S2 23(AIML) DNN EC2R July 2024

Deep Learning (Birla Institute of Technology and Science, Pilani)

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

Work Integrated Learning Programmes Division

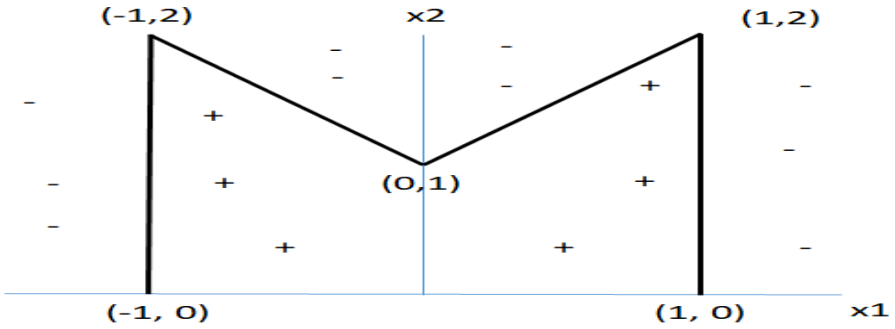
Cluster Programme - M. Tech in AI & ML

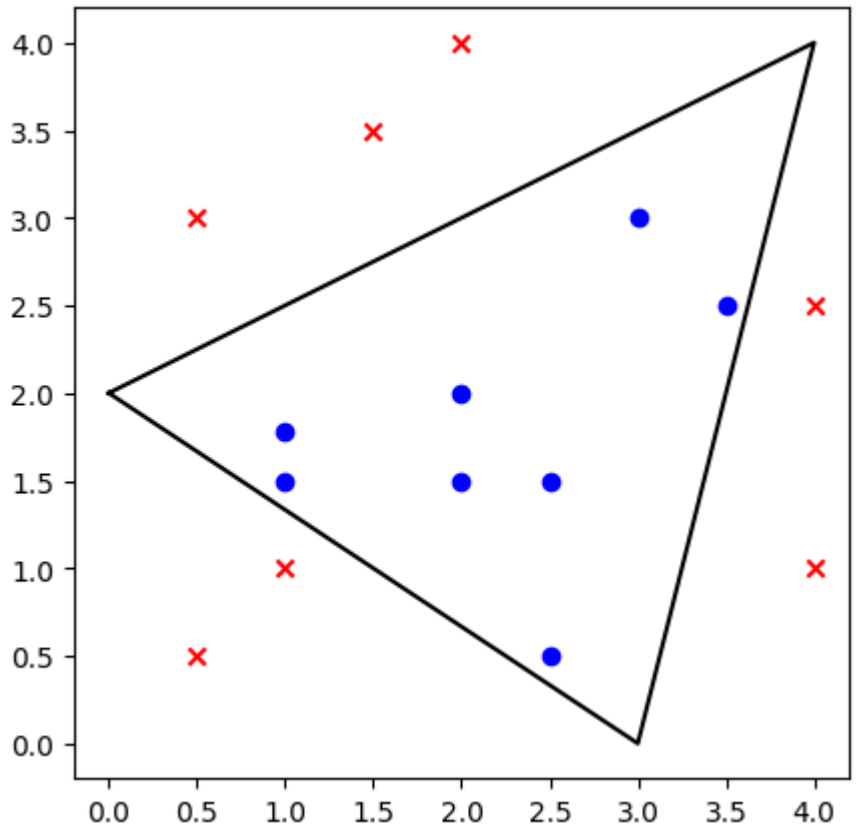
II Semester , 2023 – 24(July,2024)

Mid semester Examination (**Regular**)

Course No : AIMLC ZG511
Course Title : DEEP NEURAL NETWORK
Nature of Exam. : Closed Book
Weightage : 30 Marks
Duration : 120 minutes
Date : 21st July,2024_2 PM

Number of questions:5
Number of Pages: 2

Q. No	Question	Marks
Q.1.	(x1, x2) are input features and target classes are either +1 or -1 as shown in the figure. x2 is never negative. A fully connected multilayer perceptron network is used for classification with 100% accuracy. Step activation functions are used at all nodes, i.e., output=+1 if total input >= bias b at a node, else output = -1. a) What is the minimum number of hidden layers and minimum number of hidden nodes in each hidden layer required? (2M) b) Obtain the equations of the decision boundaries.(2M) c) Specify all weights and bias values at all nodes. Weights can be only +/-5 or 0, and bias 0 or +ve multiples of 5 only. Draw the minimal network architecture with obtained weights and bias values. Organize the nodes in each layer horizontally and show the node representing x1 at the left on the input layer. Organize the hidden nodes in ascending order of bias at that node. Show all calculation steps. (4M) 	**8M**
Q.2	Consider the binary classification problem given below:	**5M**

	 a) How many perceptrons and how many layers are required to classify the above points with 100% accuracy. [1M] b) Sketch the MLP architecture with appropriate weights and biases to classify the above data points. [4M]	
Q.3	a) Give two strengths and two weaknesses of neural networks in comparison to other machine learning models. [2M] b) A neural network is trained and tested over a dataset for which training accuracy is 100% and the testing accuracy is 45%. What are the inferences from this and how to handle this? Discuss.[3M]	**5M**
Q.4	Consider the following simple CNN architecture: **Input:** 64x64x3 (RGB image), **Convolutional Layer 1**: [64 filters of size = 2x2, stride = 2, padding = 'valid'], **Batch Normalization Layer**: Applied after Conv Layer 1, **Pooling Layer 1:** [Max pooling with filter size = 2x2, stride = 2, padding= 'valid'],	**6M**

	Convolutional Layer 2: [32 filters of size = 3x3, stride = 1, padding = 'valid'], **Pooling Layer 2**: [Average pooling with filter size = 4x4, stride=2, padding= 'valid'], **Flatten, Fully Connected Layer**: [128 neurons], **Output Layer:** [10 neurons (for classification)] For each layer of the architecture, calculate the number of the feature maps / neurons, size of the feature maps, trainable parameters, and non-trainable parameters?	
Q.5.	We know that in CNN architecture consists of Convolution layers, pooling layers, Fully connected layer and output layer. Answer the following. i)."In CNN, regularization can be applied to any of these layers except output layer in case of overfitting". Validate the statement and justify. ii) What are the activation functions to be used in output layer? When to use them? Discuss. iii) Mention the hypermeters in a CNN which helps us to have the better architecture?	**6M**