B.E. COMPUTER SCIENCE AND ENGINEERING
FOURTH YEAR FIRST SEMESTER - 2024

SUBJECT
PATTERN RECOGNITION

Time : 3 hours Full marks : 100

Group A

Answer Question No. 1 (COMPULSORY) and any one form the rest of the two questions of this Group

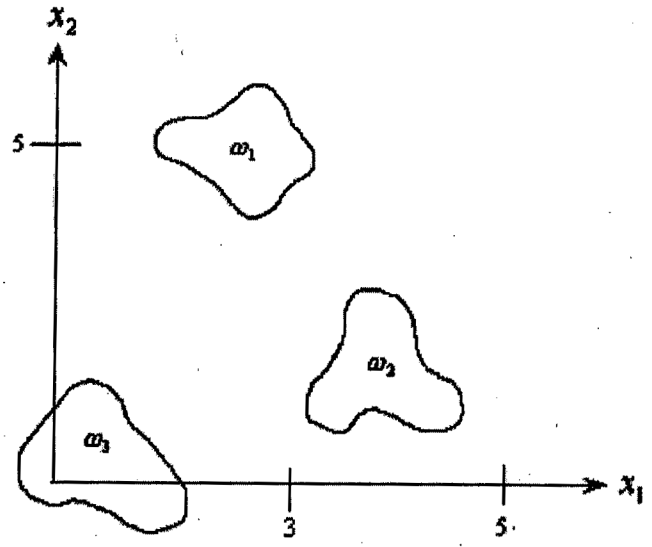
1. Answer true or false stating reasons 2x10 = 20

(a) A Naïve Bayes Classifier can only work on categorical data.
(b) The success of a pattern classification scheme using decision function depends on finding the geometrical properties of the pattern classes under consideration.
(c) In a typical PR problem, the dimensionality of measurement space is always greater than that of feature space.
(d) A NB classifier is much faster than KNN to provide prediction.
(e) In Bayesian Network, the nodes represent events and the edges represent conditional dependencies.
(f) For a supervised pattern classification problem having M classes, where the patterns are pair-wise separable, the classifier needs to compute M number of decision surfaces to perform classification.
(g) A Bayesian network is not suitable to represent the probabilistic relationships between diseases and their symptoms.
(h) A Naïve Bayes Classifier always assumes that each feature x_i is conditionally dependent of every other feature x_j for $j \neq i$.
(i) A pattern is a shape of an object that we are going to recognize.
(j) The method of pattern classification by decision functions can be expected to yield satisfactory results only when the patterns are linearly separable.

2. (a) Explain briefly the necessary steps involved in a typical Pattern Classifier with an example. 10

(b) Explain the difference between supervised and unsupervised PR with examples 10

3. (a) (a) For the following three pattern classes ω_1, ω_2 and ω_3 in $\Re^2$ compute the decision boundaries and decision rules that are needed to successfully classify all the patterns from the said three classes. 10



(b) Explain briefly a typical Naïve Bayes Classifier. How it can be useful in solving some problems of PR 6 + 4

Group B

Answer Question No. 4 (COMPULSORY) and any two form the rest of the three questions of this Group

4. Answer true or false stating reasons 2x10 = 20

(a) K-means algorithm cannot cluster data sets well with large differences in densities.
(b) Each node in a typical ANN can have any number of outgoing connections, where the signals in all of these may not be the same.
(c) A Syntactic Pattern Classifier infers a grammar from a set of training patterns.
(d) Partitional clustering methods help in exploring data at different levels of granularity.
(e) The support vectors of a linear SVM can be any points in the training set.
(f) Syntactic Pattern Recognition attempts to classify patterns based on a set of extracted features and an underlying statistical model for the generation of these patterns.

(g) While using RBF kernel with SVM, choosing a small value of 'Gamma' may overfit the classifier.
(h) Hopfield network is usually employed for data clustering.
(i) A multi-layer-perceptron is a recursive network that is suitable for solving optimization problem.
(j) The training phase is not required in a typical syntactic pattern classification system.

5. What is partitional clustering? State and explain one such method that is based on the principle of minimization of intra-class distances. Discuss the merits and demerits of the method. 2 + 12 + 6

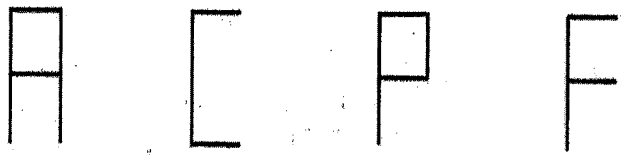
6. (a) How are the features of a biological neurone being imitated in an artificial neurone? 6

(b) Describe how can a single layer perceptron classify two linearly separable classes? Can such an ANN learn an XOR function? Justify your answer. 10 + 4

7. (a) What is syntactic pattern recognition? Why is it important? 2 + 2

(b) With necessary diagram explain briefly a typical Syntactic Pattern Recognition System. 8

(c) Suppose you need to classify the following four alphabets.



Define the necessary set of primitive strings and an appropriate grammar to solve the problem using syntactic pattern recognition method. 8