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Academic Year 2024-25 (ODD Semester)

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Department of Artificial Intelligence and Machine Learning

ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

Course Code : AI253IA | **Date : 7/1/2025**

Semester : V Sem | **Time : 9:30am to 11:30am**

Max Marks : 10 (Q) + 50(CIE) | **Duration : 30 + 90=120 min**

QUIZ 2

Note: Answer all the Questions

Q. No		Questions	M	BT	CO
1	a)	What is the purpose of the stride parameter in a convolutional layer?	2	2	1
	b)	Given the values for input gate (it=0.8), forget gate (ft=0.6), output gate (ot=0.7), previous cell state (c_{t-1}=0.5), and candidate cell state (ct=4), calculate the updated cell state ct using the LSTM cell state update equation	2	1	1
	c)	Given x_t=1.5,h_{t-1}=0.8, W_{xh}=0.4,W_{hh}=0.6, and b_h=0.2 calculate the hidden state ht at time step t using the RNN update equation	2	3	1
	d)	List any two methods of data augmentation techniques commonly used for image data.	2	2	1
	e)	Give the max pooling considering 2×2 window size 3 1 1 3 2 5 0 2 1 4 2 1 4 7 2 4	2	2	1

CIE 2

Note: Answer all the Questions

Q. No		Questions	M	BT	CO
2	a)	How is backpropagation implemented through matrix multiplication in Convolutional Neural Networks (CNNs)?	5	3	1
	b)	How do pre trained convolutional neural network handles object localization ?With neat diagram elaborate the steps in detail	5	2	1
3	a)	Consider a simple Recurrent Neural Network (RNN) with the following setup: The RNN has one hidden layer with a hidden state vector h_t which at each time step t is updated by the equation: $$h_t = \tanh(W_{hh}h_{t-1} + W_{xh}x_t + b_h)$$ Given the loss function	5	3	3

		$L - \sum_{t-1}^{T} \frac{1}{2}(y_t - \hat{y}_t)^2$ Compute the gradient of the loss with respect to W_{hy} and W_{hh} (the output weight matrix) using BPTT.			
	b)	Provide a comprehensive technical overview of a Convolutional Neural Network (CNN) architecture. Please include a brief explanation of each layer, such as the input layer, convolutional layers, activation functions, pooling layers, fully connected layers, and the output layer.	5	2	1
4	a)	In a smart grid energy management system, an Echo State Network (ESN) is used to forecast energy demand based on real-time data from IoT sensors. The system receives input features such as current energy consumption, weather conditions, and time of day. The ESN is trained to predict energy demand for the next hour. **a)** Describe the architecture of the ESN in this scenario, highlighting the roles of the input, reservoir, and output layers.	5	3	3
	b)	Consider the statement, *"Captain Rohit fail in BGT Test Series."* Discuss briefly how a Long Short-Term Memory (LSTM) network can be effectively utilized for grammatical error detection and correction in such sentences. Provide the architecture diagram of an LSTM cell and provide mathematical equations for the cell state	5	3	1
5	a)	Provide a detailed explanation of the mathematical formulations for Bidirectional and Multilayer Recurrent Neural Networks (RNNs), including the state transition equations for both forward and backward passes in BRNNs, and the effects of stacking multiple recurrent layers in Multilayer RNNs."	5	3	2
	b)	Consider a machine translation task where the goal is to translate a sentence from English to Kannada. Identify the most appropriate type of RNN for this task, and explain its architecture and justify your choice	5	4	3
6		Considering the given matrix i)Perform the convolution operation with the given filter and stride = 1 and zero padding and discuss the output in detail. Filter 3×3 Input 6×6	10	3	2

1	0	-1	
1	0	-1	
1	0	-1	

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

M-Marks, BT-Blooms Taxonomy Levels, CO-Course Outcomes

Marks Distribution	Particulars	CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Max Marks CIE & Quiz	30	5	15	-	4	12	20	14	10	-

Course Outcomes

CO1:	Describe basic concepts of neural networks, its applications and various learning models
CO2:	Analyze different network architectures, learning tasks, CNN, and deep learning models
CO3:	Investigate and apply neural networks model and learning techniques to solve problems related to society and industry.
CO4:	Demonstrate a prototype application developed using any NN tools and APIs.
CO5	Appraise the knowledge of neural networks and deep learning as an individual/as an team member.