Parent Component Title

<h2>{{ headerTitle }}</h2>

Main Content

Header Content

6406532775007. Main Content

MLT

Section Id :	64065359215
Section Number :	8
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	12
Number of Questions to be attempted :	12
Section Marks :	40
Display Number Panel :	Yes
Section Negative Marks :	0
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	No
Section Maximum Duration :	0
Section Minimum Duration :	0
Section Time In :	Minutes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	640653122748
Question Shuffling Allowed :	No

Question Number : 116 Question Id : 640653825109 Question Type : MCQ

Correct Marks : 0

Question Label : Multiple Choice Question

THIS IS QUESTION PAPER FOR THE SUBJECT "DIPLOMA LEVEL : MACHINE LEARNING TECHNIQUES (COMPUTER BASED EXAM)"

ARE YOU SURE YOU HAVE TO WRITE EXAM FOR THIS SUBJECT?
CROSS CHECK YOUR HALL TICKET TO CONFIRM THE SUBJECTS TO BE WRITTEN.

(IF IT IS NOT THE CORRECT SUBJECT, PLS CHECK THE SECTION AT THE TOP FOR THE SUBJECTS REGISTERED BY YOU)

Options :

6406532775008. ✔ YES

6406532775009. ✖ NO

Sub-Section Number : 2

Sub-Section Id : 640653122749

Question Shuffling Allowed : Yes

Question Number : 117 Question Id : 640653825110 Question Type : MCQ

Correct Marks : 2

Question Label : Multiple Choice Question

Let $\mathbf{w_1}$ and $\mathbf{w_2}$ be the top two principal components of the covariance matrix of a centered dataset. Let $\mathbf{x} \in \mathbb{R}^d$ be a data-point. Which of the following is the reconstruction error of the data-point after projecting it onto the top two principal components?

Options :

6406532775010. ✔ $\left|\left|\mathbf{x} - (\mathbf{x}^T\mathbf{w}_1)\mathbf{w}_1 - (\mathbf{x}^T\mathbf{w}_2)\mathbf{w}_2\right|\right|^2$

6406532775011. ✖ $\left|\left|\mathbf{x} - (\mathbf{x}^T\mathbf{w}_1)\mathbf{w}_1\right|\right|^2 + \left|\left|\mathbf{x} - (\mathbf{x}^T\mathbf{w}_2)\mathbf{w}_2\right|\right|^2$

6406532775012. ✖ $(\mathbf{x}^T\mathbf{w}_1)^2 + (\mathbf{x}^T\mathbf{w}_2)^2$

6406532775013. ✖ $||\mathbf{x} - \mathbf{w}_1||^2 + ||\mathbf{x} - \mathbf{w}_2||^2$

Sub-Section Number : 3

Sub-Section Id : 640653122750

Question Shuffling Allowed : Yes

Question Number : 118 Question Id : 640653825111 Question Type : MCQ

Correct Marks : 3

Question Label : Multiple Choice Question

Let $\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$ be two vectors in $\mathbb{R}^2$. Let k_1 and k_2 be two functions defined from $\mathbb{R}^2 \times \mathbb{R}^2 \to \mathbb{R}$:

$$k_1(\mathbf{x}, \mathbf{y}) = x_1y_1 + x_2y_2 + x_1x_2y_1y_2$$
$$k_2(\mathbf{x}, \mathbf{y}) = x_1y_1 + x_2y_2 + x_1x_2y_1y_2 + 1$$

Which of the following statements is true?

Options :

6406532775014. ✔ Both k_1 and k_2 are valid kernels.

6406532775015. ✖ k_1 is a valid kernel, but k_2 is not a valid kernel.

6406532775016. ✖ k_2 is a valid kernel, but k_1 is not a valid kernel.

6406532775017. ✖ Neither k_1 nor k_2 is a valid kernel.

Sub-Section Number : 4

Sub-Section Id : 640653122751

Question Shuffling Allowed : Yes

Question Number : 119 Question Id : 640653825112 Question Type : MSQ

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Consider a covariance matrix C for a mean-centered dataset in $\mathbb{R}^3$. After performing standard PCA, the three principal components turn out to be $\begin{bmatrix}1\\0\\0\end{bmatrix}$, $\begin{bmatrix}0\\1\\0\end{bmatrix}$, $\begin{bmatrix}0\\0\\1\end{bmatrix}$.

Which of the following statements are true? You can assume that C is not the zero matrix.

Options :

6406532775018. ✔ C is a diagonal matrix.

6406532775019. ✔ The diagonal entries of C are non-negative.

6406532775020. ✖ The diagonal entries of C are strictly greater than zero.

6406532775021. ✖ C has to be the identity matrix.

6406532775022. ✖ C is a matrix of the form $k\mathbf{I}$, where $k > 0$ and $\mathbf{I}$ is the identity matrix.

Sub-Section Number : 5

Sub-Section Id : 640653122752

Question Shuffling Allowed : Yes

Question Number : 120 Question Id : 640653825113 Question Type : SA

Correct Marks : 3

Question Label : Short Answer Question

Kernel PCA with a polynomial kernel of degree 3 is run on a dataset of 100 data-points. Let ϕ be the transformation corresponding to this kernel. If the largest eigenvalue of the centered kernel matrix is 10, find the largest eigenvalue of the covariance matrix of the transformed dataset, where ϕ is used to effect the transformation.

Response Type : Numeric

Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
0.1

Question Number : 121 Question Id : 640653825116 Question Type : SA
Correct Marks : 3
Question Label : Short Answer Question

The EM algorithm is run on a dataset of 100 points modeled using a GMM with three components. Let λ_k^i be the values obtained in the E-step in the final iteration. Here, i is the index of the data-point and k is the index of a component. Also, let $\pi_1 = 0.3, \pi_2 = 0.5, \pi_3 = 0.2$ be the estimates of the mixture probabilities. x_p represent one of the data-points, for some constant p. If $\lambda_1^p + \lambda_3^p = 0.2$, what is the probability that the second component generated x_p given that we have seen the data-point?

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
0.8

Sub-Section Number : 6
Sub-Section Id : 640653122753
Question Shuffling Allowed : Yes

Question Number : 122 Question Id : 640653825114 Question Type : SA
Correct Marks : 4
Question Label : Short Answer Question

$k : \mathbb{R}^2 \times \mathbb{R}^2 \to \mathbb{R}$ is a polynomial kernel of degree 4. Find the value of $k\left(\begin{bmatrix}1\\-1\end{bmatrix}, \begin{bmatrix}2\\1\end{bmatrix}\right)$.

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
16

Question Number : 123 Question Id : 640653825115 Question Type : SA
Correct Marks : 4

Question Label : Short Answer Question

Consider the k-means++ algorithm with $k = 2$ for a dataset that has 7 points: $D = \{x_1, \cdots, x_7\}$. The data-point x_7 has been chosen as the first mean, that is, $\mu_1 = x_7$. The Euclidean distance of the remaining points from this mean is given below:

Point	$d(x_i, \mu_1)$
x_1	1
x_2	2
x_3	$\sqrt{2}$
x_4	$\sqrt{3}$
x_5	$\sqrt{5}$
x_6	1

What is the probability of choosing x_2 as the second mean given that x_7 has been chosen as the first mean?

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :

0.25

Sub-Section Number :	7
Sub-Section Id :	640653122754
Question Shuffling Allowed :	No

Question Id : 640653825117 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Question Numbers : (124 to 126)

Question Label : Comprehension

Let $\mathbf{C}$ be the covariance matrix of a mean-centered dataset:

$$\mathbf{C} = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

Standard PCA is performed on this dataset. The first two PCs are given below:

$$\mathbf{w}_1 = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ 1 \end{bmatrix} \quad \mathbf{w}_2 = \frac{1}{\sqrt{2}} \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

Based on the above data, answer the given subquestions.

Sub questions

Question Number : 124 Question Id : 640653825118 Question Type : SA
Correct Marks : 2
Question Label : Short Answer Question
Find the variance of the dataset along the first principal component.
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
3

Question Number : 125 Question Id : 640653825119 Question Type : SA
Correct Marks : 1
Question Label : Short Answer Question
Find the variance of the dataset along the x-axis.
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
2

Question Number : 126 Question Id : 640653825120 Question Type : MCQ
Correct Marks : 2
Question Label : Multiple Choice Question
Find the coordinates of the point $\begin{bmatrix}2\\2\end{bmatrix}$ in the new coordinate system formed by the principal components.

Options :

6406532775029. ✔ $\begin{bmatrix}2\sqrt{2}\\0\end{bmatrix}$

6406532775030. ✖ $\begin{bmatrix}1\\0\end{bmatrix}$

6406532775031. ✖ $\begin{bmatrix}0\\1\end{bmatrix}$

6406532775032. ✖ $\begin{bmatrix}2\\0\end{bmatrix}$

Sub-Section Number : 8
Sub-Section Id : 640653122755
Question Shuffling Allowed : No

Question Id : 640653825121 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix
Question Numbers : (127 to 128)
Question Label : Comprehension

Consider the following dataset of six points in $\mathbb{R}^2$:

x	y
-1	-4
5	6
-2	-2
4	5
-3	-3
3	4

K-means clustering is run on this dataset with $k = 2$. In this version, the means are initialized first. The mean of the first cluster is initialized to $(-4, -4)$ and the mean of the second cluster is initialized to $(6, 6)$.

Based on the above data, answer the given subquestions.
Sub questions

Question Number : 127 Question Id : 640653825122 Question Type : SA
Correct Marks : 2
Question Label : Short Answer Question
If (x_1, y_1) is the mean of the first cluster after convergence, find the value of $x_1 + y_1$.
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :

-5

Question Number : 128 Question Id : 640653825123 Question Type : SA
Correct Marks : 2
Question Label : Short Answer Question
If (x_2, y_2) is the mean of the second cluster after convergence, find the value of $x_2 + y_2$.
Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :
9

Sub-Section Number :	9
Sub-Section Id :	640653122756
Question Shuffling Allowed :	No

Question Id : 640653825127 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix
Question Numbers : (129 to 130)
Question Label : Comprehension
In the context of Bayesian estimation, consider a Beta prior for the parameter p of a Bernoulli distribution:

$$p \sim \text{Beta}(4, 3)$$

The dataset has 8 ones and 5 zeros.

Based on the above data, answer the given subquestions.
Sub questions

Question Number : 129 Question Id : 640653825128 Question Type : MCQ
Correct Marks : 2
Question Label : Multiple Choice Question
What is the posterior?
Options :
6406532775040. ✔ Beta(12, 8)
6406532775041. ✖ Beta(11, 7)
6406532775042. ✖ *Br*(0.5)
6406532775043. ✖ Beta(8, 5)

Question Number : 130 Question Id : 640653825129 Question Type : SA

Correct Marks : 2

Question Label : Short Answer Question

If we use the expected value of the posterior as a point-estimate for the parameter of the Bernoulli distribution, what is $\hat{p}$?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

0.6

Sub-Section Number :	10
Sub-Section Id :	640653122757
Question Shuffling Allowed :	No

Question Id : 640653825124 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix

Question Numbers : (131 to 132)

Question Label : Comprehension

Consider a dataset of n data-points all of which are non-negative integers. These data-points are sampled from a Poisson distribution, whose probability mass function is given below:

$$f(x;\lambda) = \frac{e^{-\lambda}\lambda^x}{x!},\ \lambda > 0$$

Here λ is a parameter.

Based on the above data, answer the given subquestions.

Sub questions

Question Number : 131 Question Id : 640653825125 Question Type : MCQ

Correct Marks : 2.5

Question Label : Multiple Choice Question

Find the log-likelihood of the dataset under this distribution.

Options :

6406532775035. ✔ $\sum_{i=1}^{n} [-\lambda + x_i \log \lambda - \log (x_i!)]$

6406532775036. ✖ $\prod_{i=1}^{n} \frac{e^{-\lambda}\lambda^{x_i}}{x_i!}$

6406532775037. ✖ $\sum_{i=1}^{n} [-\lambda + \lambda \log x_i - \log(x_i!)]$

6406532775038. ✖ $\prod_{i=1}^{n} [-\lambda + x_i \log \lambda - \log(x_i!)]$

Question Number : 132 Question Id : 640653825126 Question Type : SA

Correct Marks : 2.5

Question Label : Short Answer Question

Consider a dataset that has 25 data-points. The data-point x_i and its frequency is given in the following table:

x_i	Frequency
0	1
1	4
2	6
3	9
4	5

In case the table is not clear: the value 0 appears once in the dataset, the value 1 appears four times in the dataset, and so on. Find the maximum likelihood estimate for the parameter λ of the Poisson distribution given this dataset.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

2.52

MLP

Section Id :	64065359216
Section Number :	9
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	14
Number of Questions to be attempted :	14
Section Marks :	50