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

Ans: Human Learning Systems is an alternative approach to public management which embraces the complexity of the real world and enables us to work effectively in that complexity. Learning to drive a motor-car, typewriting, singing or memorizing a poem or a mathematical table, and music etc.

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

Ans: There are 3 forms of human learning and there are machine learning equivalents.

Supervised learning is similar to [**concept learning**](https://en.wikipedia.org/wiki/Concept_learning)  where a person is required to classify new objects into existing categories, by matching the features of the new objects to examples in the categories .

In [unsupervised learning](https://en.wikipedia.org/wiki/Unsupervised_learning), the training dataset does not have any labelled corresponding output values .Since there are no “correct answers” to learn from, the objective of the algorithm is to uncover any interesting patterns that it can find in the data, and new data will help to confirm or disconfirm these patterns that it finds.

In [reinforcement learning](https://en.wikipedia.org/wiki/Reinforcement_learning), there are “correct answers” but the input data is not paired with the desired outputs. The “correct answers” contain numerical rewards, which the algorithm needs to maximise by choosing the correct actions to take. This is very much similar to a mouse navigating through a maze looking for food, where wrong moves result in the punishment of hunger, and right moves get it to the food more quickly.

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

Ans: Machine Learning is an AI technique that teaches computers to learn from experience. Machine learning algorithms use computational methods to “learn” information directly from data without relying on a predetermined equation as a model.

**Key Elements of Machine Learning:**

**1. Data Set :**Machines need a lot of data to function, to learn from, and ultimately make decisions based on it. This data can be any unprocessed fact, value, sound, image, text which can be interpreted and analyzed. A data set is a consolidated data of a similar genre that is captured in different environments. Once a dataset is ready, it is used for training, validating, and testing the ML model.

**2. Algorithms**: Machine learning algorithms use computational methods to “learn” information directly from data without relying on a predetermined equation as a model.

**3. Models**: In Machine learning, a model is a computational representation of real-world processes. An ML model is trained to recognize certain types of patterns by training it over a set of data using relevant algorithms. Once a model is trained, it can be used to make predictions.

**4. Feature Extraction**:Datasets can have multiple features. If the features in the dataset are similar or vary to a large extent, then the observations stored in the dataset are likely to make an ML model suffer from overfitting. To overcome this problem, it is necessary to regularize the number of features in data sets by using feature extraction techniques. Feature extraction aims at reducing the number of features in a dataset by creating new features from the existing ones.

**5. Training**: Training includes approaches that allow ML models to identify patterns and make decisions.

**6.Predictions:** Once the model is a train it is then used for prediction.

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

Ans: 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 called Reward, and for each bad action, the agent gets negative feedback or penalty.

1. Explain the term "learning as a search"?

Ans: 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.

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

Ans:(1)To make the computers smarter, more intelligent. The more direct objective in this aspect is to develop systems (programs) for specific practical learning tasks in application domains.

(2) To develop computational models of human learning process and perform computer simulations. The study in this aspect is also called cognitive modelling.

(3) To explore new learning methods and develop general learning algorithms independent of applications.

 Humans acquire knowledge through experience either directly or shared by others. Machines acquire knowledge through experience shared in the form of past data.

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

A picture containing diagram

Description automatically generated

1. Provide an example of the abstraction method.

Ans: Abstraction has been mainly studied in problem solving, theorem proving, knowledge representation (in particular for spatial and temporal reasoning) and machine learning. In such contexts, abstraction is defined as **a mapping between formalisms that reduces the computational complexity of the task at stake**.

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

**Ans: 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 .In other word generalization is a  **to demonstrate how well is a trained model to classify or forecast unseen data**. It

Q10.What is classification, exactly? What are the main distinctions between classification and regression?

Ans:Data Classification in data science refers to the process that tags and categorizes any kind of data so that it can be better understood and analyzed. The most significant difference between regression vs classification is that while regression helps predict a continuous quantity, classification predicts discrete class labels.

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

Ans: A regression is a statistical technique that relates a dependent variable to one or more independent (explanatory) variables. A regression model is able to show whether changes observed in the dependent variable are associated with changes in one or more of the explanatory variables.it can be used to predict the relationship between reckless driving and the total number of road accidents caused by a driver, predicting the price of a house given house features, predicting the impact of SAT/GRE scores on college admissions

1. Describe the clustering mechanism in detail.

Ans: 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.

**For ex**– The data points in the graph below clustered together can be classified into one single group. We can distinguish the clusters, and we can identify that there are 3 clusters in the below picture.

Diagram

Description automatically generated

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.

1. Supervised learning is the types of machine learning in which machines are trained using well "labelled" training data, and on basis of that data, machines predict the output. The labelled data means some input data is already tagged with the correct output. It applies the same concept as a student learns in the supervision of the teacher.
2. Studying without supervision: All the observations in the dataset are unlabeled and the algorithms learn to inherent structure from the input data.

**Observations:**

**Advantages:**

* An exact idea about the classes in the training data.
* In the case of unsupervised learning, difficult to easily understand what is happening inside the machine, how it is learning, etc.
* You can find out exactly how many classes are there before giving the data for training.
* It is possible for you to be very specific about the definition of the classes, that is, you can train the classifier in a way which has a perfect decision boundary to distinguish different classes accurately.
* After the entire training is completed, you don’t necessarily need to keep the training data in your memory. Instead, you can keep the decision boundary as a mathematical formula.
* Supervised learning can be very helpful in classification problems.
* Another typical task of supervised machine learning is to predict a numerical target value from some given data and labels.

**Disadvantages of Supervised Machine Learning**

* Supervised learning is limited in a variety of sense so that it can’t handle some of the complex tasks in machine learning.
* Supervised learning cannot give you unknown information from the training data like unsupervised learning do.
* It cannot cluster or classify data by discovering its features on its own, unlike unsupervised learning.
* In the case of classification, if we give an input that is not from any of the classes in the training data, then the output may be a wrong class label. For example, let’s say you trained an image classifier with cats and dogs data. Then if you give the image of a giraffe, the output may be either cat or dog, which is not correct.
* Similarly, let’s say your training set does not include some examples that you want to have in a class. Then, when you use those examples after training, you might not get the correct class label as the output.
* While you are training the classifier, you need to select a lot of good examples from each class. Otherwise, the accuracy of your model will be very less. This is difficult when you deal with a large amount of training data.
* Usually, training needs a lot of computation time, so do the classification, especially if the data set is very large. This will test your machine’s efficiency and your patience as well.
* We can not always give lots of information with supervision. A lot of the time, the machine needs to learn by itself from the training data. As Geoffrey Hinton quoted in 1996,*‘*‘*there’s only one place you can get so much information, that is,  from the input itself “.*

1. Observations:
   1. **Advantage:**
   * Labeling of data demands a lot of manual work and expenses. Unsupervised learning solves the problem by learning the data and classifying it without any labels.
   * The labels can be added after the data has been classified which is much easier.
   * It is very helpful in finding patterns in data, which are not possible to find using normal methods.
   * Dimensionality reduction can be easily accomplished using unsupervised learning.
   * This is the perfect tool for data scientists, as unsupervised learning can help to understand raw data.
   * We can also find up to what degree the data are similar. This can be accomplished with **probabilistic** methods.
   * This type of learning is similar to human intelligence in some way as the model learns slowly and then calculates the result.

**b.Disadvantages :**You cannot get precise information regarding data sorting, and the output as data used in unsupervised learning is labeled and not known

* Less accuracy of the resu
* lts is because the input data is not known and not labeled by people in advance. This means that the machine requires to do this itself.
* The spectral classes do not always correspond to informational classes.
* The user needs to spend time interpreting and label the classes which follow that classification.
* Spectral properties of classes can also change over time so you can’t have the same class information while moving from one image to another.