



Department of Mathematics and Computing
IIT(ISM) Dhanbad

Course Name: Neural Networks and Deep Learning Practical

Course Code: MCC542

Lab Location: Computer Lab, M&C

Do's and Don'ts:

1. Come to the lab. in time. After 5 minutes of entry time nobody will be allowed.
2. Follow the Instruction provided by the Faculty/Research Scholar at the beginning.
2. Write the program using the instructions given and then start coding.
3. Don't take out the computer accessories like: mouse, patch chord, etc.
4. During the Lab. hour don't create any disturbance

Software Requirement:

1. PYTHON
2. MATLAB
3. R
4. SPSS

1. S. N.Sivanandam and S. N.Deepa, Introduction to neural networks using Matlab, 2016.
2. Simon Haykin, Neural Networks and Learning Machines, PHI, 2008.

Reference books:

Lab Examination:

After completion of all the programs and project work in the given list of experiments there will be **one** lab exam of 100 marks during the slot provided in the academic calendar. Examination will be based on Programming followed by Viva Voce.

The 100 marks will distributed as follows:

60 Marks in program writing and execution, 30 marks in Lab. File, 10 marks in Viva Voce.

LIST OF PROGRAMS

1. Implementation of different activation functions to train Neural Network.
2. Implementation of different Learning Rules.
3. Implementation of Perceptron Networks.
4. Implementation of Adeline network for system identification.
5. Implementation of Madeline network
6. Pattern matching using different rules.
7. Project related to application of machine learning in healthcare.
8. Project related to application of machine learning in business analysis.
9. Project related to application of machine learning in sports analytics
10. Project related to application of machine learning in Time Series Analysis & Forecasting.

EXPERIMENT-1

Aim: Implementation of different activation functions to train Neural Network.

Tools/Apparatus: None

Procedure:

- 1) Check data that is linearly separable or not.
- 2) Analyze the activation functions.
- 3) Set up code for plotting.

EXPERIMENT-2

Aim: Implementation of different Learning Rules.

Tools/Apparatus: None

Procedure:

- 1) Initialize the input vectors associated with the target values.
- 2) Initialize the weights and bias.
- 3) Set learning rule.
- 4) Input layer has unique activation function.
- 5) Calculate the output.
- 6) Make adjustment of weights comparing the desired output and target values.
- 7) Continue the iterations until there is no change of weights.

EXPERIMENT-3

Aim: Implementation of Perceptron Networks

Tools/Apparatus: None

Procedure:

- 1) Initialize the input vector.
- 2) Train the network weights for the perceptron.
- 3) Make predictions with the perceptron.

EXPERIMENT-4

Aim: Implementation of Adaline network for system identification

Tools/Apparatus: None

Procedure:

- 1) During the training of the Adaline network give the input and desired output(D) as it is a supervised learning.
- 2) Calculate network output(Y) by the formula as follows
$$Y = \sum X_i(W_i)$$
$$T = X_1W_1 + X_2W_2 + X_3W_3 + \dots + X_nW_n$$
- 3) Compute error as
Error (e) = (D-Y)
- 4) Adjust the weights by delta rule as follows
$$W_{\text{new}} = W_{\text{old}} + \alpha (D-Y)X_i$$
$$(W_{\text{new}} - W_{\text{old}}) = \alpha (D-Y)X_i$$
$$\Delta W = \alpha (D-Y)X_i, \text{ Where}$$

Where α = learning rate; D= desired output; Y= network output; X_i = input, ΔW = change in weight.

EXPERIMENT-5

Aim: Implementation of Madeline network

Tools/Apparatus: None

Procedure:

- 1) Initialize the weights, Bias, Learning rate(α) to start the training
- 2) Continue step 3-8 when the stopping condition is not true.
- 3) Continue step 4-6 for every bipolar training pair.
- 4) Activate each input unit
- 5) Obtain the net input at each hidden layer, i.e. the Adaline layer
- 6) Apply the activation function to obtain the final output at the Adaline and the Madaline layer .
- 7) Calculate the error and adjust the weights.
- 8) Test for the stopping condition, which will happen when there is no change in weight or the highest weight change occurred during training is smaller than the specified tolerance.

EXPERIMENT-6

Aim: Pattern matching using different rules.

Tools/Apparatus: None

Procedure:

Depending on the label of input, type of learning(i.e . supervised/ unsupervised) use any Pattern matching algorithm where different rules can be used.

EXPERIMENT-7 / Project 1

Aim: Project related to application of machine learning in healthcare.

Tools/Apparatus: None

Procedure:

- 1) Identifying and diagnosing diseases and other medical issues.
- 2) Collection of data sets and analyzes it.
- 3) Use machine learning techniques for prediction and require development.

Examples:

- 1) Enhance medical diagnostics.
- 2) Drug discovery and development.
- 3) Automation
- 4) Radiation treatment.

EXPERIMENT-8 / Project 2

Aim: Project related to application of machine learning in business analysis.

Tools/Apparatus: None

Procedure:

- 1) Identifying and understanding the market.
- 2) Collection of previous existing data sets and analyzes it.
- 3) Use machine learning techniques for prediction and for development.

Examples:

- 1) Stock market.
- 2) Market prediction.

EXPERIMENT-9 / Project 3

Aim: Project related to application of machine learning in sports analytics

Tools/Apparatus: None

Procedure:

- 1) Initially, identify the required demand in the market and software specifications of the system.
- 2) Use previously collected data for better understanding.
- 3) Use machine learning techniques on the data set to find meaningful patterns from which future events can be predicted or classified.

Example:

- 1) Analyzing and predicting the performance of a team or individual players and strategy.
- 2) Optimization of player positioning for team sports.

EXPERIMENT-10 / Project 4

Aim: Project related to application of machine learning in Time Series Analysis & Forecasting

Tools/Apparatus: None

Procedure:

- 1) Initially, identify the required demand in the market and software specifications of the system.
- 2) Use previously collected data for better understanding.
- 3) Use machine learning techniques on the data set to find meaningful patterns from which future events can be predicted or classified.

Example:

- 1) Business Forecasting
- 2) Sensor Data Monitoring

EXPERIMENT-10a / Project 6

Aim: Design of Test Suits for White Box Testing

Tools/Apparatus: None

Procedure:

- 1) Identify the feature, component, program to be tested.
- 2) Plot all possible paths in a flow graph.
- 3) Identify all possible paths from the flow graph.
- 4) Write Test Cases to cover every single path on the flow graph.
- 5) Execute, rinse, repeat.

Example:

White Box penetration techniques: In this testing, the tester/developer has full information of the application's source code, detailed network information, IP addresses involved and all server information the application runs on. The aim is to attack the code from several angles to expose security threats

EXPERIMENT-1b / Project 7

Aim: Design of Test Suits for White Box Testing

Tools/Apparatus: None

Procedure:

- 1) Identify the feature, component, program to be tested.
- 2) Plot all possible paths in a flow graph.
- 3) Identify all possible paths from the flow graph.
- 4) Write Test Cases to cover every single path on the flow graph.
- 5) Execute, rinse, repeat.

Example:

White Box Mutation Testing: Mutation testing is often used to discover the best coding techniques to use for expanding a software solution.