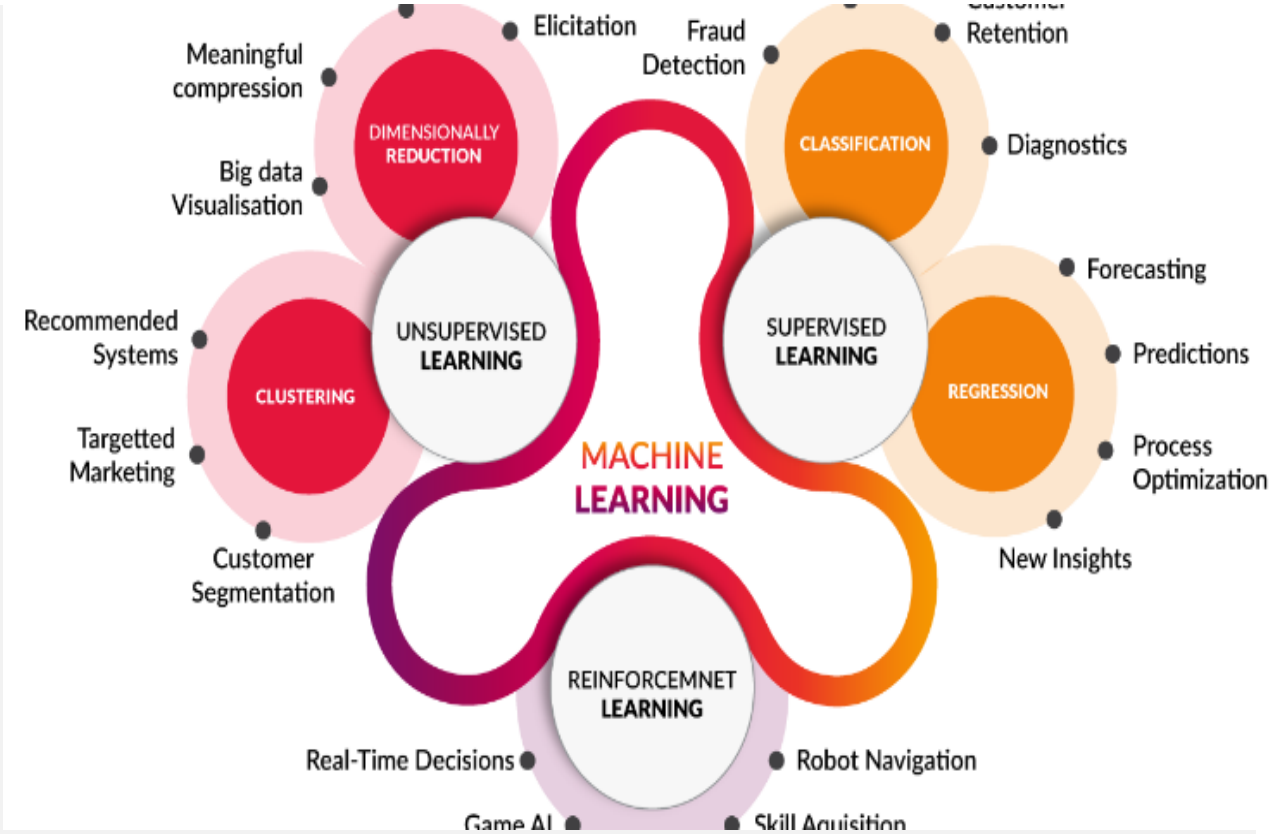


Semi-supervised machine learning

This technique is useful for a few reasons. First, the process of labelling massive amounts of data for supervised learning is often prohibitively time-consuming and expensive. What's more, too much labelling can impose human biases on the model. That means including lots of unlabeled data during the training process tends to improve the accuracy of the final model while reducing the time and cost spent building it.

Applications of Machine Learning:-

There are many uses of Machine Learning in various fields, some of the areas are Medical, Defence, Technology, Finance, Security, etc. These fields areas different applications of Supervised, Unsupervised and Reinforcement learning. Some of the areas where these ML algorithms used are as follows-


Elicitation
Meaningful compression
Big data Visualisation
DIMENSIONALLY REDUCTION
Fraud Detection
Retention
CLASSIFICATION
Diagnostics
Recommended Systems
CLUSTERING
Targetted Marketing
Customer Segmentation
UNSUPERVISED LEARNING
SUPERVISED LEARNING
MACHINE LEARNING
Forecasting
Predictions
REGRESSION
Process Optimization
New Insights
REINFORCEMNET LEARNING
Real-Time Decisions
Robot Navigation
Game AI
Skill Aquisition