ML ANN EXP -3

What is an Artificial Neural Network (ANN)?

An ANN is a computing system inspired by the structure of the human brain, consisting of interconnected neurons used to solve complex tasks.

How does a biological neural network relate to an artificial neural network?

Dendrites are inputs, the cell nucleus represents nodes, synapses represent weights, and axons represent outputs in ANNs.

What are the main components of an ANN?

Input layer, hidden layer(s), and output layer.

What is the purpose of the input layer in an ANN?

It takes various inputs provided by the user to be processed in the network.

What role does the hidden layer play in an ANN?

It processes intermediate computations and extracts patterns within the data.

What is the function of the output layer in an ANN?

It presents the final result after all transformations through the network layers.

Explain the concept of weights in an ANN.

Weights represent the connection strength between neurons, influencing the information passing through the network.

What is an activation function?

It determines whether a neuron should activate, impacting the output of that neuron.

Name two types of activation functions commonly used in ANNs.

Sigmoid and ReLU (Rectified Linear Unit).

What is Keras, and why is it used in neural networks?

Keras is a high-level neural network API that simplifies building and training models, commonly running on TensorFlow or Theano.

What is TensorFlow?

TensorFlow is a deep learning framework by Google, widely used for developing and deploying machine learning models.

Define normalization in machine learning.

Normalization scales numeric data to a common range, typically between 0 and 1, to improve model performance.

When should normalization be applied to a dataset?

When feature values have different ranges or when using models sensitive to feature scales, like KNN.

What are the types of normalisation techniques?
Min max scaling, standardisation scaling

Explain the Min-Max scaling technique.

Min-Max scaling rescales values between a specified minimum and maximum, often 0 and 1, using a formula based on min and max values.

What is standardization, and how does it differ from normalization?

Standardization rescales data to have a mean of zero and unit standard deviation, useful when data follows a normal distribution.

Describe a confusion matrix.

A confusion matrix is a table used to evaluate a classification model's performance by comparing predicted vs. actual outcomes.

What does a True Positive (TP) in a confusion matrix represent?

TP is when the model correctly predicts a positive class as positive.

What does a True Negative (TN) in a confusion matrix represent?

TN is when the model correctly predicts a negative class as negative.

What is a False Negative (FN) in the context of a confusion matrix?

FN is when the model incorrectly predicts a positive class as negative (Type-II error).

What is a False Positive (PN) in the context of a confusion matrix?

PN is when the model incorrectly predicts a negative class as positive (Type-I error).

Explain the term "classification accuracy."

Classification accuracy is the ratio of correct predictions to the total number of predictions made by the model.

$$\text{Accuracy}=\frac{TP+TN}{TP+FP+FN+TN}$$

What is precision in a classification model?

Precision measures the accuracy of positive predictions, calculated as TP / (TP + FP).

What is misclassification or error rate in a classification model?

It defines how often a model gives the wrong predictions. It is the ratio of number of incorrect predictions to the total number of predictions.

$$\text{Error rate} = \frac{FP+FN}{TP+FP+FN+TN}$$

Define recall in machine learning.

Recall is the ratio of true positive predictions to the total actual positives, indicating how well positive cases are identified.

$$\text{Recall} = \frac{TP}{TP+FN}$$

What is the F-measure in classification metrics?

The F-measure combines precision and recall, offering a balanced score when both are equally important.

$$\text{F-measure} = \frac{2*Recall*Precision}{Recall+Precision}$$

How is a Receiver Operating Characteristic (ROC) curve used in machine learning?

The ROC curve displays the performance of a classifier across different threshold values, plotting the true positive rate against the false positive rate.

What are the common uses of Keras in industry?

Keras is used by companies like Netflix, Uber, and Google for deep learning applications in recommendation systems, autonomous driving, and predictive analysis.

Why is standardization preferred over normalization in linear regression models?

Standardization is suitable when data follows a Gaussian distribution, commonly required for algorithms assuming normal distribution.

What is the significance of outliers in normalization?

Outliers can distort normalization as it forces all values within a range, potentially underrepresenting extreme values.

How can model accuracy be improved in an ANN?

By adjusting model parameters, adding more hidden layers, or using techniques like dropout to prevent overfitting.

What does a high misclassification rate indicate about a model?

A high misclassification rate suggests the model frequently predicts incorrectly, requiring model adjustments or better data preprocessing.

When is it beneficial to use Min-Max scaling over other scaling techniques?

Min-Max scaling is beneficial for models sensitive to feature scaling, like KNN and neural networks.

What is the role of a transfer function in ANNs?

A transfer function computes the weighted sum of inputs and biases to pass onto the activation function for output generation.