Started on	Saturday, 24 February 2024, 6:04 AM
State	Finished
Completed on	Thursday, 29 February 2024, 8:34 AM
Time taken	5 days 2 hours
Grade	**9.00** out of 10.00 (**90**%)

Question **1**

Correct

Mark 1.00 out of 1.00

The PDF of the Gaussian mixture is given as

- $\sum_{i=1}^{K} p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}}_i\|^2}$
- $\sum_{i=1}^{K} \left(\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}}_i\|^2}\right)^{p_i}$
- $\prod_{i=1}^{K} p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}}_i\|^2}$
- $\prod_{i=1}^{K} \left(\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}}_i\|^2}\right)^{p_i}$

Your answer is correct.

The correct answer is:

$\sum_{i=1}^{K} p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}}_i\|^2}$

Question **2**

Correct

Mark 1.00 out of 1.00

The likelihood of the complete data is

- $\prod_{j=1}^{M}\prod_{i=1}^{K}\left(\alpha_i(j)p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2}\right)$
- $\prod_{j=1}^{M}\prod_{i=1}^{K}\left(p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2}\right)^{\alpha_i(j)}$ ✔
- $\prod_{j=1}^{M}\sum_{i=1}^{K} p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}}_i\|^2}$
- $\sum_{j=1}^{M}\sum_{i=1}^{K} \alpha_i(j)p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}-\bar{\boldsymbol{\mu}}_i\|^2}$

Your answer is correct.

The correct answer is:

$$\prod_{j=1}^{M}\prod_{i=1}^{K}\left(p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2}\right)^{\alpha_i(j)}$$

Question **3**

Correct

Mark 1.00 out of 1.00

The expected value of the log-likelihood in iteration l is

- $\prod_{j=1}^{M}\sum_{i=1}^{N}\left(\alpha_i^{(l)}(j)\ln p_i - \frac{N}{2}\ln 2\pi\sigma^2 - \frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2\right)$
- $\sum_{j=1}^{M}\sum_{i=1}^{N}\alpha_i^{(l)}(j)\left(\ln p_i - \frac{N}{2}\ln 2\pi\sigma^2 - \frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2\right)$ ✔
- $\prod_{j=1}^{M}\prod_{i=1}^{N}\left(\alpha_i^{(l)}(j)\ln p_i - \frac{N}{2}\ln 2\pi\sigma^2 - \frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2\right)$
- $\sum_{j=1}^{M}\prod_{i=1}^{N}\left(\ln p_i - \frac{N}{2}\ln 2\pi\sigma^2 - \frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2\right)^{\alpha_i^{(l)}(j)}$

Your answer is correct.

The correct answer is:

$$\sum_{j=1}^{M}\sum_{i=1}^{N}\alpha_i^{(l)}(j)\left(\ln p_i - \frac{N}{2}\ln 2\pi\sigma^2 - \frac{1}{2\sigma^2}\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i\|^2\right)$$

Question **4**

Correct

Mark 1.00 out of 1.00

The quantity $\alpha_i^{(l)}(j) = \Pr\left(\mathcal{C}_i|\bar{\mathbf{x}}(j)\right)$ is given as

- $$\frac{p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i^{(l-1)}\right\|^2}}{\sum_{k=1}^{K} p_k \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_k^{(l-1)}\right\|^2}}$$ ✔
- $$\frac{p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i^{(l-1)}\right\|^2}}{\prod_{k=1}^{K} p_k \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_k^{(l-1)}\right\|^2}}$$
- $$\frac{\left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i^{(l-1)}\right\|^2}}{\sum_{k=1}^{K} \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_k^{(l-1)}\right\|^2}}$$
- $$\frac{p_i}{\sum_{k=1}^{K} p_k}$$

Your answer is correct.

The correct answer is:

$$\frac{p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i^{(l-1)}\right\|^2}}{\sum_{k=1}^{K} p_k \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_k^{(l-1)}\right\|^2}}$$

Question **5**

Correct

Mark 1.00 out of 1.00

The quantity $\overline{\boldsymbol{\mu}}_i^{(l)}$ is given as

- $\dfrac{\sum_{j=1}^{M} \alpha_i^{(l)}(j) e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i^{(l-1)}\right\|^2}}{\sum_{j=1}^{M} \alpha_i^{(l)}(j)}$
- $\dfrac{\sum_{i=1}^{K} \alpha_i^{(l)}(j)\bar{\mathbf{x}}(j)}{\sum_{i=1}^{K} \alpha_i^{(l)}(j)}$
- $\dfrac{\sum_{j=1}^{M} \alpha_i^{(l)}(j) p_i \times \left(\frac{1}{2\pi\sigma^2}\right)^{\frac{N}{2}} e^{-\frac{1}{2\sigma^2}\left\|\bar{\mathbf{x}}(j)-\bar{\boldsymbol{\mu}}_i^{(l-1)}\right\|^2}}{\sum_{j=1}^{M} p_i \alpha_i^{(l)}(j)}$
- $\dfrac{\sum_{j=1}^{M} \alpha_i^{(l)}(j)\bar{\mathbf{x}}(j)}{\sum_{j=1}^{M} \alpha_i^{(l)}(j)}$ ✔

Your answer is correct.

The correct answer is:

$$\frac{\sum_{j=1}^{M} \alpha_i^{(l)}(j)\bar{\mathbf{x}}(j)}{\sum_{j=1}^{M} \alpha_i^{(l)}(j)}$$

Question **6**

Correct

Mark 1.00 out of 1.00

The **entropy** $H(X)$ of this source is

- $\sum_{i=1}^{n} p(x_i) \log_2 \frac{1}{p(x_i)}$ ✔
- $\sum_{i=1}^{n} p(x_i) \log_2 p(x_i)$
- $\sum_{i=1}^{n} \frac{1}{p(x_i)} \log_2 \frac{1}{p(x_i)}$
- $\sum_{i=1}^{n} \log_2 \frac{1}{p(x_i)}$

Your answer is correct.

The correct answer is:

$$\sum_{i=1}^{n} p(x_i) \log_2 \frac{1}{p(x_i)}$$

Question **7**

Incorrect

Mark 0.00 out of 1.00

Consider a source with 8 equiprobable symbols. What is its entropy?

- 1
- 1.5
- 3
- 2

Your answer is incorrect.

The correct answer is:
3

Question **8**

Correct

Mark 1.00 out of 1.00

The **conditional entropy** $H(X|Y)$ is defined as

- $\sum_{j=1}^{m} p(y_j) H(Y = y_j | X)$
- $\sum_{j=1}^{m} H(X | Y = y_j)$
- $\sum_{i=1}^{n} p(x_i) H(Y | X = x_i)$
- $\sum_{j=1}^{m} p(y_j) H(X | Y = y_j)$

Your answer is correct.

The correct answer is:
$\sum_{j=1}^{m} p(y_j) H(X | Y = y_j)$

Question **9**

Correct

Mark 1.00 out of 1.00

To construct the decision tree classifier (DTC), one has to choose the **feature** that

- ◉ maximizes the **information gain** ✔
- ○ minimizes the **information gain**
- ○ has zero **information gain**
- ○ that has **information gain** equal to unity

Your answer is correct.

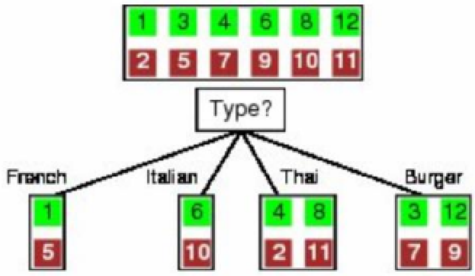
The correct answer is:
maximizes the **information gain**

Question **10**

Correct

Mark 1.00 out of 1.00

What is the information gain for the type feature depicted in the figure below?



- ○ 0.82
- ○ 0.36
- ◉ 0 ✔
- ○ 0.54

Your answer is correct.

The correct answer is:
0