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

Autonomous Institute Affiliated to VTU

April 2025 Semester End Make-Up Examinations

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

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

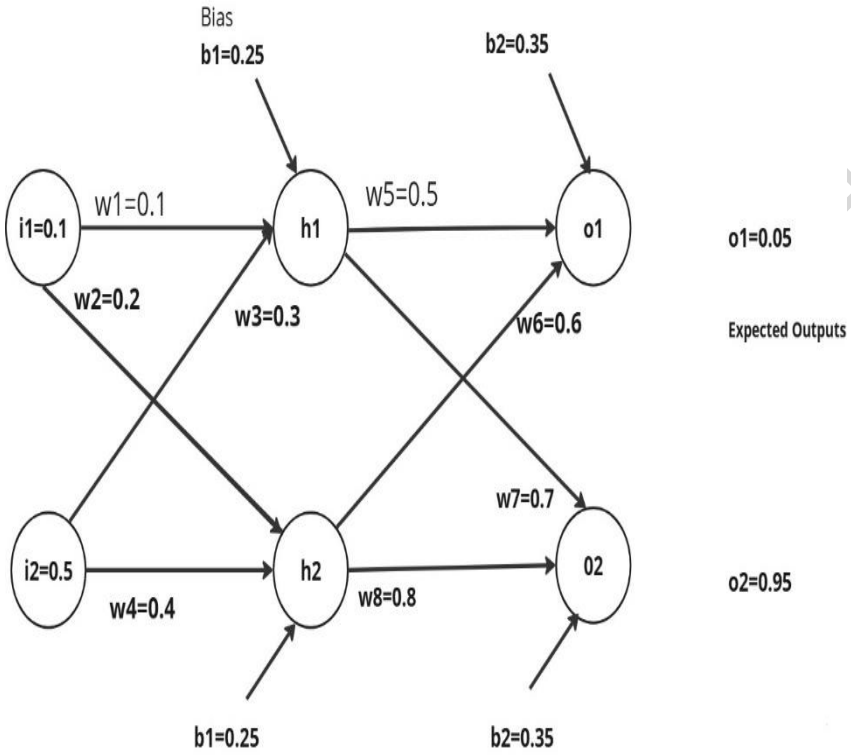
Course Code: 22CS7PENDL **Max Marks: 100**

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 influence of feedback in the neural networks. Obtain the expressions input signal $x_j(n)$, internal signal $x_j'(n)$ and output signal $y_k(n)$.	*CO2*	*PO 2*	**10**
	b)		Identify and analyse three basic elements of the neuron model. Formulate the neuron k using mathematical terms. Compare the effect of adding the bias b_k and adding fixed input x_0 and show that they are mathematically equivalent.	*CO2*	*PO2*	**10**
			OR			
2	a)		Show that the use of search-then-coverage schedule can overcome the slow convergence encountered with the LMS algorithm, plot the variations of η and η_0 for the same.	*CO1*	*PO1*	**7**
	b)		Justify the principle statistical analysis of the LMS algorithm for the small learning rate parameter	*CO2*	*PO2*	**7**
	c)		By considering Threshold and Sigmoid as activation functions, analyze how it influences the training and performance of the neural networks. Indicate which activation function may be favored over the other based on specific scenarios.	*CO2*	*PO2*	**6**
			UNIT - II			
3	a)		Analyze how time can be incorporated into the operation of a neural network to enable temporal pattern recognition and what are the two basic ways this can be achieved. With the block diagram of a discrete-time memory structure consisting of p identical sections connected in cascade, derive an equation for memory depth D.	**CO1, 2**	**PO1, 2**	**10**
	b)		Derive the local gradient expressions for Neuron j as an output node and as a hidden node, detailing the differences in their calculations	*CO2*	*PO2*	**10**
			OR			

	4	a)	Evaluate how batch and online learning impact convergence rate, generalization capability, and computational performance	*CO2*	*PO2*	**5**
		b)	Explain the three basic features of the multilayer perceptron and the two phases of training by back-propagation algorithm with LMS as a special case.	*CO1*	*PO1*	**5**
		c)	Apply the backpropagation algorithm for the network given below to update the weights w1- w8 to obtain the expected output with the learning rate 0.6. Use sigmoid activation function to train the network. In the network, i1, i2 are input layer neurons, h1 and h2 in hidden layer neurons and o1 and o2 are output layer neurons.  	*CO1*	*PO1*	**10**
			UNIT - III			
	5	a)	Implement the meta-algorithm using early stopping to determine the best amount of time to train, how long to train and retrain the data, and determine a point at which overfitting begins during training and continue its training until the value is reached.	*CO1*	*PO1*	**10**
		b)	Discuss how data augmentation techniques can vary across different applications.	*CO1*	*PO1*	**5**
		c)	Define dropout. Analyze the differences between bagging and dropout by examining their effects on training and prediction in neural networks.	CO1,2	PO1, 2	**5**
			OR			
	6	a)	Analyse how Multi-task learning improves generalization by pooling the examples arising out of several tasks.	*CO2*	*PO2*	**5**
		b)	Show how the parameters between two models performing the same/similar classification task are close to each other. Illustrate how parameter sharing occurs when processing images.	*CO2*	*PO2*	**5**

		c)	Illustrate how dropout trains an ensemble consisting of all sub-networks. Examine how dropout can help reduce overfitting in neural networks and explore its computational advantages.	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Mention various priors and analyze the concept of viewing a convolutional network as a fully connected network with an infinitely strong prior. Examine how this perspective provides insights into convolutional networks' operation.	*CO2*	*PO2*	**10**
		b)	Mention the three different stages in Convolutional neural network. Show how max-pooling introduces invariance. Illustrate learned invariance by taking any handwritten digit. Also analyze the requirement for down-sampling.	*CO2*	*PO2*	**10**
			OR			
	8	a)	Derive the equation for convolution operation with an illustration. Provide a detailed explanation and derivation of the formula for discrete convolution and state any properties of convolution.	*CO2*	*PO2*	**10**
		b)	Show how convolution neural network output a high dimensional structured object. Illustrate recurrent convolutional neural network for pixel labeling. Provide strategies to overcome the disadvantages when output plane is smaller than input plane.	*CO2*	*PO2*	**10**
			UNIT - V			
	9	a)	Examine the techniques for unfolding a computational graph with a repetitive structure within a dynamical system. Formulate this unfolding process using the external input signal $\mathbf{x}^t$ and the hidden unit h. Mention the advantages of the unfolding process.	**CO1, 2**	**PO1, 2**	**10**
		b)	Design a recurrent neural network that can map the input sequence to an output sequence that are of different lengths. Describe the process of the mapping using the architecture and mention the limitations of using the architecture.	**CO3**	**PO3**	**10**
			OR			
	10	a)	Discuss how the computation in most recurrent neural networks can be decomposed. Analyze how the blocks of parameters are treated as shallow transformations. How a deeper RNN can be implemented?	**CO1, 2**	**PO1, 2**	**10**
		b)	Examine the techniques for unfolding a computational graph of a Recursive Network. List its advantages over Recurrent Nets. Also write the variants of Recursive Net idea.	*CO2*	*PO2*	**10**

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