**SIVAKUMAR PALANIRAJAN**

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

Human learning can be done to acquire new knowledge or to modify already present knowledge. This can be done through experiences that a human goes through during their life.

Examples:

* Learning how to drive a car
* Learning how to speak

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

* Cognitive Learning: this is the type of learning where we undergo mental processing to think and learn by understanding situations.
* Experiential Learning: this is the type of learning where we learn through various experiences that we reflect upon through our life.
* Observational Learning: this is the type of learning where we learning through observing and mimicking the actions and choices of others.

The experiential learning is quite similar to the concept of reinforcement learning where the agent tends to learn by interacting with its surroundings and its past experiences.

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

* Machine learning is the crucial division of the artificial intelligence which is basically what that dictates the behavior of the intelligent models which we build.
* Machine learning works by training specific algorithms onto datasets in which it slowly learns each characteristic of the dataset which increases its capability to make accurate predictions regarding the dataset or the specified task.
* Key responsibilities include: Data collection, data preprocessing, model building, finetuning of parameters, model evaluation.

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

* Penalty is something negative with respective to reinforcement learning, this is basically awarded to an agent when its action was not desirable.
* Reward is the opposite of it, it is given to an agent whenever its action is exactly what is required at that point of that time. We could call that action of the agent as a successful action.

**5. Explain the term “learning as a search”?**

* This is the idea where AI models tend to learn through repetitive search. Exploration tends to occur such that the optimal solution is found.
* Examples include Hyperparameter tuning, Exploration vs Exploitation

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

* Machine learning has the ultimate goal of mimicking human intelligence and to make predictions that are as accurate as possible which is hassle-free.
* Machine learning has various goals such as classification, regression and clustering.
* The relationship between these and human learning is that these tend to increase human knowledge regarding a data which can be difficult for a layman to observe and breakdown. For example, the task of regression where a certain value is to be predicted after centuries could be a tough and cumbersome task for a human but these algorithms can do such predictions based on the data that they are trained upon.

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

* Crucial elements of ML are the model, the data and the prediction.
* In comparison to real-life, the model could be human beings, the data could be the knowledge that is already present and the prediction could be something such as an action that is to be taken.
* So, us Human beings use our knowledge which is the data, we analyze it and make reasonable observations from it. Due to this we tend to be more intelligent just like how ML models tend to become intelligent for its specific task. Then we tend to make actions using the knowledge. Similarly, ML models tend to make predictions.

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

* Abstraction is where we try to hide the irrelevant details of a process and only focus on the crucial parts.
* An important example of abstraction method is data abstraction where we define data types such as the implementation details are kept hidden.
* Use of classes and objects help in data abstraction.

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

**process?**

* Generalization is the technique through which we tend to generalize something to match multiple scenarios instead of its effectiveness being narrow and with less reach.
* This has a crucial role in ML where we need always need a model which has high level of generalization such that our model isn’t overfitted to the data that it was trained upon. We need our model to work well with data that it isn’t familiar with, that would be a crucial requirement for a well-developed model.

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

* Classification is the task where it is required to classify something into a specific class or a label. For example, if we are required to find out if a fruit is apple or not, then it is a classification task.
* Classification and regression tend to differ in the fact that classification is where we are working to classify something of interest whereas in regression, we try to predict a specific numeric value after n period or situations.
* Classification works on features which are categorical whereas regression works on numerical features.

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

* Regression is the task where we try to predict a numeric value based on a group of dependent features.
* It works by building the regression equation which could be linear or even polynomial. It all depends on the number of dependent variables.
* Example: If we have data on the stock prices of a specific stock over a specific period of time, we could use the data to build a regression model to predict the stock’s price at a certain time.

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

* Clustering is the only unsupervised task in which we don’t have any labelled target features.
* The whole concept behind clustering is to find the hidden relation between the various datapoints which are generally numeric or the categorical features could be encoded. Concepts such as Euclidean distance and Manhattan distance can be used to find the similarity between the points.
* Finally, the model tends to group the data points into various groups.
* Algorithms like K-Means and DBSCAN can be used here.

**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.**

**STUDYING UNDER SUPERVISION**

* Studying under supervision is basically where the model is being trained while having the target feature or with the knowledge of what it must be able to predict.
* This makes the task of prediction easier and more suitable for real-life application.
* As supervision is present, the model could be corrected whenever it gives inaccurate results as it could learn by correcting its predictive function such as the regression equation or the entropy equations of decision trees to rectify its error.

**REINFORCEMENT LEARNING IS A FORM OF LEARNING BASED ON POSITIVE REINFORCEMENT**

* Reinforcement learning is where there are two types of reinforcements: positive and negative.
* Positive is used to reward and motivate the agent whenever it takes the right action.
* Whereas negative is used to correct the agent and let it know that its action was the wrong one and it should be avoided.
* So, reinforcement learning depends heavily on both these concepts but we require positive reinforcement to make the agent learn which actions are desirable.