Learning denotes changes in a system that enable the system to do the same task more efficiently next time.
Learning is an important feature of intelligence.

Definition: -
A Computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, If its performance at tasks in T, as measured by P, improves with experience E.

This means:

Given: A task T
A performance measure P
Some experience E with the task.

Goal: Generalize the experience in a way that allows for improving your performance on the task.

Why do you require machine learning?

Understand and improve the efficiency of human learning.

Discover new things or structure that is unknown to humans.

Fill incomplete specifications about a domain.
Learning Agents:- An agent is an entity that is capable of perceiving and do action. An agent can be viewed as perceiving its environment through sensors and acting upon that environment through actuators.

In computer science, an agent is a software agent that assists users and acts in performing computer-related tasks.

Components of a learning system :-

- Performance element :- The performance element is the agent itself that acts in the world.
- Learning element : -It responsible for making improvements, takes knowledge about performance element and some feedback, determined how to modify performance element.
- Critic :- Tells the learning element how agent is doing(success or failure) by comparing with a fixed standard of performance.
- Problem generator :- suggests problem or actions that will generate new examples or experiences that will aid in training the system further.

Paradigms of machine learning :-

- Rote learning :- learning by memorization.

- Induction :- learning from examples; A form of supervised learning, uses specific examples to reach general conclusions; concepts are learned from sets of labeled instances.
- Clustering : -Discovering similar group; Unsupervised, Inductive learning in which natural classes are found for data instances, as well as ways of classifying them.
- Analogy :- Determine correspondence between two different representations that come from inductive learning in which a system transfers knowledge from one database into another database of a different domain.
- Discovery :- Learning without the help from a teacher. Learning is both inductive and deductive. It is deductive if it proves theorems and discovers concepts about those theorems. It is inductive when it raises conjectures(guess). It is unsupervised, specific goal not given.
- Genetic algorithms :- Inspired by natural evolution.
- Reinforcement:- Learning from feedback (positive or negative reward) given at end of a sequence of steps. Unlike supervised learning, the reinforcement learning takes place in an environment where the agent cannot directly compare the results of its action to a desired result. Instead, it Is given some reward or punishment that relates to its actions. It may win or lose a game, or be told it has made a good move or a poor one. The job of reinforcement learning is to find a successful function using these rewards.
- Rote learning :- Rote learning technique avoids understanding the inner complexities, but focuses on memorizing the material so that it can be recalled by the learner exactly the way it was read or heard.

Learning from example : induction

A process of learning by example. The system tries to induce a general rule from a set of observed instances.
The learning methods extract rules and patterns out of massive data sets.

The learning process belong to supervised learning, does classification and constructs class definitions, called induction or concept learning.
The techniques used for constructing class definitions(or concept learning) are :-

- Winston's learning program.
- Version spaces
- Decision trees

Decision trees :-

It's a powerful tool for classification and prediction.
Decision trees represent rules.
Rules are easily expressed so that humans can understand them or even directly use in database access language like SQL, so that records falling into a particular category may be retrieved.

Decision tree is a classifier in the form of a tree structure where each node is either a leaf or decision node.

Leaf node : - indicates the target attribute(class) values of examples.

Decision node :- specify test to be carried on an attribute value.

Decision tree is a typical inductive approach to learn knowledge on classification. The condition are : -

-Attribute value description :- Object or case must be expressible as a fixed collection of properties or attributes having discrete values