

Assignment: Machine Learning Basics

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Q1.) Supervised Machine Learning with example:-

Supervised learning involves training the machine learning model on a labeled dataset. A labeled dataset consists of a number of training examples(called inputs/ features) and their corresponding outputs(labels). The model is supposed to learn the relationship between the features and the labels, from the training data. It then uses this knowledge to predict outcomes of new, unseen and unlabeled data.

Ex:- Suppose we have a basket of fruits, and we want to train the ML model to identify the fruits based on their shape and color. Firstly we will feed the data of each fruit in the basket one by one to the model:-

- If the fruit shape: rounded, depression on top , and color : red ----- it is apple.
- If the fruit shape : long curving cylinder, and color : green-yellow ----- it is banana.
- If the fruit shape : almost perfect sphere, and color: orange ----- it is orange.
- If the fruit shape: small spheres and small depression on top, and color : red ---- it is cherry.

Then when we give the model a new fruit(banana), it can recognize that it is a banana, by checking the features of the new fruit, and concluding that its features are almost similar to a banana.

Q2.) Unsupervised Machine Learning with example:-

In unsupervised learning, the model is given unlabeled data(i.e., no corresponding labels are associated with the data), and the model is supposed to find and discover patterns, relationships, similarities and differences in the unlabeled data, and then group them accordingly.

Ex:- Suppose a ML model is given an image consisting of a large number of dogs, cats, and horses, without any labels attached with the animals. Also, the model has never seen such an image, so no prior training of data.

Now, the machine cannot give the label for dogs as “Dogs”, cats as “Cats”, and horses as “Horses”, because it doesn’t know these categories. But the model can, and is supposed to, find similarities, differences, and patterns in these images, and group them into three parts:-

- First part may have all of the dogs in the image
- Second part may have all of the cats in the image
- Third part may have all of the horses in the image

Q3.) Reinforcement Machine Learning with Example:-

In Reinforcement Learning, there are two entities: the agent, which is the decision maker, and the environment, which is the world with which the agent interacts. The agent, on performing an action, gets a reward, or feedback from the environment, in response. The agent aims to maximize its

cumulative rewards over time, and thus performs actions in the environment, learns from the rewards it receives, and develops a policy(a strategy for deciding next action based on the current state of the environment) which will help the agent to maximize its rewards. This process involves exploring various possibilities of actions, and exploiting known(or learnt) information to find the best strategy.

For a state- action pair, the expected reward is given by the Value Function.

Example of Reinforcement Learning:-

Let us consider the Tic-Tac-Toe Game, in which:

- State:- The current board configuration.
- Action:- Placing X or O in any empty cell
- Reward:- +1 for win, 0 for draw, and -1 for loss
- Agent: The player, which is either X or O

Initially, in the first game, the agent has no prior knowledge. Thus it begins by exploring random moves. Based on its action, the board configuration is updated, and the opponent(part of environment) then performs its action, and so on, until the game is over. Based on the outcome of the first game, the agent receives its reward, and it accordingly updates its policy.

As the agent plays more and more no. of games, it learns how to make decisions, i.e. what action to take at a particular state so as to win the game. Thus it develops the best strategy over time, to win more often.

Q4.) Classification V/S Regression V/S Clustering:-

Classification:- It is a type of supervised learning, in which a model is trained on a labeled dataset, and is used to predict the category/class of unseen data.

Real life examples are email spam detection(spam/ not spam), image recognition(cat/dog/other), Disease diagnosis(Positive/negative).

It gives discrete labels as output.

Regression:- It is also a type of supervised learning, which is used to predict continuous numerical values, based on the hypothesis developed by the model , from the labeled training data.

Real life examples include forecasting stock prices, estimation of a car's value based on its age and mileage, and estimation of house prices based on features like size and location.

It gives continuous data points(values) as output.

Clustering:- It is a type of unsupervised learning, in which the model is supposed to group the unlabeled input data into clusters(groups) such that the items in a cluster are more similar than to those in other clusters.

Real life examples include Customer Segmentation for targeted marketing , and Image Compression(grouping similar colors)

It gives the clusters/ groups of similar items as output.