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Course outline

How does an NPTEL online course work? ()

Week 0 ()

Week 1 : ()

Week 2 : ()

Lecture 06 : Discriminant Function - I (unit?unit=29&lesson=30)

Lecture 07 : Discriminant Function - II (unit?

Week 2 : Assignment 2

Your last recorded submission was on 2023-08-09, 19:47 IST Due date: 2023-08-09, 23:59 IST.

1) ***2 points***

Choose the correct option regarding discriminant functions $g_i(x)$ for multiclass classification (x is the feature vector to be classified).

Statement i : Risk value R ($\alpha_i|x$) in Bayes minimum risk classifier can be used as a discriminant function.
Statement ii : Negative of Risk value R ($\alpha_i|x$) in Bayes minimum risk classifier can be used as a discriminant function.
Statement iii : Aposteriori probability P($\omega_i|x$) in Bayes minimum error classifier can be used as a discriminant function.
Statement iv : Negative of Aposteriori probability P($\omega_i|x$) in Bayes minimum error classifier can be used as a discriminant function.

a. Only Statement i is true
b. Both Statements ii and iii are true
c. Both Statements i and iv are true
d. Both Statements ii and iv are true

- ○ a.
- ○ b.
- ◉ c.
- ○ d.

2) ***2 points***

Which of the following is regarding functions of discriminant functions $g_i(x)$ i.e., $f(g_i(x))$

a. We can not use functions of discriminant functions $f(g_i(x))$, as discriminant functions for multiclass classification.
b. We can use functions of discriminant functions, $f(g_i(x))$, as discriminant functions for multiclass classification provided, they are constant functions i.e., $f(g_i(x)) = C$ where C is a constant.
c. We can use functions of discriminant functions, $f(g_i(x))$, as discriminant functions for multiclass classification provided, they are monotonically increasing functions.
d. None of the above is true.

- ○ a.
- ○ b.
- ◉ c.
- ○ d.

3) ***2 points***

The class conditional probability density function for the class ω_i, i.e., $P(x|\omega_i)$ for a multivariate normal (or Gaussian) distribution (where x is a d dimensional feature vector) is given by

a. $p(x|\omega_i) = \frac{1}{(2\pi)^{d/2}|\Sigma_i|^{1/2}} \exp(-\frac{1}{2}(x-\mu_i)^T\Sigma_i^{-1}(x-\mu_i))$
b. $p(x|\omega_i) = \frac{1}{(2\pi)^{d/2}} \exp\left(-\frac{1}{2}(x-\mu_i)^T\Sigma_i^{-1}(x-\mu_i)\right)$
c. $p(x|\omega_i) = \frac{1}{(2\pi)^{d/2}} \exp(-\frac{1}{2}(x-\mu_i)^T(x-\mu_i))$
d. None of the above

- ○ a.
- ◉ b.
- ○ c.
- ○ d.

4) ***2 points***

There are some data points for two different classes given below.

Class 1 points: $\{(2,6),(3,4),(3,8),(4,6)\}$

Class 2 points: $\{(3,0),(1,-2),(5,-2),(3,-4)\}$

Compute the mean vectors μ_1 and μ_2 for these two classes and choose the correct option.

a. $\mu_1 = \begin{bmatrix}2\\6\end{bmatrix}$ and $\mu_2 = \begin{bmatrix}3\\-1\end{bmatrix}$
b. $\mu_1 = \begin{bmatrix}3\\6\end{bmatrix}$ and $\mu_2 = \begin{bmatrix}2\\-2\end{bmatrix}$
c. $\mu_1 = \begin{bmatrix}3\\6\end{bmatrix}$ and $\mu_2 = \begin{bmatrix}3\\-2\end{bmatrix}$
d. $\mu_1 = \begin{bmatrix}3\\5\end{bmatrix}$ and $\mu_2 = \begin{bmatrix}2\\-3\end{bmatrix}$

- ○ a.

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- b.
- c. (selected)
- d.

5) **2 points**

There are some data points for two different classes given below.

Class 1 points: $\{(2,6),(3,4),(3,8),(4,6)\}$

Class 2 points: $\{(3,0),(1,-2),(5,-2),(3,-4)\}$

Compute the covariance matrices Σ_1 and Σ_2 and choose the correct option.

a. $\Sigma_1 = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 2 & 0 \\ 0 & 0.5 \end{bmatrix}$

b. $\Sigma_1 = \begin{bmatrix} 0.5 & 0 \\ 0 & 2 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$

c. $\Sigma_1 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

d. $\Sigma_1 = \begin{bmatrix} 0.5 & 0 \\ 0 & 0.5 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

- a.
- b.
- c. (selected)
- d.

6) **2 points**

There are some data points for two different classes given below.

Class 1 points: $\{(2,6),(3,4),(3,8),(4,6)\}$

Class 2 points: $\{(3,0),(1,-2),(5,-2),(3,-4)\}$

What will be the value expression of decision boundary between these two classes if both the class has equal class probability 0.5? For the input sample $x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ consider $g_i(x) = x^t A_i x + B_i^t x + C$, where $A = -\frac{1}{2}\Sigma_i^{-1}$, $B = \Sigma_i^{-1}\mu_i$, $C = -\frac{1}{2}\mu_i^t\Sigma_i^{-1}\mu_i - \frac{1}{2}\ln|\Sigma_i| + \ln|P(\omega_i)|$

a. $x_1 = 0.09x_2^2 - 1.12x_2 + 0.5$

b. $x_2 = 0.19x_1^2 - 1.12x_1 + 3.5$

c. $x_1 = 0.09x_1^2 - 1.12x_2 + 0.5$

d. $x_2 = 0.19x_2^2 - 1.12x_1 + 3.5$

- a. (selected)
- b.
- c.
- d.

7) **2 points**

Let Σ_i represents the covariance matrix for i^{th} class. Assume that the classes have the same co-variance matrix. Also assume that the features are statistically independent and have same co-variance. Which of the following is true?

a. $\Sigma_i = \Sigma$, (diagonal elements of Σ are zero)

b. $\Sigma_i = \Sigma$, (diagonal elements of Σ are non-zero and different from each other, rest of the elements are zero)

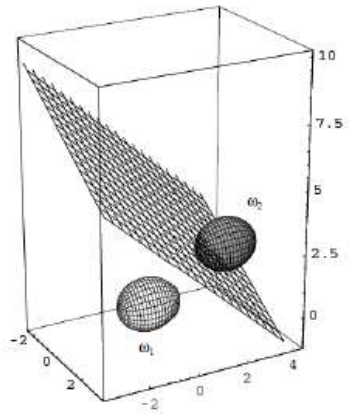
c. $\Sigma_i = \Sigma$, (diagonal elements of Σ are non-zero and equal to each other, rest of the elements are zero)

d. None of these

- ○ a.
- ○ b.
- ◉ c.
- ○ d.

8) ***2 points***

The decision surface between two normally distributed class ω_1 and ω_2 is shown on the figure. Can you comment which of the following is true?



a. $p(\omega_1) = p(\omega_2)$

b. $p(\omega_2) > p(\omega_1)$

c. $p(\omega_1) > p(\omega_2)$

d. None of the above.

- ○ a.
- ◉ b.
- ○ c.
- ○ d.

9) ***2 points***

You are given some data points for two different class.
Class 1 points: $\{(11,11),(13,11),(8,10),(9,9),(7,7),(7,5),(15,3)\}$
Class 2 points: $\{(7,11),(15,9),(15,7),(13,5),(14,4),(9,3),(11,3)\}$
Compute the covariance matrices and choose the correct option.

a. $\Sigma_1 = \begin{bmatrix} 1 & 0 \\ 0 & 5.65 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 3.65 & -1.0 \\ -1.0 & 3.65 \end{bmatrix}$

b. $\Sigma_1 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

c. $\Sigma_1 = \begin{bmatrix} 3.65 & -1.0 \\ -1.0 & 3.65 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 9.67 & -1.0 \\ -1.0 & 9.67 \end{bmatrix}$

d. $\Sigma_1 = \begin{bmatrix} 9.67 & -1.0 \\ -1.0 & 9.67 \end{bmatrix}$ and $\Sigma_2 = \begin{bmatrix} 9.67 & -1.0 \\ -1.0 & 9.67 \end{bmatrix}$

- ○ a.
- ○ b.
- ◉ c.
- ○ d.

10) ***2 points***

You are given some data points for two different class.
Class 1 points: $\{(11,11),(13,11),(8,10),(9,9),(7,7),(7,5),(15,3)\}$
Class 2 points: $\{(7,11),(15,9),(15,7),(13,5),(14,4),(9,3),(11,3)\}$
Assume that the points are samples from normal distribution and a two class Bayesian classifier is used to classify them. Also assume the prior probability of the classes are equal i.e.,

$$p(\omega_1) = p(\omega_2)$$

Which of the following is true about the corresponding decision boundary used in the classifier? (Choose correct option regarding the given statements)

Statement i: Decision boundary passes through the midpoint of the line segment joining the means of two classes
Statement ii: Decision boundary will be orthogonal bisector of the line joining the means of two classes.

a. Only Statement i is true

b. Only Statement ii is true

c. Both Statement i and ii are true

d. None of the statements are true

- ○ a.
- ◉ b.
- ○ c.
- ○ d.

You may submit any number of times before the due date. The final submission will be considered for grading.

Submit Answers