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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: V**
Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**
Course Code: 23AM5PCINN **Max Marks: 100**
Course: Introduction to Neural Networks

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.

				CO	PO	Marks
			UNIT - I			
1	a)		Define Neural Network and explain the benefits of neural network.	CO1	PO1	**5**
	b)		How to Build information and invariances into Neural Network Design? Discuss.	CO1	PO1	**5**
	c)		Prove the Perceptron convergence theorem for a two-class pattern classification problem.	CO3	PO2	**10**
			OR			
2	a)		Derive and infer the relationship between perceptron models and Bayesian classifiers within the framework of a Gaussian environment.	CO2	PO2	**10**
	b)		State LMS algorithm. Derive and determine the stability and rate of convergence condition for LMS algorithm.	CO2	PO2	**10**
			UNIT - II			
3	a)		Derive Back-propagation algorithm for Multilayer Feed forward neural network to compute local gradients of hidden and output neurons.	CO1	PO2	**10**
	b)		Discuss the heuristics required for making the back propagation algorithm to perform better.	CO1	PO1	**6**
	c)		Illustrate the role of Hessian in Online Learning.	CO2	PO1	**4**
			OR			
4	a)		Describe the concept of annealing the learning rate in on-line learning and its impact on convergence to the optimal parameter in multilayer perceptron.	CO1	PO2	**10**
	b)		Differentiate batch learning and online learning	CO1	PO1	**6**
	c)		Demonstrate working of multilayer perceptron for nonlinearly separable pattern.	CO1	PO1	**4**
			UNIT - III			
5	a)		Explain how generalization occurs in a nonlinear hypothetical network to produce correct input–output mapping.	CO2	PO1	**6**
	b)		Exemplify the different Variants of Cross-Validation technique to improve the performance of a model.	CO3	PO2	**6**

		c)	Illustrate the concept of Complexity Regularization and Network Pruning in designing a multilayer perceptron.	*CO3*	*PO1*	**8**
			OR			
	6	a)	Explain curse of dimensionality, and its implications in high-dimensional data analysis. Describe two strategies to mitigate the challenges posed by the curse of dimensionality,	*CO3*	*PO1*	**6**
		b)	Describe the perspective of supervised learning as a numerical optimization problem in multilayer perceptron.	*CO2*	*PO1*	**8**
		c)	Illustrate the concept of a replicator (identity) mapping in a multilayer perceptron and its use in data compression	*CO3*	*PO1*	**6**
			UNIT - IV			
	7	a)	Analyze the linear separability manifest within a Radial Basis Function (RBF) network with an example to illustrate its practical implications.	*CO2*	*PO2*	**6**
		b)	Illustrate curve-fitting problem and provide the structure of Radial Basis Function Networks.	*CO1*	*PO1*	**6**
		c)	Apply the cover's theorem to improve the effectiveness of the pattern classification task by enhance the separability of patterns in the RBF network.	*CO2*	*PO2*	**8**
			OR			
	8	a)	Explain the hybrid learning procedure, along with its key components in training the RBF network.	*CO1*	*PO1*	**5**
		b)	In the XOR problem, there are four patterns -(1, 1), (0, 1), (0, 0), and (1, 0) - in a two-dimensional input space. Construct a pattern classifier that produces the binary output '0' in response to the input pattern (1, 1), or (0, 0) and the binary output '1' in response to the input pattern (0, 1) or (1, 0) using suitable Radial Basis Function (RBF).	*CO2*	*PO3*	**5**
		c)	The size of the hidden layer, in the RBF network is large and computing the inverse matrix R-1(n) for n = K (where K is number of hidden layer) is computationally intensive. Using Recursive Least Square algorithm, provide alternate solution to find R-1(n).	*CO2*	*PO3*	**10**
			UNIT - V			
	9	a)	Illustrate how can Kohonen network be used to compress data with minimum loss of information.	*CO3*	*PO2*	**10**
		b)	Describe in detail three essential processes involved in the formation of the self-organizing map with necessary mathematical equations.	*CO3*	*PO1*	**10**
			OR			
	10	a)	Discuss density matching and feature selection properties of SOM algorithm.	*CO3*	*PO1*	**10**
		b)	Describe the relationship between the Kernel Self-Organizing Map (SOM) and the Kullback–Leibler Divergence (KLD), with necessary mathematical equations	*CO3*	*PO1*	**10**

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