Indian Institute of Information Technology Sri City

Mid-1; **Machine Learning***; Feb 2019*

Calculators are allowed; closed book & closed notes exam; 90 min. duration.

Assume any missing information appropriately by clearly stating them.

1

(a) Consider the training set given. Apply Naive Bayes classifier to classify a data item $(\text{Blue, True})^t$. [2 Marks]

A	B	Class-label
Red	True	Yes
Green	False	Yes
Green	True	Yes
Blue	False	No
Blue	False	No
Red	False	No
Blue	True	Yes
Green	True	No

(b) Considering the above given training set, find overall error rate of the Naïve Bayes classifier. [4 Marks]

2

For a one dimensional two class problem, let three actions, viz., $\alpha_1, \alpha_2, \alpha_3$ are possible where α_1 is to decide the class is ω_1, $\alpha_2$is to decide the class is ω_2, and α_3 is to reject. Let the class conditional density for the two classes be

$$\mathbf{p(x|\omega_1)} = \begin{cases} \mathbf{1 - \frac{x}{2}}, & \mathbf{\text{for } 0 \le x \le 2} \\ \mathbf{0}, & \mathbf{\text{otherwise}} \end{cases}, \qquad \mathbf{p(x|\omega_2)} = \begin{cases} \mathbf{\frac{x}{2} - \frac{1}{2}}, & \mathbf{\text{for } 1 \le x \le 3} \\ \mathbf{0}, & \mathbf{\text{otherwise}} \end{cases}$$

and assume equal priors. Let the loss matrix where the loss $\lambda_{ij} = \lambda(\alpha_i|\omega_j)$ is $\begin{bmatrix} 0 & 1 \\ 1.5 & 0 \\ 0.3 & 0.4 \end{bmatrix}$, find the decision regions for these actions on the 1D space. Draw appropriate diagrams to highlight your understanding. [6 Marks]

3

Consider that the parametric form of the density function to be

$$\mathbf{p(x)} = \mathbf{\frac{1}{\theta^2} x e^{-x/\theta}}, \qquad \mathbf{0 \le x < \infty,\ 0 < \theta < \infty}$$

Let the given data be $D = \{x_1, x_2, \dots, x_n\}$, find the maximum likelihood estimate for the parameter θ. [3 Marks]

--the end--