Module 2: Introduction to Neural Networks - Assignment

Introduction:

Neural networks, primarily known for their applications in classification tasks, can also be employed for regression problems. In this exercise, we aim to demonstrate the usage of a simple neural network in predicting a linear relationship between input features and the output.

Objective:

The primary objective is to predict the output value y based on two input features x1 and x2 using a basic neural network model with the equation y=3x1+4x2. The neural network will be trained using a feed-forward and back-propagation mechanism to minimize the error between the predicted and actual values.

Methodology:

1. **Activation Functions:**

- Define the sigmoid function, a popular activation function used in neural networks.
- Define the tanh function, which is another common activation function that returns values between -1 and 1.
- Define the relu function, which returns positive values as they are and zeroes out negative values.

2. **Sample Data:**

- Use the following sample data for training:
  x1=3, x2=2, yactual=17

3. **Feed Forward:**

- Initialize the random weights w1 and w2 between 1 and 10.
- Predict the output ypred using the equation ypred= x1 x w1 + x2 x w2

4. **Error Calculation:**

- Compute the squared error as error = (yactual-ypred)*(yactual-ypred)

5. **Back Propagation:**

- Compute the gradients of the error with respect to the weights.
- Update the weights using the computed gradients and a learning rate.

6. **Training:**

- The above steps (Feed Forward to Back Propagation) are performed iteratively (20 times in this example) to refine the weights and minimize the error.

7. **Visualization:**

- Plot the progression of the error across epochs.
- Plot the progression of ypred across epochs.

Expected Outcome:

After sufficient training, the predicted ypred should be close to the actual value yactual=17. The error graph should show a declining trend, indicating that the model is learning and improving its predictions over time.