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MTECH - I Year / I Semester (एमटेक - प्रथम वर्ष/प्रथम सेमेस्टर)
Session: July-December 2025 (सत्र: **जुलाई - दिसंबर,** २०२५**)**

Experiment 1

1. Write a Python program to implement McCulloch-Pitts neuron for basic logic gates (AND, OR, NOT, NAND, NOR).
2. Write a Python program for verification of XOR gate using McCulloch-Pitts neuron.
3. Write a Python program to implement Hebb Network (without inbuilt functions).
4. Write a Python program to implement Multilayer Perceptron (without inbuilt functions).

Experiment 2

5. Implement ANN model using XOR gate with two layer architecture for given x1 and x2. Weights are bipolar {-1, 1}. Find all possible weight combinations that satisfy XOR.
6. Implement ANN model for two-level OR-AND implementation with inputs x1 and x2 (bipolar weights).
7. Implement NAND gate ANN model by adding bias b=1. Calculate three weights w0, w1, and w2.
8. Design a Hebb net to implement OR and AND functions (consider bipolar inputs and targets).

Experiment 3

9. Write a program for solving linearly separable problem using Perceptron Model (AND Gate with bipolar inputs and outputs). Train with learning rates {0.1, 0.01, 0.001}. Draw graph (loss vs iterations).
10. Write a program for solving non-linearly separable problem using Perceptron Model. Train with learning rates {0.1, 0.01, 0.001}.
11. Write a program for solving linearly separable problem using Adaline Model (AND Gate, bipolar). Train with learning rates {0.1, 0.01, 0.001}.
12. Write a program for solving non-linearly separable problem using Madaline Model (AND Gate, bipolar). Train with learning rates {0.1, 0.01, 0.001}.

Experiment 4

13. Write a Python program to implement ANN with Backpropagation Learning Algorithm.
14. Write a program for XOR gate using backpropagation (3 binary inputs → 1 output). Use sigmoid activation, learning rate=0.1, epochs=10. Draw error vs epoch graph.
15. Build ANN with 5 input features, 3 hidden layers (10,7,5 neurons), and 1 output neuron. Generate random dataset (100 samples). Target: binary (sum(features)>2.5). Train with sigmoid activation, learning rate=0.1, epochs=100. Draw error vs epoch graph.

Experiment 5

16. Write a Python program for Kohonen's Self-Organizing Map (SOM). Input neurons=5, output neurons=2. Learning rate=0.1. Use Squared Euclidean distance.
17. Write a Python program to implement a Full Counterpropagation Network (CPN). The network should consist of 4 input neurons, 2 neurons in the hidden (Kohonen) layer, and 2 neurons in the output (Grossberg) layer. Use all initial learning rates as 0.5 and the Squared Euclidean distance as the similarity measure to determine the winning neuron in the Kohonen layer. The program should perform both Phase I (unsupervised learning) and Phase II (supervised learning) of the CPN algorithm. Use the following input and target pairs for training: X = {(1,0,0,0), (0,1,0,0), (0,0,1,0), (0,0,0,1)} and corresponding targets Y = {(1,0), (0,1), (1,0), (0,1)}. Display the initial weights of both layers, identify the winning neuron for each input during Phase I, update and display the weights after both training phases, and finally, show the output generated by the network for each input pattern.
18. Write a Python Program to implement ART1 and ART 2.

Experiment 6

19. Write python Program to realize Fuzzy Sets arithmetic.
20. Write a Python code for designing fuzzy controller for FAN. Inputs: Temperature (T) and Humidity (H). Output: Fan Speed (S). Use triangular membership functions. Implement Takagi-Sugeno model rules. Calculate fan speed for given inputs.
21. In an automatic air conditioner controller, design fuzzy logic controller with 3 fuzzy sets for Temperature, Rotor, and Fan speed. Compute composition of relations R1∘R2 and crisp value of fan speed.

Experiment 7

22. Write a Python code to implement various defuzzification methods (menu-driven): Centroid, Center of Sums, Weighted Sum, Mean of Maximum, Smallest of Maximum, Largest of Maximum. Use trapezoidal functions (overlapping, user-defined).
23. Design a fuzzy logic controller for a washing machine using Python. Inputs: Degree of dirt, Type of dirt. Output: Wash time. Implement rules for wash time (Very Short, Short, Medium, Long, Very Long).

Experiment 8

24. Write a Python program to realize various steps of Genetic Algorithm (GA).
25. Write a Python program to realize GA-based Backpropagation Networks.
26. Write a Python Program to realize Fuzzy Controlled Genetic Algorithms.