KUMARAGURU college of technology
character is life

Register Number:……

M.TECH DEGREE EXAMINATIONS: NOVEMBER /DECEMBER 2024

(Regulation 2018)

Second Semester

DATA SCIENCE

P18ITI2205: Deep Learning

COURSE OUTCOMES

CO1: Understand the fundamental principles, theory and approaches for learning with deepneural networks

CO2: Understand the key concepts, issues and practices when training and modelling deepneural networks

CO3: Understand convolution neural networks and various popular CNN architectures inliterature

CO4: Apply neural networks in applications like - object detection, face recognition, neuralstyle transfer

CO5: Understand the variations of neural network for sequence data, apply RNN in applicationslike - Sentiment classification, Language translation, Speech Recognition and Trigger word detection.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following describes the Adam optimization algorithm? CO2 [K_2]

   a) An algorithm that combines the advantages of momentum and RMSProp
   b) A method that only adjusts the learning rate based on the gradient's direction
   c) A technique that only works for binary classification problems
   d) An approach that uses L1 regularization by default

2. Calculate the IoU between two bounding boxes: The first box has dimensions 3x4 and the second box has dimensions 4x3. They have an overlapping area of 2x2.. CO4 [K_3]

   a) 0.1
   b) 0.2
   c) 0.3
   d) 0.5

3. Which of the following architectures consists of two or more identical subnetworks? CO4 [K_1]

   a) Yolo
   b) Inception Network
   c) RNN
   d) Siamese Network

4. Match List I with List II. CO1 [K_2]

List I	List II
A.Neuron	i. Applies transformation to the weighted sum
B. Activation Function	ii. Units of a neural network that receive input and output values
C. Weights	iii. Constant value added to the weighted sum
D.Bias	iv. Adjusts during training to minimize the loss

A B C D

a) i ii iii iv

b) iii i iv ii

c) ii i iii iv

d) ii i iv iii

5. Assertion (A): Pooling layers are essential in CNNs for reducing the dimensionality of feature maps. CO3 [K_2]
Reason(R): By down-sampling the feature maps, pooling layers help decrease the computational load and control overfitting, while preserving the most important information.

a) Both A and R are individually true but R is not the correct explanation of A
b) Both A and R are Individually true and R is the correct explanation of A
c) A is false but R is true
d) A is true but R is false

6. A team is developing a mobile app that can help users find specific items in a grocery store by scanning the aisles. What is/are the primary task they need to implement in their app? CO5 [K_2.]

i. Object classification

ii. Object recognition

iii. Object localization

iv.Image segmentation

a) i and only
b) iii and iv
c) ii and iii
d) iii only

7. Which of the following is the advantage of using recurrent layers in an RNN? CO5 [K_1]

a) RNN can capture temporal dependencies in the input data
b) RNN can handle variable-length inputs
c) RNN can generate synthetic data
d) RNN can handle non-linear transformations

8. An input image has been resized to a matrix of dimensions 64 x 64, and a filter of size 5 x 5 is applied with a stride of 2. What will be the dimensions of the resulting convoluted matrix? CO3 [K_3]

a) 5 X 5
b) 64 X 5
c) 30 X 30
d) 64 X 64

9. Which of the following techniques are effective in preventing a model from overfitting to the training dataset? CO2 [K_2]

   i. Dropout
   ii. Early stopping
   iii. Pooling
   iv. Data augmentation

   a) iii only b) i only
   c) ii and iii d) i,ii and iv

10. Arrange the steps for training a logistic regression model in the correct order CO1 [K_2]

    1. Apply the sigmoid activation function to compute the predicted output.
    2. Initialize parameters (weights and bias) randomly.
    3. Calculate the gradient of the loss with respect to the parameters.
    4. Update parameters using the gradient descent algorithm.
    5. Compute the loss using the binary cross-entropy loss function.

    a) 2, 1, 5, 3, 4 b) 3, 2, 1, 5, 4
    c) 5, 4, 3, 2, 1 d) 1, 2 ,3, 4, 5

PART B (10 x 2 = 20 Marks)

11.	In a neural network that predicts values ranging from 0 to 1, why is the sigmoid function often more suitable than the ReLU function?	CO1	[K_2]
12.	What is a neural network, and how does it mimic the way the human brain works?	CO1	[K_2]
13.	State the key characteristic of the VGG16 architecture .	CO2	[K_2]
14.	What are vanishing and exploding gradient problems, and how do they affect the training of deep neural networks?	CO2	[K_2]
15.	Why do we prefer Convolutional Neural networks over Artificial Neural networks for image data as input?	CO3	[K_2]
16.	What are strided convolutions, and how do they differ from regular convolutions?	CO3	[K_2]
17.	In a facial recognition system, key facial features like the eyes, nose, and mouth are detected. How does landmark detection assist in improving the accuracy of this system?	CO4	[K_3]
18.	What is non-max suppression, and why is it used in object detection pipelines?	CO4	[K_2]
19.	What is a Recurrent Neural Network and how does it differ from traditional feedforward neural networks?	CO5	[K_2]
20.	In what ways does a Gated Recurrent Unit enhance the performance of traditional RNN architectures?	CO5	[K_2]

PART C (10 x 5 = 50 Marks)

21.	Imagine you are creating a neural network model to aid in diagnosing diseases from medical images like X-rays or MRIs. What steps would you take to ensure the accuracy and reliability of your model? Consider aspects such as data collection, preprocessing, model selection, training, and evaluation.	CO1	[K_2]
22.	Construct a computational graph for the following mathematical expression: $z=(x+y)*(a-b)$. Identify all the nodes and edges in the graph and explain how forward propagation computes the value of z.	CO1	[K_3]
23.	Given a neural network output layer with five neurons having values [1.3, 5.1, 2.2, 0.7, 1.1], compute the class probabilities using the softmax function.	CO2	[K_3]
24.	Describe the concept of dropout regularization in neural networks. How does dropout work, and why is it effective in preventing overfitting?	CO2	[K_2]
25.	Describe the architecture of LeNet-5 and explain how it was designed for digit recognition tasks	CO3	[K_2]
26.	Elucidate the role of activation functions, such as ReLU and Softmax, in fully connected layers of a neural network. Discuss how they impact the network's ability to learn and make predictions	CO3	[K_2]
27.	Discuss the challenges of face recognition and explain how one-shot learning addresses these challenges.	CO4	[K_2]
28.	Elucidate the function of anchor boxes in object detection algorithms. In what ways do they assist in predicting the locations and sizes of objects?	CO4	[K_2]
29.	How is sentiment classification performed using RNNs? Provide a brief explanation of the process.	CO5	[K_2]
30	Describe the architecture of an LSTM cell and how it addresses the vanishing gradient problem. Why are the gates in an LSTM important for managing information flow?"	CO5	[K_2]

Answer any TWO Questions

PART D (2 x 10 = 20 Marks)

31.	Describe the architecture and functioning of Convolutional Neural Networks in detail. Include an explanation of the key components such as convolutional layers, activation functions, pooling layers, and fully connected layers. Illustrate how these components work together to enable CNNs to perform image classification task.	CO3	[K_2]
32.	What is YOLO in the context of object detection, and how does its architecture enable real-time detection of multiple objects in images? Explain	CO4	[K_2]
33.	A research team is developing a neural network model to perform sentiment analysis on lengthy text sequences. During training, they observe difficulties in learning dependencies between distant words, resulting in suboptimal performance on longer sentences. Describe the architecture of an LSTM cell and discuss how it effectively mitigates the vanishing gradient problem that the team is encountering with their sequence data.	CO5	[K_3]

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