

29 Nov
2023A1 Remedial Assignment

Q1

How does Back Propagation Algorithm work?

→ Back Propagation is a crucial algorithm for training Artificial Neural Networks.

Q2

Steps:

① Forward Pass:

- In the forward pass, input data is passed through the neural network layer by layer.
- Neurons apply activation functions to weighted inputs, producing output activations.

Q2

Calculate Error

- The difference between predicted output and actual target is computed using a loss function.
- Common loss functions include:

→ Mean Squared Error (MSE)
for regression

→ Cross Entropy. ~~for~~ for classification

(3) Backward Pass:

- During the backward pass, error gradients are calculated with respect to the network weights.
- These gradients represent how much each weight contributed to the error.

(4) Gradient Descent:

- Utilizing the gradients, the weights are updated through an iterative optimization process, often using gradient descent.
- Learning rate controls the step size in the weight update process.

(5) Supervised Learning vs Unsupervised Learning

(I) Supervised Learning:

- ① The algorithm learns from a labelled dataset, where each training example has both input features and corresponding output labels.

- ② The model generalizes patterns from few training data to make predictions on new, unseen data.

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- (3) The goal is to learn mapping from input to output, so as to make predictions.

(4) Training Process:

During the training, the model minimizes the differences between predicted and actual values by adjusting parameters on input-output pairs.

(5) Examples:

- Image classification
- Regression analysis
- NLP tasks

- (6) Evaluation: Performance is often assessed using metrics like accuracy, precision, recall, or F1 score

(*) Unsupervised Learning

- (1) It deals with unlabelled data.

- (2) Aims to discover hidden insights, group similar data points, or reduce the dimensionality of the data without the use of labelled outputs.

- (3) Training Process: Algorithm is unsupervised learning explores the inherent structure of the data through techniques like clustering.

dimensionality reduction, and associated
data mining

- (4) Example: → Clustering algorithms,
→ Dimensionality Reduction Algs (PCA)
→ Generation Models (e.g. auto encoders)

- (5) Evaluation: It is subjective and depends
on specific task; for clustering,
metrics like silhouette score may be used.

Q3 Q-3. Explain k-means clustering Algorithm.

1. Initialization:

The algorithm starts by randomly selecting k initial centroids, representing cluster centers.

2. Assignment:

Each data point is assigned to the nearest centroid, based on a distance metric, often Euclidean distance.

3. Update Centroids:

Centroids are calculated as the mean of all data points assigned to a particular cluster.

Q.1

Report :

The assignment and centroid update steps are repeated iteratively until convergence.

Q.4

What is SVM ? How does it work ?

- SVM is a powerful supervised machine learning algorithm for classification and regression.
- SVM constructs a hyperplane to separate data into classes, maximizing the margin between them.
- Kernel Trick: SVM can map data into higher dimensional spaces enabling better separation when a linear boundary is sufficient.

Q.5

What is decision tree algorithm ? List some popular algorithms used for deriving decision trees and their attribute selection measures.

- Decision trees are versatile and interpretable models used in supervised learning.

(A)

Definition A decision tree is a tree like structure where each external node represents a class label or regression value.



Popular Algorithms:

(1) CART (Classification & Regression Tree)

Attribute selection Measure:

Classification : Gini Impurity

Regression : MSE (Mean squared error)

(2) ID3 (Iterative Dichotomiser 3)

Attribute selection measure: Information Gain

(3) Random Forest

Attribute selection Measure: Gini Impurity or Information Gain

(4)

C4.5 (Successor to ID3)

Attribute selection Measure: Gain Ratio