Assignment - 7

Title: WAP to implement Neural Network Classifier / Naive Layer Classifier.

Aim: WAP to implement Neural Network Classifier

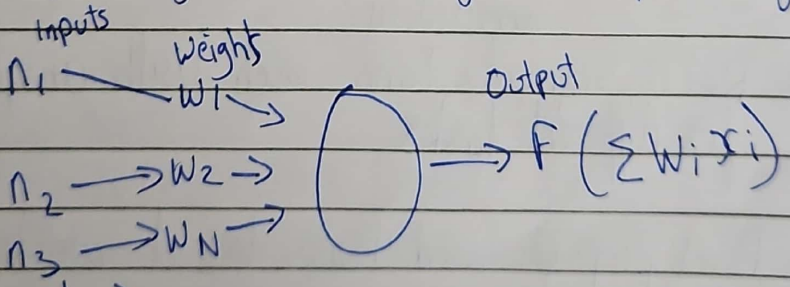
Objective: To study Neural Network Classifier

- Theory:- 1) Neural Network

A) In machine learning, a neural network is a model inspired by the structure & function of biological neural networks in animal brains. An ANN consists of connected units of nodes called artificial neurons, which loosely model the neurons in the brain.

2) Structure & Function of a single neuron in a neural network.

Ans) The Artificial Neural Network is basically having 3 layers. namely input layer, hidden layer & output layer.



Key Components →

1) Inputs: Data/Features or Outputs from previous neurons.
2) Weights: Adjust input importance
3) Bias: Shift the weighted sum
4) Activation Function: Introduces non-linearity, enabling the network to learn complex patterns.
5) Output: Result sent to the next layer or as the final prediction.

3) Basic Architecture of a feedforward neural network.
A feedforward neural algorithm (FNN) process data in one direction, from input to output, without feedback loops.
Basic Architecture:
1) Input Layer: Receives the input data (eg pixel values, features)
2) Hidden Layers: One or more layers where neurons apply weights, biases, and activations functions to learn patterns.
3) Output Layer: Produces the final predication or result eg classification label

FAQs →

Q1. What is an activation function & why is it important in neural networks?

A) An activation function determines whether a neuron should be activated by introducing non-linearity into the network importance

1) Non-Linearity: Allows the networks to learn complex patterns beyond linear relationships.
2) Decision Boundaries: Helps the network classify or predict accurately.
3) Examples: ReLU, Sigmoid, Tanh - each with unique properties for different tasks

Q2) What is Backpropogation, and how does it work in the training of neural networks?

Ans) Backpropogation is an algorithm used to train neural networks by adjusting weights & biases to minimize error

How it work:-

- Forward pass - Inputs data flows through network, generating an output
- Loss Calculation - The error (loss) is measured by comparing the output to the target.

- Backward Pass: The error is propagated back through the network using the chain rule of calculus.
- Weight Update- Weights & biases are adjusted using gradient descent to minimize the loss.

The iterative process continues until the network learns to make accurate predictions.

Q3 Refine & compare different loss function used in training neural networks.

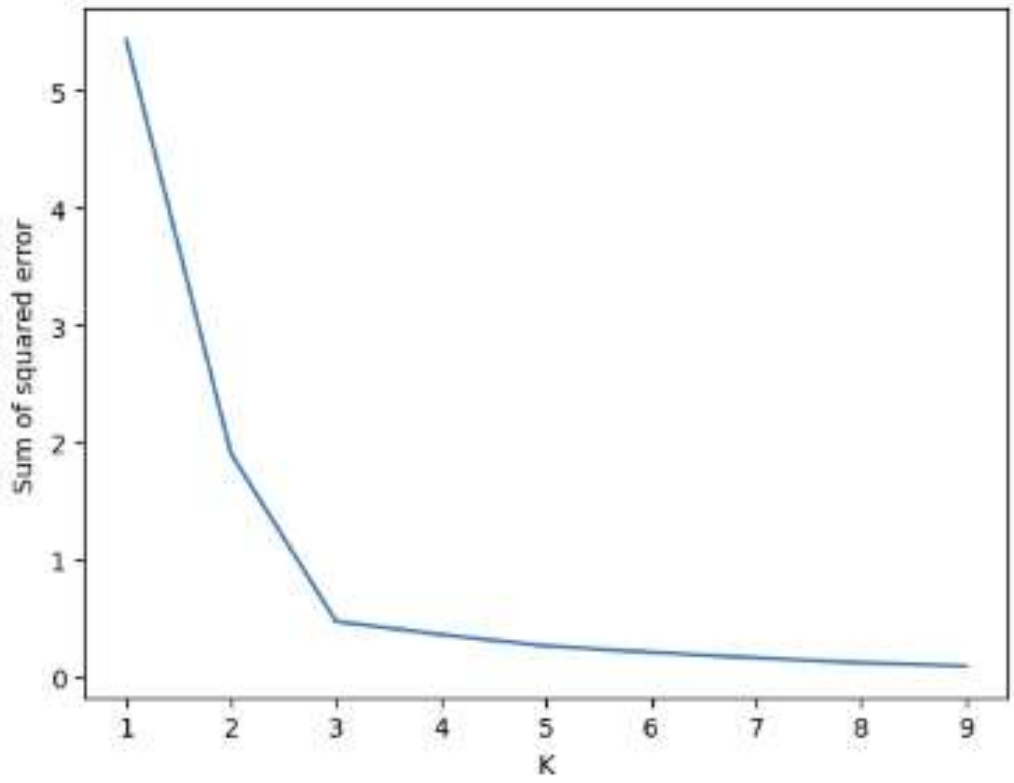
Ans) i) Mean Squared Error (MSE):
- Use: Regression tasks
- Formula: $1/n \sum (y_{prod} - y_{true})^2$
- Effect: Penalizes large errors more than small ones.

ii) Cross-Entropyloss:
- Formula: $-1/n \sum [y_{true} \log (y_{prod})]$
- Use: Classification tasks (eg. binary or multi-class)
- Effect: Measures how far the predicted probabilities are from actual classes.

iii) Hinge loss:
- Formula: $\max(0, 1 - y_{true} \cdot y_{prod})$
- Use: Used in SVMs for classification
- Effect: Focuses on maximizing the margin between classes.

Comparison:
- MSE - Sensitive to outliners, good for continous outputs
- Cross-Entropy - Better for probabilistic classification
- Hinge loss - Emphasises correct class separation.

Jagila 24/6/2025


Sum of squared error
0
1
2
3
4
5
1
2
3
4
5
6
7
8
9
K