

**COMPUTER SCIENCE & ENGINEERING (Data Science)**  
**(Semester VI) Deep Learning-1 Lab (CDP308)**

**List of Practical:**

**1. Perceptron Learning Algorithm**

**1A.** Implement Perceptron learning algorithm for classification of following points  $\{P_0(-1,-1,-1), P_1(-1,-1,1), P_2(-1,1,-1), P_3(-1,1,1), P_4(1,-1,-1), P_5(1,-1,1), P_6(1,1,-1), P_7(1,1,1)\}$  in to two classes:

$C_1 = \{P_7(1,1,1)\}$

$C_2 = \{P_0(-1,-1,-1), P_1(-1,-1,1), P_2(-1,1,-1), P_3(-1,1,1), P_4(1,-1,-1), P_5(1,-1,1), P_6(1,1,-1)\}$

**1B.** Write a python program to find the number of linearly separable problems out of total binary classification problems on  $\{P_0(-1,-1,-1), P_1(-1,-1,1), P_2(-1,1,-1), P_3(-1,1,1), P_4(1,-1,-1), P_5(1,-1,1), P_6(1,1,-1), P_7(1,1,1)\}$ .

**2. Training of neuron with various activation functions.**

**2A.** A college professor believes that if the grade for internal examination is high in a class, the grade for external examination will also be high. A random sample of 7 students in that class was selected, and the data is given below:

Input	0.1	0.2	0.3	0.4	0.5	0.6	0.7
Target	1.2	1.4	1.55	1.75	2.01	2.2	2.35

Write a python program for linear regression using a single neuron (with proper activation function) on the above dataset, and find the coefficients  $w_1$  and  $b$ .

Predict the external marks if internal marks are 0.15.

Draw the scatter plot between Internal Exam and External Exam. Draw a straight line with red line using above  $w_1$ ,  $w_2$  and  $b$ .

**2B.** Generate 51 points for  $t = 1/(1 + \exp(-3x))$ , where  $x \in [-2, 3]$ . Use this dataset to train sigmoid neuron using gradient descent learning algorithm. Draw two curves with different colours, for target and output ( $y$ ) of the trained neuron.

**3A.** Implement Error Back propagation algorithm for fully connected neural network to solve two input XOR classification problem.

**3B.** Implement Error Back propagation algorithm for fully connected neural network to solve three input XNOR classification problem.

**4A.** Generate 61 points for **target** =  $\sin(x)$ , where  $x \in [-3, 3]$ . Use this dataset to train two layer neural networks using gradient descent learning algorithm. Draw two curves with different colours, for target and output ( $y$ ) of the trained neural network.

**4B.** Use MNIST dataset to train neural networks using gradient descent learning algorithm. Experiments with various Architectures of neural networks, and with different activation functions for hidden and output layers.

## 5. Study of Optimizers

**5A.** Create a generic feedforward neural in which design stochastic gradient descent optimizer.

**5B.** Study the roll of learning rate and decay. Draw a graph for different learning rate and find best learning rate

**5C.** Design Adagrad, RMSProp and ADAM optimizer. Also compare the performance of all the optimizer you have designed.

## 6. Study of Convolutional Neural Network

**6A.**Design a Convolutional neural network with sigmoid activation.(Don't use pooling layer)

**6B.** Design a Convolutional neural network with softmax activation at last layer and RELU in convolutional layer and first hidden layer.(Use pooling layers)

**6C.** Implement Convolutional neural network designed in 6B on MNIST dataset where 10 neuron in last layer.

## 7. Transfer Learning:

**7A.** Apply transfer Learning to VGG16 on fruits classification dataset.

**7B.** Apply transfer Learning to RESNET on fruits classification dataset.