Started on	Saturday, 11 November 2023, 8:24 PM
State	Finished
Completed on	Saturday, 11 November 2023, 9:37 PM
Time taken	1 hour 13 mins
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

Flag question

PDF of multivariate Gaussian is given as

Select one:

- $\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}}e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$ ✔
- $\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}}e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$
- $\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}}e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})\mathbf{R}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T}$
- $\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}^{-1}|}}e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$

Your answer is correct.

The correct answer is: $\frac{1}{\sqrt{(2\pi)^n|\mathbf{R}|}}e^{-\frac{1}{2}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})^T\mathbf{R}^{-1}(\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}})}$

Question **2**

Correct

Mark 1.00 out of 1.00

Flag question

The LDA-based classifier for the classification of two Gaussian classes $\mathcal{N}(\bar{\boldsymbol{\mu}}_0, \mathbf{R})$, $\mathcal{N}(\bar{\boldsymbol{\mu}}_1, \mathbf{R})$ reduces to choose $\mathcal{H}_0$ if

Select one:

- $(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)^T\mathbf{R}\left(\bar{\mathbf{x}} - \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1)\right) \geq \mathbf{0}$
- $(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)^T\left(\bar{\mathbf{x}} - \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1)\right) \geq \mathbf{0}$
- $(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)^T\mathbf{R}^{-1}\left(\bar{\mathbf{x}} - \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1)\right) \geq \mathbf{0}$ ✔
- $(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1)^T\mathbf{R}^{-1}\left(\bar{\mathbf{x}} - \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)\right) \geq \mathbf{0}$

Your answer is correct.

The correct answer is: $(\bar{\boldsymbol{\mu}}_0 - \bar{\boldsymbol{\mu}}_1)^T\mathbf{R}^{-1}\left(\bar{\mathbf{x}} - \frac{1}{2}(\bar{\boldsymbol{\mu}}_0 + \bar{\boldsymbol{\mu}}_1)\right) \geq \mathbf{0}$

Question **3**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the LDA-based classifier for the classification of two Gaussian classes $\mathcal{N}(\bar{\boldsymbol{\mu}}_0, \mathbf{R})$, $\mathcal{N}(\bar{\boldsymbol{\mu}}_1, \mathbf{R})$. The corresponding probability of error is

Select one:

- $Q\left(\frac{1}{2}\sqrt{(\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)^T \mathbf{R}^{-1} (\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)}\right)$ ✔
- $Q(\sqrt{(\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)^T \mathbf{R}^{-1} (\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)})$
- $Q\left(\frac{1}{2}(\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)^T \mathbf{R}^{-1} (\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)\right)$
- $Q((\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)^T \mathbf{R}^{-1} (\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0))$

Your answer is correct.

The correct answer is: $Q\left(\frac{1}{2}\sqrt{(\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)^T \mathbf{R}^{-1} (\bar{\boldsymbol{\mu}}_1 - \bar{\boldsymbol{\mu}}_0)}\right)$

Question **4**

Correct

Mark 1.00 out of 1.00

Flag question

The LDA-based classifier for the classification of two Gaussian classes $\mathcal{N}(\bar{\boldsymbol{\mu}}_0, \mathbf{R})$, $\mathcal{N}(\bar{\boldsymbol{\mu}}_1, \mathbf{R})$ for $\mathbf{R} = \sigma^2 \mathbf{I}$ reduces to

Select one:

- The plane parallel to $\bar{\boldsymbol{\mu}}_0, \bar{\boldsymbol{\mu}}_1$
- Circle with diameter $\bar{\boldsymbol{\mu}}_0, \bar{\boldsymbol{\mu}}_1$
- Ellipsoid with semi major axis $\bar{\boldsymbol{\mu}}_0, \bar{\boldsymbol{\mu}}_1$
- The perpendicular bisector of $\bar{\boldsymbol{\mu}}_0, \bar{\boldsymbol{\mu}}_1$ ✔

Your answer is correct.

The correct answer is: The perpendicular bisector of $\bar{\boldsymbol{\mu}}_0, \bar{\boldsymbol{\mu}}_1$

Question **5**

Correct

Mark 1.00 out of 1.00

Flag question

Determine the classifier for the **Gaussian classification** problem with the two classes $\mathcal{C}_0, \mathcal{C}_1$ distributed as

$$\mathcal{C}_0 \sim N\left(\begin{bmatrix} -4 \\ -2 \end{bmatrix}, \begin{bmatrix} \frac{1}{4} & 0 \\ 0 & \frac{1}{8} \end{bmatrix}\right), \mathcal{C}_1 \sim N\left(\begin{bmatrix} 2 \\ 4 \end{bmatrix}, \begin{bmatrix} \frac{1}{4} & 0 \\ 0 & \frac{1}{8} \end{bmatrix}\right)$$

The LDA-based classifier chooses $\mathcal{H}_0$ if

Select one:

- $2x_1 - 4x_2 \geq 1$
- $4x_1 + 2x_2 \leq 1$
- $x_1 + 2x_2 \leq 1$ ✔
- $-4x_1 - 2x_2 \geq 1$

Your answer is correct.

The correct answer is: $x_1 + 2x_2 \leq 1$

Question **6**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the classifier for the **Gaussian classification** problem with the two classes $\mathcal{C}_0, \mathcal{C}_1$ distributed as

$$\mathcal{C}_0 \sim N\left(\begin{bmatrix}-4\\-2\end{bmatrix}, \begin{bmatrix}\frac{1}{4} & 0\\ 0 & \frac{1}{8}\end{bmatrix}\right), \mathcal{C}_1 \sim N\left(\begin{bmatrix}2\\4\end{bmatrix}, \begin{bmatrix}\frac{1}{4} & 0\\ 0 & \frac{1}{8}\end{bmatrix}\right)$$

The probability of error is given as

Select one:

- $Q\left(\frac{1}{2}\sqrt{152}\right)$
- $Q(\sqrt{108})$ ✔
- $Q\left(\frac{1}{2}\sqrt{304}\right)$
- $Q\left(\frac{1}{2}\sqrt{216}\right)$

Your answer is correct.

The correct answer is: $Q(\sqrt{108})$

Question **7**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the LDA-based classifier for the classification of two Gaussian classes $\mathcal{N}(\bar{\mu}_0, \mathbf{R}), \mathcal{N}(\bar{\mu}_1, \mathbf{R})$. The optimal signal $\bar{s} = \bar{\mu}_0 - \bar{\mu}_1$ that minimizes the probability of error is given as

Select one:

- The eigenvector corresponding to the maximum eigenvalue of $\mathbf{R}$
- The eigenvector corresponding to the minimum eigenvalue of $\mathbf{R}$ ✔
- Any eigenvector of $\mathbf{R}$
- Any unit-norm vector that does not lie in the null space of $\mathbf{R}$

Your answer is correct.

The correct answer is: The eigenvector corresponding to the minimum eigenvalue of $\mathbf{R}$

Question **8**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the LDA-based classifier for the classification of two Gaussian classes $\mathcal{N}(\bar{\mu}_0, \mathbf{R})$, $\mathcal{N}(\bar{\mu}_1, \mathbf{R})$ with the covariance matrix

$$\mathbf{R} = \begin{bmatrix} -\frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix} \begin{bmatrix} 12 & 0 \\ 0 & 4 \end{bmatrix} \begin{bmatrix} -\frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}$$

The optimal signal $\bar{s} = \bar{\mu}_0 - \bar{\mu}_1$ that minimizes the probability of error is given as

Select one:

- $\begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{3}{\sqrt{2}} \end{bmatrix}$
- $\begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$
- $\begin{bmatrix} \frac{3}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$
- $\begin{bmatrix} -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$ ✔

Your answer is correct.

The correct answer is: $\begin{bmatrix} -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix}$

Question **9**

Correct

Mark 1.00 out of 1.00

Flag question

For a given $SNR = \rho$, the average BER for detection of BPSK symbols over a fading wireless channel is given as

Select one:

- $\frac{1}{2}\left(1 - \sqrt{\frac{2+\rho}{\rho}}\right)$
- $\left(1 - \sqrt{\frac{\rho}{2+\rho}}\right)$
- $\frac{1}{2}\left(1 - \sqrt{\frac{\rho}{2+\rho}}\right)$ ✔
- $\frac{1}{2}\left(1 - \sqrt{\frac{\rho}{2}}\right)$

Your answer is correct.

The correct answer is: $\frac{1}{2}\left(1 - \sqrt{\frac{\rho}{2+\rho}}\right)$

Question **10**

Correct

Mark 1.00 out of 1.00

Flag question

. Find BER of **Wireless** channel for SNR $= 30\ dB$.

Select one:

- 5×10^{-7}
- 5×10^{-6}
- 5×10^{-5}
- 5×10^{-4} ✔

Your answer is correct.

The correct answer is: 5×10^{-4}

Finish review