

December 2023

B.Tech (IT/CSE)-VII SEMESTER

Neural Networks and Deep Learning (PEC-CSD-703/PEC-CS-D-703)

Max. Marks:75

Time: 3 Hours

Instructions: 1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.

2. Answer any four questions from Part -B in detail.

3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) What does a gradient descent algorithm do? (1.5)
- (b) What is the purpose of an Activation Function in a Neural Network? (1.5)
- (c) Define hebbian learning rule. (1.5)
- (d) What is Overfitting, How Does Overfitting Affect Model Performance on New Data? (1.5)
- (e) Write some applications of ANN. (1.5)
- (f) Define Deep Learning. (1.5)
- (g) What is Learning Vector Quantization (LVQ)? (1.5)
- (h) Define Adaptive Resonance Networks. (1.5)
- (i) Differentiate between Supervised and Unsupervised learning algorithm. (1.5)
- (j) What is the Role of the Learning Rate in Training Neural Networks? (1.5)

PART -B

- Q2 (a) Explain the biological prototype of neuron. Also explain the characteristics of neuron. (10)
- (b) What is Bi-direction associative memory? Explain its various types. (5)
- Q3 (a) Distinguish between the feed forward and feedback neural networks. Compare their input-output mapping. (5)
- (b) Define Support Vector Machine (SVM) for classification problem. What are support vectors in SVM? Explain how it separates non-separable patterns. (10)
- Q4 Explain the following (15)
- (a) Dimensionality reduction in PCA.
- (b) Recurrent NN
- Q5 (a) What is the primary objective of the Backpropagation Algorithm? How does the Backpropagation Algorithm update the weights in a neural network? Explain the forward pass and backward pass in the context of Backpropagation. (10)
- (b) Sketch the architecture of Boltzmann network and mention the steps for recall Procedure. (5)

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- Q6 (a) What is radial basis function network (RBFN)? Explain the training algorithm used for RBFN. (10)
- (b) What is the objective of the LMS algorithm? How is the error calculated in the context of the LMS algorithm? Write any applications of LMS algorithm? (5)

Q7 Derive the training algorithm of Kohonen network. Also explain how SOMs can be used for data compression. Construct KSOM to clusters from the given vectors (15)

$[0 \ 0 \ 1 \ 1], [1 \ 0 \ 0 \ 0], [0 \ 1 \ 1 \ 0], [0 \ 0 \ 0 \ 1]$

Number of clusters to be formed is 2, Assume an initial learning rate of 0.5. Use initial weight matrix :

$$W_{ij} = \begin{bmatrix} 0.2 & 0.9 \\ 0.4 & 0.7 \\ 0.6 & 0.5 \\ 0.8 & 0.3 \end{bmatrix}$$

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PART-B

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- (b) Define support Vector Machine (SVM) for classification problem. What are support vectors in SVM? Explain how it separates non-separable patterns. (10)
- Q4 Explain the following: (10)
  - (a) Dimensionality reduction in PCA
  - (b) Recurrent NN
- Q5 (a) What is the primary objective of the backpropagation algorithm? How does the backpropagation algorithm update the weights in a neural network? Explain the forward pass and backward pass in the context of backpropagation. (10)
- (b) Sketch the architecture of Boltzmann network and mention the steps for recall procedure. (5)