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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU)

VI Semester B. E. Examinations Sept/Oct – 2024

Artificial Intelligence and Machine Learning

ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

			M	BT	CO
1	1.1	Define Hebbian learning and articulate the rule it follows.	02	2	1
	1.2	What is the concept of adaption in the context of neural networks?	02	1	1
	1.3	Given an input vector x[1,2], f {x}= [1,2] and a desired output d=3, assuming the initial weights of a single – layer perceptron are w=[0.5, -0.5]. Compute the output of the perceptron using a linear activation function.	02	2	1
	1.4	In a batch mode, if the total error after one epoch is E=5 for 10 samples and in sequential mode the error after the first 5 samples is E_5=3E, what is the average error per sample in each mode?	02	1	1
	1.5	i. In a convolution layer _____. refers to the addition of pixels around the border of an image to control the spatial dimensions of the output. ii. The process of _____ in a CNN reduce the spatial dimensions of the input volume and helps to make the representations more invariant to small translations	02	2	1
	1.6	Complete the answer: Local Response Normalization (LRN) is a technique used in CNNs to _____.	02	1	1
	1.7	Match each concept or application related to Recurrent Neural Networks (RNNs) in Column A with its corresponding description or example in Column B.			

Column A	Column B
I. Expressiveness of Recurrent Networks	i. Similar to LSTM but with a simplified structure for faster computation and fewer parameters.
II. Long Short- Term Memory (LSTM)	ii. Application involving generating textual descriptions for images.
III. Application to Automatic image Captioning	iii. A model's ability to represent complex dependencies and relationships within sequences.
IV. Gated Recurrent Units(GRUs)	iv. RNN variant that addresses the vanishing gradient problem using gates for better long-term memory retention

			02	1	1

	1.8	State whether the below sentences are true or false i. Echo-State Networks are a type of RNN that relies on a large, fixed reservoir of neurons with random weights and only trains the output layer. ii. RNN are ineffective for handwriting recognition tasks due to their inability to learn temporal patterns in sequential data.	02	4	1
	1.9	In the context of Multi-Armed Bandits, what is the Greedy Algorithm? Give one limitation.	02	2	2
	1.10	In the context of self-driving cars, how does reinforcement learning contribute to decision making?	02	1	1

PART-B

2	a	Articulate the working of multi-layer feed forward and RNN architectures in various applications through necessary diagrams.	08	2	2
	b	Analyze the key differences between supervised and unsupervised and reinforcement machine learning.	08	2	1
3	a	What is unconstrained optimization problem? Explain the working of Least Mean Square method.	08	2	3
	b	With a neat sketch elaborate the working of multi-layer perceptron.	08	2	2
		OR			
4	a	For back propagation algorithm, analyze the different ways of defining stopping criteria.	08	2	3
	b	With relevant example discuss how back propagation can be a solution for XOR problem.	08	2	2
5	a	AlexNet is implemented by researchers for automation of recognition of casting surface defects and the accuracy is 86%. Analyze the given case study and list out the reasons for better performance with respect to the case study.	08	2	2
	b	For the given input perform different convolution operations considering Zew padding and stride=1 6 3 4 4 5 0 3 4 7 4 0 4 0 4 7 0 2 3 4 5 2 3 7 5 0 3 0 7 5 8 1 2 5 4 2 8 0 1 0 6 0 0 6 4 1 3 0 4 5	08	3	2
		OR			
6	a	Assume a series of data stored as PET scan images with reference to classifying the image as presence or absence of cancer causing tissues. The number of images is less for training. Identify and justify the technique used to increase the training set and explain the process in detail.	08	2	2

	b	Elaborate how pooling can be used to detect the edges in an image. For the given input matrix below *Input 6 x 6 matrix* 3 0 1 2 7 4 1 5 8 9 3 1 2 7 2 5 1 3 0 1 3 1 7 8 4 2 1 6 2 8 2 4 5 2 3 9 *Filter 3 X3* 1 0 -1 1 0 -1 1 0 -1 Apply max and average pooling considering the size of 3 × 3.	08	3	2
7	a	Explain the concept of Back Propagation Through Time (BPTT) and its role in training RNNs. How does it address the issue of learning long term dependence?	06	3	3
	b	Articulate the role of RNNs in natural language processing (NLP) tasks. Identify and elaborate an appropriate RNN model for language translation with an example.	10	2	2
		OR			
8	a	Analyze the differences between CNN and RNN	06	3	3
	b	With suitable example and necessary diagrams illustrate the working of LSTM	10	2	2
9	a	Demonstrate the basic framework of Reinforcement learning (RL) and key components involved in the learning process. How do challenges such as exploration versus exploitation impact RL algorithms?	06	2	2
	b	With an example, illustrate how a neural network can be used as a function approximator in an RL setting, such as playing Atari games. Describe how the neural network estimates the value function and benefits of this approach.	10	3	3
		OR			
10	a	Consider the example “The player chases the ball”. Apply Markov-Decision process and elaborate the steps in detail.	06	2	2
	b	Analyze how DL techniques are used in building conversational systems such as chatbots. Also list the benefits and limitations of using DL for natural language understanding and generation.	10	2	3