B.E. Computer Science & Engineering (Model Curriculum) Semester-VI
TEE2043CS - Elective Paper-III : Neural Network and Deep Learning

P. Pages : 3

Time : Three Hours

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*7 4 1 6 *

Max. Marks : 80

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Notes : 1.   All questions are compulsory.
2.   All questions carry equal marks.
3.   Assume suitable data wherever necessary.
4.   Illustrate your answers wherever necessary with the help of neat sketches.

1. a)   What is an Artificial Neuron? Explain how the organization of biological neural network in brain inspires the multi-layer architecture of ANN.   **8**

   b)   Differentiate between Supervised, Unsupervised and Reinforcement Learning with suitable examples. Also state how Deep learning is resembles and differs from the machine learning.   **8**

OR

2. a)   What do you mean by linearly separable and non-linearly separable problems? Why it is not possible to use perceptron to solve non-linearly separable problems? Prove with an example.   **8**

   b)   What is Reinforcement Learning in ANNs? Explain the concept of the reward signal in Reinforcement Learning.   **8**

3. a)   Write a steps for Perceptron Learning Algorithm. List limitations of single layer Perceptron.   **8**

   b)   Consider 4 data points with 3 dimensions that are divided into two classes, Class-1 and Class-2   **8**

Sample	Data Point (x)	Class
S1	[1, 0, 1]	1
S2	[0, 1, 1]	0
S3	[1, 1, 0]	0
S4	[0, 0, 1]	0

Let the initial weight vector be [-0.5, 1, 0.2]. Apply the perceptron learning algorithm to the sample data in the same order. Find the value of weight vector at the end of sample S4.
(Hint : If $x \in 1$, perform $w = w + x$, else perform $w = w - x$)

OR

4. a)   State true or false – "Single perceptron solve only linearly separable problem". Justify your answer by giving equation of separator and inequalities for the following 2 input logical function.
1) AND
2) XOR. Among this two logical function which one is linearly non separable? And why?   **8**

b) Explain the intuition behind gradient descent. Explain the steps involved in the Back Propagation Algorithm. **8**

5. a) Consider the following test cases of a binary classifier with Actual class (Ground Truth) and Predicted output. Find the corresponding predicted class for each test case by considering the error threshold = 0.6 (i.e. if predicted output is greater than threshold then classified as class-1 otherwise class-0) **8**

Actual Class	Predicted Output
0	0.5
1	0.9
0	0.7
1	0.7
1	0.3
0	0.4
1	0.5

1) construct the Confusion Matrix

2) Find the Accuracy

3) Find the Error Rate

4) Find the Precision

5) Find the Recall

b) What are the different types of activation functions popularly used? Explain any four. **8**

OR

6. a) What are the applications of ART in ANNs? Provide examples. **8**

b) What is Associative Memory in Artificial neural Networks (ANNs)? Explain with an example. **8**

7. a) What is exploding gradient problem? How does it affect deep neural networks? Wha are the strategies to mitigate the exploding gradient problem? **8**

b) Compare and contrast Batch, Mini-Batch and Stochastic Gradient Descent. **8**

OR

8. a) There is a set of certain optimizers which helps in improving the parameter optimization process. Explain any two optimizers among the following:
a) Adagrad b) RMSProp c) Adam **8**

b) What is regularization in deep learning? How does it help in preventing overfitting? Provide examples of regularization techniques used in deep learning. **8**

9. a) What are the basic building blocks of CNN architecture? Explain the process of convolution with a very simple image data of size 6 X 6 and a filter 3 X 3. **8**

b) Explain the role of filter, padding and strides in a convolution layer of a CNN. What will be the shape of the output matrix for an image of size 15 X 15 if padding size is 1, stride size is 2 and 3 X 3 filter used for convolution. **8**

OR

10. a) Given the input matrix and the kernel, perform convolution with stride being 2, padding being 1. **8**

1	0	1	1	0
0	0	0	1	1
1	0	0	0	1
0	1	1	1	0
1	1	0	1	0

Input matrix

1	0	0
0	0	1
1	1	0

Kernel

b) Differentiate between:- **8**

a) Max Pooling versus Average Pooling

b) Same versus Valid Convolution (Padding).

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