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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: VII**

Branch: Computer Science and Engineering **Duration: 3 hrs.**

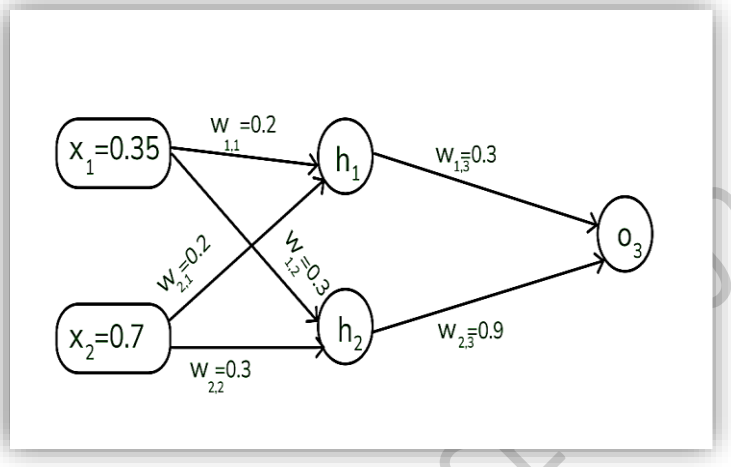
Course Code: 22CS7PENDL **Max Marks: 100**

Course: Neural Network and Deep Learning

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Analyze the design of Rosenblatt's perceptron for the Mc Culloch-Pitts model of a neuron. Show the summing of the linear combination of the inputs applied on synapses using the signal-flow graph of the perceptron with appropriate mathematical equations.	*CO1*	*PO 1*	**5**
	b)		Compare and contrast single-layer feedforward networks, multilayer feedforward networks, and recurrent networks in terms of their structural differences, representational power, and suitability for different types of data and tasks with suitable diagrams.	*CO2*	*PO2*	**5**
	c)		Derive the error correction learning algorithm for the perceptron using the perceptron convergence theorem. Formulate the algorithm for adapting the weight vector of the elementary perceptron.	*CO2*	*PO2*	**10**
			OR			
2	a)		Consider the classification task. You first train your network on 20 samples. Training converges, but the training loss is very high. You then decide to train this network on 10,000 examples. Is your approach to fixing the problem correct? If yes, explain the most likely results of training with 10,000 examples. If not, give a solution to this problem.	*CO2*	*PO2*	**5**
	b)		Analyze how the threshold and sigmoid activation functions influences the training and performance of the neural networks. In what scenarios does one activation function be preferred over the other.	*CO2*	*PO2*	**5**
	c)		Examine the Least Mean Square (LMS) algorithm for minimizing the instantaneous cost function. Derive the gradient vector for the steepest descent method and illustrate the process using a signal flow graph that incorporates feedback.	*CO1*	*PO1*	**10**

			UNIT - II			
	3	a)	Derive the mathematical formulation of the Universal Approximation Theorem for a nonlinear input-output mapping in neural networks.	*CO2*	*PO2*	**5**
		b)	Write the algorithm for stratified k-Fold cross-validation.	*CO1*	*PO1*	**5**
		c)	Assume that the neurons have the sigmoid activation function to perform forward and backward pass on the network. And also assume that the actual output of y is 0.5 and the learning rate is 1. Show weight updates by using back-propagation algorithm. 	*CO1*	*PO1*	**10**
			OR			
	4	a)	Derive the steps in applying the Conjugate Gradient Method and Quasi Newton method for the supervised training of a multilayer perceptron.	*CO1*	*PO1*	**10**
		b)	How training differs from pure optimization ? Write the process to minimize the average training error.	*CO1*	*PO1*	**10**
			UNIT - III			
	5	a)	Which regularization method leads to weight sparsity? Explain why.	*CO1*	*PO1*	**5**
		b)	Discuss Parameter Sharing and Typing in Deep Learning.	*CO1*	*PO1*	**5**
		c)	Can over fitting happen in a neural network? If yes how to deal with over fitting in a neural network.			**10**
			OR			
	6	a)	What is dropout in neural networks? Can it be compared with bagging or boosting in regular machine learning scenario?	*CO1*	*PO1*	**5**
		b)	Analyse the importance of regularization techniques that encourage sparsity and discuss the impact of the strategy on model parameters.	*CO2*	*PO2*	**5**
		c)	Explain Data Augmentation Techniques.	*CO1*	*PO1*	**10**
			UNIT - IV			
	7	a)	Describe the Pooling operation in CNN.	*CO1*	*PO1*	**5**

		b)	The input image has been converted into a matrix of size 12 x 12 and a kernel/filter of size 3 x 3 with a stride of 1. Determine the size of the convoluted matrix?	*CO2*	*PO2*	**5**
		c)	Show the different variants of the convolution in terms of convolution with a stride and the effect of zero padding on network size with appropriate diagrams.	*CO1*	*PO1*	**10**
			OR			
	8	a)	What will happen if the Learning Rate is set too low or too high?	*CO1*	*PO1*	**5**
		b)	Can we use CNN to perform dimensionality reduction? If yes then which layer is responsible for dimensionality reduction particularly in CNN.	*CO1*	*PO1*	**5**
		c)	Describe the architecture of a typical Convolutional Neural Network (CNN)?	*CO1*	*PO1*	**10**
			UNIT - V			
	9	a)	Discuss the vanishing gradient in RNN and how they can be solved.	*CO1*	*PO1*	**5**
		b)	Illustrate unfolding computational graph with example.	*CO1*	*PO1*	**5**
		c)	Draw and explain the architecture of Recurrent Neural Network Architecture.	*CO1*	*PO1*	**10**
			OR			
	10	a)	How the Sequence to Sequence Model works?	*CO1*	*PO1*	**10**
		b)	Differentiate between recurrent neural networks and recursive neural networks.	*CO2*	*PO2*	**5**
		c)	What is Gradient Clipping? Why is it essential in training RNNs?	*CO1*	*PO1*	**5**

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