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B.Tech. Second Assessment Examinations – February 2019

Sixth Semester

Computer Science and Engineering

15CSE361 Pattern Recognition

[Time: Two hours Maximum: 50 Marks]

CO	Course Outcomes
CO01	Understand the working principles of pattern recognition system and algorithms
CO02	Apply statistical methods for decision making
CO03	Understand non parametric decision making system
CO04	Apply and evaluate Non-metric approach for real world problems
CO05	Apply and analyze unsupervised learning methods for real world problems.

Answer all Questions

1. Differentiate parametric and non-parametric decision making [2] [CO03]
2. What is density estimation? [2] [CO02]
3. What are the advantages and disadvantages of the histogram density estimator? [2] [CO03]
4. In a set of 10000 samples, X varies from 400 to 700. At what values of X would the boundaries of the histogram intervals be located using the square root rule? [2] [CO03]
5. Write the formula for the kernel density estimate given an arbitrary kernel K. [2] [CO03]
6. There are two classes and the penalty for misclassifying a sample that belongs to class A is 1. The reward for correctly classifying a sample from class A is 3. For a sample from B, the penalty for misclassifying it is 4 and the reward for correctly classifying it is 6. If a sample has p(A/x)=2/3. What is the expected loss (risk) of choosing class A as well as choosing class B? What class should be chosen? [5] [CO02]
7. What estimated density function that would be produced by applying a symmetric triangular kernel with a base width of 4 to samples lying at 2,4 and 6? From the estimated density function find p(3), p(1) and p(2 <= x <=6) [5] [CO03]
8. Prove that, (Assume x is a discrete random variable)
   (a) Squared error loss function leads to the mean as the minimum risk predictor of the next outcome. [2] [CO03]
   (b) Absolute error loss function leads to the median as the minimum risk predictor of the next outcome. [2] [CO03]
   (c) 0-1 error loss function leads to the mode as the minimum risk predictor of the next outcome. [1] [CO03]

9. Consider the following values for a random variable A= {44, 61, 17, 26, 72, 36, 61, 35, and 49}. Determine the minimum risk predictor of the next outcome of A based on.
   (a) Squared error loss function [2] [CO03]
   (b) Absolute error loss function [2] [CO03]
   (c) 0-1 Loss function [1] [CO03]

10. Use the following data to classify a sample with x = 5.4 given that P(A) = P(B) = 0.5. The following data are the values of feature x for 60 randomly chosen samples from class A:
   0.80, 0.91, 0.93, 0.95, 1.32, 1.53, 1.57, 1.63, 1.67, 1.74, 2.01, 2.18, 2.27, 2.31, 2.40, 2.61, 2.64, 2.64, 2.67, 2.85, 2.96, 2.97, 3.17, 3.17, 3.38, 3.67, 3.73, 3.83, 3.99, 4.06, 4.10, 4.12, 4.18, 4.20, 4.23, 4.27, 4.27, 4.39, 4.40, 4.46, 4.47, 4.61, 4.64, 4.89, 4.96, 5.12, 5.15, 5.33, 5.33, 5.47, 5.64, 5.85, 5.99, 6.29, 6.42, 6.53, 6.70, 6.78, 7.18, 7.22.
   And the following measurements are 60 values of x for some random samples from class B:
   3.54, 3.88, 4.24, 4.30, 4.30, 4.70, 4.75, 4.97, 5.21, 5.42, 5.60, 5.77, 5.87, 5.94, 5.95, 6.04, 6.05, 6.15, 6.19, 6.21, 6.33, 6.41, 6.43, 6.49, 6.52, 6.58, 6.60, 6.63, 6.65, 6.75, 6.90, 6.92, 7.03, 7.08, 7.18, 7.29, 7.33, 7.41, 7.41, 7.46, 7.61, 7.67, 7.68, 7.68, 7.78, 7.96, 8.03, 8.12, 8.20, 8.22, 8.33, 8.36, 8.44, 8.45, 8.49, 8.75, 8.76, 9.14, 9.20, 9.86.
   Use Triangular Kernel to estimate the density p(x) at x = 5.4 with a bandwidth of 4.
   [10] [CO04]

11. Classes A and B are both bivariate normally distributed in features x and y. For A, mean value for feature x and y is 0, standard deviation for x is 2 and for y it is 1. For B, mean value for feature x is 5 and for y it is 0, standard deviation for x and y is 1. It is twice as expensive to misclassify an A as it is to misclassify a B, and the prior probabilities are equal.
   (a) What is the equation of a discriminant function that is positive in the region in which class A should be chosen?
   (b) Sketch the optimal decision boundary. [10] [CO02]

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