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Sixth Semester

Computer Science Engineering

15CSE361 Pattern Recognition

[Time : Two hours Maximum : 50 Marks]

Answer all questions

PART A **(5 x 2 =10 Marks)**

1. Differentiate between supervised and unsupervised learning with example.
2. What does it mean if two classes C1 and C2 are described as linearly separable?
3. Why we need to generalize a classifier?
4. Assume there are c classes w1, · · · , wc, and one feature vector x, give the Bayes rule for classification in terms of a priori probabilities of the classes and class conditional probability densities of x.
5. Define pattern. Give some examples of pattern.

PART B **(8 x 5 =40 Marks)**

6. For example, lets build a classifier to determine the likelihood if someone is cheating on their income tax. In this example we are trying to determine a class (Yes or No for cheating) given a set for features (got refund, and marital status). In this case, the feature for got refund is yes (y) or no (n) and for marital status is divorced (d), married (m) and single (s).

   Here is the data we are given:

Refund	marital status	cheat
Y	s	n
N	m	n
N	s	n
Y	m	n
N	d	y
N	m	n

Y	d	n
N	s	y
N	m	n
N	s	y

Now lets say we are asked to look at an example where refund = no and and marital status (M.S.) = single. Using naive Bayes (given the naive assumption that getting a refund and MS are independent) determine the probability what the person cheated on their taxes.

7. You ask your neighbour to water a sickly plant while you are on vacation. Without water the plant will die with probability 0.8. With water it will die with probability 0.15. You are 90 percent certain the neighbour will remember to water the plant. (a) What is the probability that the plant will be alive when you return? (b) If it is dead what is the probability that your neighbour forgot to water it?

8. Features x and y are bivariate normally distributed and independent within class A and B. For class A, the means are [0,0] and the variances are [1,1].For B means are [3, 2] and variances are [2, 0.5].P(A) = P(B)=0.5.
   a. What is the equation of the optimal decision boundary?
   b. Sketch the decision boundary for each class?

9. Suppose you are given the following set of data with three Boolean input variables a, b, and c, and a single Boolean output variable K.
   According to the naive Bayes classifier, what is P (K = 1|a = 1, b = 1, c = 0)?

a	*b*	*c*	*K*
1	0	1	1
1	1	1	1
0	1	1	0
1	1	0	0
1	0	1	0
0	0	0	1
0	0	0	1
0	0	1	0

10. Explain the life cycle of a pattern recognition system. List some applications of pattern recognition.

11. Suppose a bank classifies customers as either good or bad credit risks. On the basis of extensive historical data, the bank has observed that 1% of good credit risks and 10% of bad credit risks overdraw their account in any given month. A new customer opens a checking account at this bank. On the basis of a check with a credit bureau, the bank believe that there is a 70% chance the customer will turn out to be a good credit risk.

Suppose that this customer's account is overdrawn in the first month. How does this alter the bank's opinion of this customer's creditworthiness?

12. Explain why a linear threshold perceptron's can represent the AND and OR functions but not the XOR function.

13. Draw a perceptron network that computes the OR function of its input and give the truth table for the network. Make sure to specify what sort of units you are using.