1. ***What is the concept of human learning? Please give two examples.***

Ans->Human learns from pattern.

Example->understanding complete book by studying from chapter one.

Kids learn ball,cone from its shape

1. ***What different forms of human learning are there? Are there any machine learning equivalents?***

With each Google search, several machine learning systems work together, ranging from understanding the language in which you’re searching to tailoring your results so that « bass » fishing enthusiasts are not swamped with guitar results. Likewise, Gmail’s spam and phishing recognition systems use auto-learning models to keep spam out of your inbox.

Among the most visible manifestations of the power of machine learning are virtual assistants, including Amazon’s Alexa, Apple’s Siri, Microsoft Cortana, and Google Assistant.

Both humans and machines make errors while using their intelligence during problem solving. In ML, systems store all the examples, if we take an overstocked model that has a poor generalization it will not work on any unprecedented examples.

Also, the education system in most Asian countries surpasses the students by providing coaching and classes on technical subjects which allows them to solve only exemplary problems. Such problems are solved in exams with no need for intelligence of any kind. Those students can solve problems they have already seen and only the problems they have seen in the past. They cannot correctly handle general problems with precision because their intelligence is not generalized. That is the main reason why skill levels of university graduates are insufficient. Simply put, the great majority of students become exaggerated models of learning.

Nowadays, machine learning is a booming part of the growing artificial intelligence research. This is due to the implementation of neural network software, imitating the human brain’s functions, as well as the availability of large and affordable computing hardware resources, which offers potential for solving problems that until now have depended on the power of the human brain.

Massive amounts of data (Big Data) consisting of medical or financial information, image libraries or information on customer behavior, and so on, are all processed by very complex types of algorithms to generate digital knowledge with no need for traditional programming.

When we compare machine learning to human learning theories, ideas become much easier to understand and less confusing. But obviously there remain some fundamental differences between the two, which is primarily the barrier that keeps artificial intelligence away from approaching general human intelligence.

***3. What is machine learning, and how does it work? What are the key responsibilities of machine learning?***

Ans-> Machine learning is a data analytics technique that teaches computers to do what comes naturally to humans and animals: learn from experience. Machine learning algorithms use computational methods to “learn” information directly from data without relying on a predetermined equation as a model. The algorithms adaptively improve their performance as the number of samples available for learning increases. Deep learning is a specialized form of machine learning.

Computational finance, for credit scoring and algorithmic trading

Image processing and computer vision, for face recognition, motion detection, and object detection

Computational biology, for tumor detection, drug discovery, and DNA sequencing

Energy production, for price and load forecasting

Automotive, aerospace, and manufacturing, for predictive maintenance

Natural language processing, for voice recognition applications

***4. Define the terms "penalty" and "reward" in the context of reinforcement learning.***

Reinforcement Learning is a feedback-based Machine learning technique in which an agent learns to behave in an environment by performing the actions and seeing the results of actions. For each good action, the agent gets positive feedback, and for each bad action, the agent gets negative feedback or penalty.

In Reinforcement Learning, the agent learns automatically using feedbacks without any labeled data, unlike supervised learning.

Since there is no labeled data, so the agent is bound to learn by its experience only.

RL solves a specific type of problem where decision making is sequential, and the goal is long-term, such as game-playing, robotics, etc.

The agent interacts with the environment and explores it by itself. The primary goal of an agent in reinforcement learning is to improve the performance by getting the maximum positive rewards.

The agent learns with the process of hit and trial, and based on the experience, it learns to perform the task in a better way. Hence, we can say that "Reinforcement learning is a type of machine learning method where an intelligent agent (computer program) interacts with the environment and learns to act within that." How a Robotic dog learns the movement of his arms is an example of Reinforcement learning.

It is a core part of Artificial intelligence, and all AI agent works on the concept of reinforcement learning. Here we do not need to pre-program the agent, as it learns from its own experience without any human intervention.

Example: Suppose there is an AI agent present within a maze environment, and his goal is to find the diamond. The agent interacts with the environment by performing some actions, and based on those actions, the state of the agent gets changed, and it also receives a reward or penalty as feedback.

The agent continues doing these three things (take action, change state/remain in the same state, and get feedback), and by doing these actions, he learns and explores the environment.

The agent learns that what actions lead to positive feedback or rewards and what actions lead to negative feedback penalty. As a positive reward, the agent gets a positive point, and as a penalty, it gets a negative point.

What is Reinforcement Learning

Terms used in Reinforcement Learning

Agent(): An entity that can perceive/explore the environment and act upon it.

Environment(): A situation in which an agent is present or surrounded by. In RL, we assume the stochastic environment, which means it is random in nature.

Action(): Actions are the moves taken by an agent within the environment.

State(): State is a situation returned by the environment after each action taken by the agent.

Reward(): A feedback returned to the agent from the environment to evaluate the action of the agent.

Policy(): Policy is a strategy applied by the agent for the next action based on the current state.

Value(): It is expected long-term retuned with the discount factor and opposite to the short-term reward.

Q-value(): It is mostly similar to the value, but it takes one additional parameter as a current action (a).

Key Features of Reinforcement Learning

In RL, the agent is not instructed about the environment and what actions need to be taken.

It is based on the hit and trial process.

The agent takes the next action and changes states according to the feedback of the previous action.

The agent may get a delayed reward.

The environment is stochastic, and the agent needs to explore it to reach to get the maximum positive rewards.

***5. Explain the term "learning as a search"?***

Definition. Learning can be viewed as a search through the space of all sentences **in** a concept description language for a sentence that best describes the data. Alternatively, it can be viewed as a search through all hypotheses in a hypothesis space.

***6. What are the various goals of machine learning? What is the relationship between these and human learning?***

Its goal and usage is to build new and/or leverage existing algorithms to learn from data, in order to build generalizable models that give accurate predictions, or to find patterns, particularly with new and unseen similar data.

Humans acquire knowledge through experience either directly or shared by others. Machines acquire knowledge through experience shared in the form of past data. We have the terms, Knowledge, Skill, and Memory being used to define intelligence.

The simple difference is that human beings use their brain, ability to think, memory, while AI machines depend on the data given to them. As we all know that humans learn from past mistakes and intelligent ideas and intelligent attitudes lie at the basis of human intelligence.

***7. Illustrate the various elements of machine learning using a real-life illustration.***

Image recognition. Image recognition is a well-known and widespread example of machine learning in the real world. ...

Speech recognition. Machine learning can translate speech into text. ...

Medical diagnosis. ...

Statistical arbitrage. ...

Predictive analytics. ...

Extraction.

***8. Provide an example of the abstraction method.***

In simple terms, abstraction “displays” only the relevant attributes of objects and “hides” the unnecessary details. For example, when we are driving a car, we are only concerned about driving the car like start/stop the car, accelerate/ break, etc. ... This is a simple example of abstraction.

***9. What is the concept of generalization? What function does it play in the machine learning process?***

generalization, in psychology, the tendency to respond in the same way to different but similar stimuli. ... For example, a child who is scared by a man with a beard may fail to discriminate between bearded men and generalize that all men with beards are to be feared.

Generalization refers to your model's ability to adapt properly to new, previously unseen data, drawn from the same distribution as the one used to create the model. Determine whether a model is good or not. ... Divide a data set into a training set and a test set

***What is classification, exactly? What are the main distinctions between classification and regression?***

Classification is the task of predicting a discrete class label. Regression is the task of predicting a continuous quantity

***11. What is regression, and how does it work? Give an example of a real-world problem that was solved using regression.***

Regression in machine learning consists of mathematical methods that allow data scientists to predict a continuous outcome (y) based on the value of one or more predictor variables (x). Linear regression is probably the most popular form of regression analysis because of its ease-of-use in predicting and forecasting.

Medical researchers often use linear regression to understand the relationship between drug dosage and blood pressure of patients. For example, researchers might administer various dosages of a certain drug to patients and observe how their blood pressure responds

***12. Describe the clustering mechanism in detail.***

Clustering is the task of dividing the population or data points into a number of groups such that data points in the same groups are more similar to other data points in the same group than those in other groups. In simple words, the aim is to segregate groups with similar traits and assign them into clusters.

***13. Make brief observations on two of the following topics:***

***i. Machine learning algorithms are used***

***ii. Studying under supervision***

***iii. Studying without supervision***

***iv. Reinforcement learning is a form of learning based on positive reinforcement.***

Supervised learning is a machine learning approach that’s defined by its use of labeled datasets. These datasets are designed to train or “supervise” algorithms into classifying data or predicting outcomes accurately. Using labeled inputs and outputs, the model can measure its accuracy and learn over time.

Supervised learning can be separated into two types of problems when data mining: classification and regression:

Classification problems use an algorithm to accurately assign test data into specific categories, such as separating apples from oranges. Or, in the real world, supervised learning algorithms can be used to classify spam in a separate folder from your inbox. Linear classifiers, support vector machines, decision trees and random forest are all common types of classification algorithms.

Regression is another type of supervised learning method that uses an algorithm to understand the relationship between dependent and independent variables. Regression models are helpful for predicting numerical values based on different data points, such as sales revenue projections for a given business. Some popular regression algorithms are linear regression, logistic regression and polynomial regression.

Unsupervised learning uses machine learning algorithms to analyze and cluster unlabeled data sets. These algorithms discover hidden patterns in data without the need for human intervention (hence, they are “unsupervised”).

Unsupervised learning models are used for three main tasks: clustering, association and dimensionality reduction:

Clustering is a data mining technique for grouping unlabeled data based on their similarities or differences. For example, K-means clustering algorithms assign similar data points into groups, where the K value represents the size of the grouping and granularity. This technique is helpful for market segmentation, image compression, etc.

Association is another type of unsupervised learning method that uses different rules to find relationships between variables in a given dataset. These methods are frequently used for market basket analysis and recommendation engines, along the lines of “Customers Who Bought This Item Also Bought” recommendations.

Dimensionality reduction is a learning technique used when the number of features (or dimensions) in a given dataset is too high. It reduces the number of data inputs to a manageable size while also preserving the data integrity. Often, this technique is used in the preprocessing data stage, such as when autoencoders remove noise from visual data to improve picture quality.

In reinforcement learning, developers devise a method of rewarding desired behaviors and punishing negative behaviors. This method assigns positive values to the desired actions to encourage the agent and negative values to undesired behaviors. This programs the agent to seek long-term and maximum overall reward to achieve an optimal solution.

These long-term goals help prevent the agent from stalling on lesser goals. With time, the agent learns to avoid the negative and seek the positive. This learning method has been adopted in artificial intelligence (AI) as a way of directing unsupervised machine learning through rewards and penalties.