BASIC CONCEPTS OF AI AND MACHINE LEARNING :

MACHINE LEARNING :

Machine learning contains elements of mathematics, statistics and computer science , which is helping to drive advances in the development of artificial intelligence . it is the study of computer algorithms which expands and develop through experiences .

The method of predicting a model on a trained range of inputs learning function to maps the known output, which discover the pattern of new sets of data.

Example 1: To predict the model for microprocessor knee joint which is trained with numerous input or labeled data of the knee angle variation in different sub phase of gait cycle and apply on new amputee to predict the new data by the phase dependent pattern recognition approach.

Example 2: Intuitive myoelectric prosthesis or pattern recognition control prosthesis, FES.

Pattern recognition is an automatically recognition of pattern applied in data analysis, signal processing etc. when the pattern of algorithm trained from labeled data that is supervised learning. When the model of algorithm is fruitfully trained, the model can be used for the prediction of a new data. The ultimate goal of this ML is to develop a successful predictor function. The models of discrete or categorical categories of dependent variables are known as classification algorithm and with continuous value known as regression algorithm. Three basic steps followed to finalize a model are training, validating and application of algorithm to new data. Algorithm used for supervised learning are support vector machines, linear regression, linear discriminant analysis (LDA) etc. This is error based learning.

Example: Prediction of a model to relate the patient's energy consumption using Trans femoral prosthesis with the function of walking velocity in level surfaces.

The linear regression model for the above statement is:

$Y = b + aX + e$

Y = Energy consumption

b = Y intercept

a = Slope of the Line

X = Walking velocity (Independent variable), e = Error

The Logistic regression model is used to model the probability of a certain class or event such as pass fail, win/loss, healthy/sick etc. This is fall between 0 and 1 with categorical dependent variables.

Unsupervised learning :

The algorithm of unsupervised learning finds a solution to unknown or unlabeled data which is not required any kind of supervision from human. It works of its own to gather information and allow performing more complex task compared to supervised learning. Cluster analysis and k means are the methods used for pattern formation for the new data.

Example: Intent detection algorithm with unlabeled data based on reference pattern is an unsupervised learning method used in microprocessor knee.

Reinforcement learning :

This is concerned with how a software agent must take action in an environment to maximize the cumulative reward. The agent learns from the consequences of its actions and selects the choice from its past experiences and the new choices by the trial and error learning. This is generally output based learning. The components of the RL are agent and environment. The agent (Learner) learns about a policy (π) (strategy or approach that the agent uses to determine the next action based on the current state) by observing or interacting with the environment. All the possible steps followed by the agent during the process of learning are known as the “action” and current condition returned by the environment is “state”. The approach that the agent uses to determine the next action based on the current state is known as “policy”. The artificial intelligence gets either reward or penalties for the action the agent performs. The reward is an instant return from the environment to appraise the last action. The goal of an agent to maximize the reward based on the set of actions. The agent follows the concept of exploration and exploitation to get the optimal action value or rewards. The exploration is about exploring and capturing more information from the environment and exploitation uses the already known information to get the reward.