BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – M.Tech.(CSE)-AIML-2023
Course Name – Pattern Recognition
Course Code - PEC-MCSM301A
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Choose the correct option, in a typical pattern recognition application, the raw data is processed and converted into a form that is amenable for a machine to use.

a) =TRUE() b) =FALSE()
c) Can be true or false d) Can not say

(ii) Recognize the type of process that has a constant mean and variance over time.

a) Non-stationary process b) Random process
c) Stationary process d) Independent process

(iii) Identify the key assumption in the Bayesian classifier for minimizing classification error.

a) Class conditional densities are normally distributed b) All features are discrete
c) The prior probabilities are unknown d) The data is independent and identically distributed (i.i.d.)

(iv) Distinguish between discrete features and continuous features in Bayesian classifiers.

a) Discrete features require parametric modeling, continuous features require non-parametric b) Discrete features are represented by probability density functions
c) Discrete features use likelihood functions, continuous features use probability mass functions d) Discrete features are modeled with probability mass functions, continuous features with probability density functions

(v) Define Maximum-Likelihood Estimation (MLE).

a) A method to maximize the prior probability of a parameter b) A method to estimate the parameters that maximize the likelihood of the observed data
c) A method to minimize the variance of the dataset d) A method to estimate Bayesian posterior probabilities

(vi) Discuss the importance of the E-step in the EM algorithm.

a) It estimates the parameters of the model
b) It updates the model using observed data
c) It computes the expected value of the latent variables given current parameters
d) It refines the clustering process

(vii) Identify the components of a discrete HMM.

a) States, observations, transition probabilities
b) States, features, classification labels
c) Observations, parameters, model accuracy
d) Inputs, outputs, training data

(viii) Illustrate how the Forward Algorithm works in HMMs.

a) It calculates the most likely path of hidden states
b) It computes the probabilities of sequences of observed events
c) It finds the optimal transition probabilities
d) It initializes the model parameters

(ix) Compare supervised learning to unsupervised learning in classification.

a) Supervised learning requires labeled data; unsupervised does not
b) Both require labeled data
c) Both use the same algorithms
d) Unsupervised learning is less effective

(x) Identify how SVMs deal with outliers in the dataset.

a) SVMs ignore outliers
b) SVMs can be adjusted to allow for soft margins to accommodate outliers
c) SVMs become ineffective with outliers
d) SVMs only work with clean datasets

(xi) Define autocorrelation in the context of random processes.

a) The correlation between two different processes
b) The correlation of a signal with a delayed version of itself
c) The variance of a random process
d) The mean of a random process

(xii) Identify the difference between joint and conditional probability.

a) Joint probability considers two events occurring simultaneously; conditional considers one given the other
b) Joint probability is the same as conditional probability
c) Conditional probability is always greater than joint probability
d) Both probabilities cannot be calculated together

(xiii) Compare the role of prior and likelihood in Bayesian classifiers.

a) Prior controls data distribution, likelihood controls classification
b) Prior affects decision surfaces, likelihood defines the boundary
c) Prior updates class membership, likelihood assigns class probability
d) Prior maximizes accuracy, likelihood minimizes error rates

(xiv) Explain the purpose of Maximum-Likelihood Estimation (MLE) in parameter estimation.

a) To estimate the parameters that maximize the data likelihood
b) To minimize the variance of the parameters
c) To reduce the dimensionality of data
d) To increase the mean of the data

(xv) Analyze the advantage of Bayesian estimation over Maximum-Likelihood Estimation in situations with limited data.

a) Bayesian estimation incorporates prior distributions and handles uncertainty
b) Bayesian estimation performs better with larger datasets
c) Bayesian estimation always provides a unique solution
d) Bayesian estimation is less computationally complex

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Classify the types of training methods used for deep learning neural networks and their relevance to model performance. (3)
3. Write some common challenges in pattern recognition. (3)
4. Illustrate the working of a normal density function in classification with an example. (3)

5. Illustrate the concept of Bayesian estimation and how it differs from maximum-likelihood estimation. (3)
6. Discuss the significance of non-metric methods in pattern classification and provide an example. (3)

OR

Classify the types of clustering methods and their suitability for different data types in unsupervised learning. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Summarize regression analysis and its types in pattern recognition contexts. (5)
8. Illustrate how normal density functions are applied in Bayesian classification. (5)
9. Describe the role of Gaussian mixture models in handling data with multiple underlying distributions. (5)
10. Summarize how parameter estimation methods contribute to the development of unsupervised learning algorithms. (5)
11. Analyze the role of backpropagation in training neural networks. (5)
12. Explain how K-means clustering algorithm works and its applications in data analysis. (5)

OR

Explain hierarchical clustering and compare it with K-means clustering. (5)

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