Practice Lab Neural Network 1

Student Information:

- **Name of Group**: Siddhesh Kotwal
- **Roll Number**: 42
- **Batch**: DL2
- **Date of Submission**: 14-01-2025

Neural Network Implementation from Scratch

Objective:

The goal of this assignment is to implement a simple feedforward neural network from scratch in Python without using any in-built deep learning libraries. The implementation includes the basic components such as:

- Forward pass
- Backward propagation (backpropagation)
- Training using gradient descent

Problem Definition:

- **Dataset**: The dataset used in this assignment is the XOR problem, where the task is to classify the logical XOR of two binary inputs.
- **Task**: The neural network learns to classify the XOR problem, which is a classic problem in machine learning used to demonstrate the limitations and potential of neural networks.

Methodology

Neural Network Architecture:

- **Input Layer**: 2 neurons (representing the two binary inputs for XOR).
- **Hidden Layer**: 4 neurons (using Sigmoid activation function).
- **Output Layer**: 1 neuron (using Sigmoid activation function for binary classification).

Forward Pass:

- The forward pass involves computing the weighted sum of inputs at each layer, applying the activation function (Sigmoid), and passing the result to the next layer until the output is obtained.

Backpropagation:

- During backpropagation, the error (difference between predicted and actual outputs) is propagated back through the network. The weights are updated using gradient descent based on the derivatives of the loss function with respect to the weights and biases.

Loss Function:

- **Mean Squared Error (MSE)**: This loss function is used for regression tasks, but in this case, it is also used for the XOR classification task to measure the difference between predicted outputs and actual outputs.

Optimization:

- The network is trained using **Gradient Descent** to minimize the loss function, with a learning rate of 0.1 and a total of 1000 epochs.

Results

- The neural network is successfully trained to learn the XOR problem, with the training loss decreasing over the epochs.
- A **Loss Curve** is plotted to visualize the training process, showing how the Mean Squared Error reduces as the network learns.

GitHub Repository Link:

You can view the full implementation and code on GitHub:
https://github.com/SiddheshKotwal/Deep-Learning.git

Acknowledgments:

- Special thanks to the instructors for providing this exercise that enhances understanding of neural network fundamentals and practical implementation.