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Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree (R, S) Examination November 2024 (2019 Scheme)

Course Code: AIT401

Course Name: FOUNDATIONS OF DEEP LEARNING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

Marks

- | | | |
|----|---|-----|
| 1 | What is deep learning, and why is it considered a breakthrough in artificial intelligence? | (3) |
| 2 | Calculate the output Y of a three-input neuron with bias. The input feature vector is $(x_1, x_2, x_3) = (0.8, 0.6, 0.2)$ and weight values are $[w_1, w_2, w_3] = [0.2, 0.1, -0.3]$ and Bias is 0.25. Use Binary Sigmoid as the activation function. | (3) |
| 3 | Discuss in detail how early stopping acts as a Regularizer. | (3) |
| 4 | List any three methods to prevent overfitting in neural networks | (3) |
| 5 | Assume an input volume of dimension $64 \times 64 \times 3$. What are the dimensions of the resulting volume after convolving a 5×5 kernel with zero padding, stride of 1 and 2 filters? | (3) |
| 6 | How can transfer learning be used to improve the performance of a convolutional neural network for image classification tasks? | (3) |
| 7 | What is the main difference between a convolutional neural network (CNN) and a recurrent neural network (RNN)? | (3) |
| 8 | Differentiate between LSTM and GRU | (3) |
| 9 | What is an autoencoder? Give one application of an autoencoder. | (3) |
| 10 | Where is Boltzmann machines used? | (3) |

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

- | | | |
|----|---|-----|
| 11 | a) Explain the backpropagation algorithm for neural network training. | (8) |
| | b) Discuss bias variance trade-off in neural networks. | (6) |

OR

- 12 a) Describe various activation functions used in neural networks and its derivatives (8)
b) Discuss the structure and functionality of a Perceptron. (6)

Module II

- 13 a) Explain the different techniques to improve model performance and generalization (10)
b) Explain the vanishing and exploding gradient problem (4)

OR

- 14 a) Enumerate how early stopping, dropout, and batch normalization can be used to improve the performance of a deep neural network. (8)
b) Distinguish between Momentum Optimizer, RMSProp, and Adam, in the context of deep neural network training? (6)

Module III

- 15 a) Sketch and explain Convolutional Neural Network architecture, and expand each stage in detail. (10)
b) Describe common pooling methods like max-pooling and average pooling. Discuss how pooling layers contribute to reducing spatial dimensions while preserving essential features. (4)

OR

- 16 a) Explain the following convolution functions (8)
a) kernel flipping b) down sampling c) strides d) zero padding.
b) Take one pre-trained CNN architecture (e.g., VGGNet-19) and describe its key features, use of convolutional layers, and pooling layers. Explain the advantages of using pre-trained models as a starting point for new projects. (6)

Module IV

- 17 a) Explain the general structure of LSTM and Illustrate how LSTM decides what to remember and what to forget? (9)
b) Discuss different ways to make a Recurrent Neural Network(RNN) a deep RNN with the help of diagrams. (5)

OR

- 18 a) Illustrate the concept of language modelling using an RNN. Describe the structure of an RNN-based language model and how it generates probabilistic predictions for sequences of words. (9)
b) Discuss the key considerations in designing an RNN architecture. (5)

Module V

- 19 a) Describe the structure and working principles of a variational autoencoder (VAE). (7)
- b) Define Deep Belief Networks (DBNs) and their significance in the field of deep learning (7)

OR

- 20 a) Compare Boltzmann Machine with Deep Belief Network (7)
- b) Explain Generative Adversarial Networks using a suitable diagram (7)
