**MACHINE LEARNING TECHNIQUES**

**TASK-1**

% Representation and Learning of Boolean Functions in Machine Learning

clc; clear; close all;

% Define truth tables for AND, OR, NOT, and XOR gates

AND\_inputs = [0 0; 0 1; 1 0; 1 1];

AND\_targets = [0; 0; 0; 1];

OR\_inputs = [0 0; 0 1; 1 0; 1 1];

OR\_targets = [0; 1; 1; 1];

NOT\_inputs = [0; 1];

NOT\_targets = [1; 0];

XOR\_inputs = [0 0; 0 1; 1 0; 1 1];

XOR\_targets = [0; 1; 1; 0];

% Train and Test the Perceptron for AND Gate

disp('Training AND Gate:');

AND\_net = perceptron;

AND\_net = train(AND\_net, AND\_inputs', AND\_targets');

AND\_outputs = AND\_net(AND\_inputs')';

disp('AND Gate Outputs:');

disp(AND\_outputs);

% Train and Test the Perceptron for OR Gate

disp('Training OR Gate:');

OR\_net = perceptron;

OR\_net = train(OR\_net, OR\_inputs', OR\_targets');

OR\_outputs = OR\_net(OR\_inputs')';

disp('OR Gate Outputs:');

disp(OR\_outputs);

% Train and Test the Perceptron for NOT Gate

disp('Training NOT Gate:');

NOT\_net = perceptron;

NOT\_net = train(NOT\_net, NOT\_inputs', NOT\_targets');

NOT\_outputs = NOT\_net(NOT\_inputs')';

disp('NOT Gate Outputs:');

disp(NOT\_outputs);

% Train and Test a Feedforward Network for XOR Gate

disp('Training XOR Gate:');

XOR\_net = feedforwardnet(2); % 2 hidden neurons

XOR\_net = train(XOR\_net, XOR\_inputs', XOR\_targets');

XOR\_outputs = XOR\_net(XOR\_inputs')';

XOR\_outputs = round(XOR\_outputs); % Round outputs to binary values

disp('XOR Gate Outputs:');

disp(XOR\_outputs);

% Visualize Results

figure;

subplot(2,2,1);

gscatter(AND\_inputs(:,1), AND\_inputs(:,2), AND\_targets, 'rb', 'ox');

title('AND Gate Training Data');

subplot(2,2,2);

gscatter(OR\_inputs(:,1), OR\_inputs(:,2), OR\_targets, 'rb', 'ox');

title('OR Gate Training Data');

subplot(2,2,3);

bar([NOT\_inputs NOT\_targets], 'grouped');

title('NOT Gate Training Data');

legend('Input', 'Target');

subplot(2,2,4);

gscatter(XOR\_inputs(:,1), XOR\_inputs(:,2), XOR\_targets, 'rb', 'ox');

title('XOR Gate Training Data');