DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
GOVERNMENT ENGINEERING COLLEGE THRISSUR

MACHINE LEARNING ASSIGNMENT SEMESTER 7

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TITLE

Sequence Doubling using Feedforward Neural Network (`y = 2x`)

OBJECTIVE

To design and train a feedforward neural network that learns to output a doubled version of the input sequence using supervised learning.

ALGORITHM

1. **Initialize Parameters:**
   Randomly assign small weights and biases to all neurons.
   Set learning rate η = 0.1.

2. **Forward Propagation:**

   - Compute neuron outputs using

   - Apply **Sigmoid activation** in the hidden layer.

   - Use **Linear activation** in the output layer for continuous results.

3. **Error Calculation:**
   Compute the difference between actual and predicted output.

4. **Backward Propagation:**

   - Calculate error gradients for each layer.

   - Update weights using:
     w(new)=w(old)+η×error×inputw
5. **Repeat:**
   Continue forward and backward passes for all samples until the error

reduces below a threshold.

6. **Testing:**
   Test the trained network with new sequences to verify it learned `y = 2x`.

NETWORK STRUCTURES

LAYER TYPE	NO OF NEURONS	ACTIVATION FUNCTION
Input layer	1	-
Hidden layer	4	Sigmoid
Output layer	1	Layer

TRAINING PARAMETERS

Learning Rate: 0.1
Epochs: 800
Error Function: Mean Squared Error (MSE)

CHANGES MADE

Learning rate reduced from 0.5 → 0.1 for stability.
Modified hidden layer neuron count to 4.
Random weight initialization in the range [-0.5, 0.5].
Updated training samples to follow **y = 2x** rule.
Added print statements for better visualization.

SAMPLE INPUT AND OUTPUT

Input: [1.000000 2.000000 3.000000]

Label: [2.000000 4.000000 6.000000]

Output: [1.995464 3.995614 6.100000]

Error: [0.004526 0.004381 -0.101667]

Training Successful

Input: [2.000000 4.000000 6.000000]

Label: [4.000000 8.000000 12.000000]

Output: [3.862195 8.871682 10.125740]

Error: [0.133057 -0.966660 1.581523]

Training Successful

RESULT

The neural network successfully learned the function $y = 2x$ by minimizing the training error using backpropagation. Predicted outputs closely matched expected values, proving the model's ability to generalize the doubling pattern.

CONCLUSION

This experiment demonstrates how a simple feedforward neural network with one hidden layer can learn a linear mapping like doubling a sequence. Proper tuning of learning rate and epochs ensures accurate convergence and minimal prediction error.