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Artificial Intelligence
Assignment # 2

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Question #1

Explain the working and application of the following algorithms. You need to add the example for each case.

a) Decision Tree Algorithm For Classification

Decision trees are a non-parametric supervised learning method used for classification and regression. The goal is to create a model that predicts the value of a target variable by learning simple decision rules inferred from the data features.

Example:

Let's say you want to predict whether a person will buy a car or not based on their age, income, and credit score. The decision tree will split the data into subsets based on these features and create decisions rules to predict whether a person will buy a car or not.

b) **Decision Tree Algorithm For Regression:**

Decision trees can also be used for regression problems where the target variable is continuous instead of categorical.

Example:

Let's say you want to predict the price of a house based on its size, location and number of bedrooms. The decision will split the data into subsets based on these features and create decision rules to predict the price of the house.

c) **Principal Component Analysis (PCA):**

This algorithm is used to reduce the dimensionality of a dataset while retaining as much of the original variance as possible. It achieves this by finding a new set of variables that are linear combinations of the original variables. These new variables are called principal components, and they capture the max amount of variance in the data.

Example:

It can be used to reduce the number of features needed to recognize faces in images.

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d) **FP-growth Algorithm:**

This algorithm is used to find frequent itemsets in a dataset. It is a two-pass algorithm that first constructs a frequent itemset tree (FP-tree) and then uses it to generate frequent itemsets. It is faster and more memory-efficient than the Apriori algorithm.

Example:

FP-Growth is to identify the most frequently bought items in a grocery store.

e) **Deep Q-Network (DQN):**

This algorithm combines reinforcement learning and deep neural networks to solve complex decision making problems. It uses a Q-value ~~(function)~~ algorithm to learn the optimal action-value function which maps state-action pairs to their expected reward. The Q-value function is approximated using a deep neural network. DQN has been used to achieve human level performance in games such as, Atari and Go.

Example:

DQN is to train an autonomous driving agent to make decisions based on (camera) sensor inputs.