U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**
Course Code: 22AM6PCAML **Max Marks: 100**
Course: Advanced Machine Learning

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

			UNIT - I	*CO*	*PO*	**Marks**
1	a)	With an equation, discuss how to generate data using the class-conditional probabilities and class priors.		*CO2*	*PO1*	**04**
	b)	Derive the posterior predictive distribution for a single multinoulli trial and also discuss how to avoid the zero-count problem using the Dirichlet-multinomial model.		*CO3*	*PO3*	**08**
	c)	Illustrate different types of features used to form the class-conditional density of the Naive Bayes Classifier.		*CO3*	*PO2*	**08**
		UNIT - II				
2	a)	Provide the Strategies for preventing overfitting in multivariate Gaussian or Multivariate Normal (MVN).		*CO1*	*PO1*	**06**
	b)	Derive the Inverse Wishart distribution (IW) using multivariate gamma function. Visualization IW with necessary graphs.		*CO3*	*PO3*	**06**
	c)	Derive the class posterior using Linear Discriminant Analysis (LDA) model. Visualize LDA with necessary graphs.		*CO3*	*PO3*	**08**
		UNIT - III				
3	a)	With an equation, discuss how to compute posterior using Bayesian model selection.		*CO1*	*PO1*	**06**
	b)	Derive the equation to compute the log marginal likelihood using Bayesian information criterion approximation.		*CO3*	*PO3*	**08**
	c)	Demonstrate how the frequency statistics is based on the sampling distribution with a suitable example.		*CO3*	*PO3*	**06**
		UNIT - IV				
4	a)	Verify that the log marginal distribution of the observed data ln p(X) can be decomposed into two terms in the form ln p(X) = L(q) + KL(q‖p) where L(q) and KL(q‖ p) is given.		*CO2*	*PO2*	**06**
	b)	Illustrate the Expectation Propagation algorithm using a simple example of clutter problem to infer the mean θ of a multivariate		*CO3*	*PO3*	**08**

			Gaussian distribution over a variable x (set of observations) drawn from the distribution with necessary graph and equations.			
		c)	Discuss the concept of Markov chain Monte Carlo (MCMC) considering sampling from a large class of distributions.	***CO1***	***PO1***	**06**
			OR			
	5	a)	Demonstrate how the Expectation Propagation and Variational message passing correspond to the optimization of two different KL divergences.	***CO3***	***PO3***	**06**
		b)	Explain Gibbs Sampling and Illustrate by alternate updates of two variables whose distribution is a correlated Gaussian.	***CO2***	***PO2***	**06**
		c)	Discuss the Box-Muller method for generating Gaussian distributed random numbers starts by generating samples from a uniform distribution.	***CO1***	***PO1***	**08**
			UNIT - V			
	6	a)	Explain the concept of kernel trick.	***CO1***	***PO1***	**06**
		b)	Derive Mercer kernel using gram matrix with a suitable example.	***CO3***	***PO3***	**08**
		c)	Discuss the Application: Google's PageRank algorithm for web page ranking using Markov models.	***CO3***	***PO2***	**06**
			OR			
	7	a)	Examine the Kernels for comparing documents using the bag of words.	***CO1***	***PO1***	**06**
		b)	Describe how to recursively compute the filtered marginal in a Hidden Markov Model using the forwards algorithm.	***CO2***	***PO1***	**08**
		c)	Discuss the types of inference problems for temporal models.	***CO1***	***PO1***	**06**

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