Assignment-11

The due date for submitting this assignment has passed.

Due on 2021-04-07, 23:59 IST.

As per our records you have not submitted this assignment.

1) Consider K-means clustering algorithm with points $\bar{\mathbf{x}}(j), j = 1, 2, \ldots, m$. Let $\alpha_i^{(l)}(j)$ denote the cluster assignment indicator in iteration l, which equals 1 if $\bar{\mathbf{x}}(j)$ is assigned to cluster i in iteration l. The centroid $\bar{\boldsymbol{\mu}}_i^{(l)}$, of cluster i in iteration l can be evaluated as *1 point*

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

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{\sum_{j=1}^{m} \alpha_i^{(l)}(j)\bar{\mathbf{x}}(j)}{\sum_{j=1}^{m} \alpha_i^{(l)}(j)}$

2) Consider K-means clustering algorithm with points $\bar{\mathbf{x}}(j), j = 1, 2, \ldots, m$. Let $\bar{\boldsymbol{\mu}}_i^{(l-1)}$ is the centroid of cluster i in iteration $l-1$. The quantity $\alpha_i^{(l)}(j)$ that denotes the cluster assignment indicator in iteration l, which equals 1 if $\bar{\mathbf{x}}(j)$ is assigned to cluster i in iteration l, can be evaluated as *1 point*

$$\alpha_i^{(l)}(j) = \begin{cases} 1, & i = \tilde{i} \\ 0, & i \neq \tilde{i} \end{cases}$$

where $\tilde{i}$ is given as

- $\frac{\sum_{j=1}^{m} \bar{\mathbf{x}}(j)}{\sum_{j=1}^{m} \alpha_i^{(l)}(j)}$
- $\frac{\sum_{j=1}^{m} \alpha_i^{(l)}(j)\bar{\mathbf{x}}(j)}{m}$
- $\arg\max \|\bar{\mathbf{x}}(j) - \bar{\boldsymbol{\mu}}_i^{(l-1)}\|$
- $\arg\min \|\bar{\mathbf{x}}(j) - \bar{\boldsymbol{\mu}}_i^{(l-1)}\|$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\arg\min \|\bar{\mathbf{x}}(j) - \bar{\boldsymbol{\mu}}_i^{(l-1)}\|$

3) In a support vector machine (SVM) for classification of the points $\bar{\mathbf{x}}$, let the hyperplanes be given as *1 point*

$$\bar{\mathbf{a}}^T\bar{\mathbf{x}} + \bar{\mathbf{b}} \geq 1$$
$$\bar{\mathbf{a}}^T\bar{\mathbf{x}} + \bar{\mathbf{b}} \leq -1$$

The distance between the hyperplanes is given as

- $\frac{2}{\|\bar{\mathbf{a}}\|}$
- $\|\bar{\mathbf{a}}\|$
- $\frac{2b}{\|\bar{\mathbf{a}}\|}$
- $2(b+1)\|\bar{\mathbf{a}}\|$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{2}{\|\bar{\mathbf{a}}\|}$

4) In a support vector machine (SVM) for classification of the points $\bar{\mathbf{x}}$, let the hyperplanes be given as *1 point*

$$-8x_1 + 6x_2 + 3 \geq 5$$
$$-8x_1 + 6x_2 + 3 \leq -5$$

The distance between the hyperplanes is given as

- $\frac{2}{10}$
- 5
- 1
- 10

No, the answer is incorrect.
Score: 0

Accepted Answers:
1

5) Consider the linear system of equations $\bar{\mathbf{y}} = \mathbf{X}\bar{\boldsymbol{\theta}}$, where $\mathbf{X}$ is a matrix of size $m \times n$, with number of measurements m much lower than the number of unknowns n. It is known that the vector $\bar{\boldsymbol{\theta}}$ contains many zeros and only very few of its elements are non-zero. Such a vector $\bar{\boldsymbol{\theta}}$ can be determined using which of the following techniques? *1 point*

- Least Squares
- Orthogonal Matching Pursuit
- Least Norm
- Principal Component Analysis

No, the answer is incorrect.
Score: 0

Accepted Answers:
Orthogonal Matching Pursuit

6) Consider the linear system of equations $\bar{\mathbf{y}} = \mathbf{X}\bar{\boldsymbol{\theta}}$, where $\mathbf{X}$ is a matrix of size $m \times n$, with number of measurements m much lower than the number of unknowns n. Sensing of $\bar{\boldsymbol{\theta}}$ using very few measurements is termed as *1 point*

- Compressed sensing
- Artificial Intelligence
- Least Norm
- Principal Component Analysis

No, the answer is incorrect.
Score: 0

Accepted Answers:
Compressed sensing

7) Consider the sparse regression problem *1 point*

$$\bar{\mathbf{y}} = \underbrace{[\mathbf{X}_1 \quad \mathbf{X}_2 \quad \cdots \quad \mathbf{X}_n]}_{\mathbf{X}}\bar{\boldsymbol{\theta}}$$

Which of the following statements is true

- The columns of $\mathbf{X}$ are sparse
- The vector of regression coefficients $\bar{\boldsymbol{\theta}}$ is sparse
- The rows of $\mathbf{X}$ are sparse
- The output vector $\bar{\mathbf{y}}$ is sparse

No, the answer is incorrect.
Score: 0

Accepted Answers:
The vector of regression coefficients $\bar{\boldsymbol{\theta}}$ is sparse

8) Consider the sparse regression problem *1 point*

$$\bar{\mathbf{y}} = \underbrace{[\mathbf{X}_1 \quad \mathbf{X}_2 \quad \cdots \quad \mathbf{X}_n]}_{\mathbf{X}}\bar{\boldsymbol{\theta}}$$

The column most similar to $\bar{\mathbf{y}}$ is determined as

- $\arg\min \mathbf{X}_j^T\bar{\mathbf{y}}$
- $\arg\max \mathbf{X}_j^T\bar{\mathbf{y}}$
- $\arg\max \|\mathbf{X}_j - \bar{\mathbf{y}}\|$
- $\arg\min \|\mathbf{X}_j - \bar{\mathbf{y}}\|$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\arg\max \mathbf{X}_j^T\bar{\mathbf{y}}$

9) Consider the sparse signal estimation problem below *1 point*

$$\begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} = \begin{bmatrix} 0 \\ 2 \\ 8 \\ 10 \end{bmatrix}$$

The non-zero signal coefficients in the sparse solution are

- x_3, x_4
- x_2, x_3
- x_4, x_6
- x_2, x_5

No, the answer is incorrect.
Score: 0

Accepted Answers:
x_2, x_5

10) Consider the sparse signal estimation problem below *1 point*

$$\begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} = \begin{bmatrix} 0 \\ 2 \\ 8 \\ 10 \end{bmatrix}$$

The values of the non-zero signal coefficients in the sparse solution are

- $10, 8$
- $4, 2$
- $2, 8$
- $8, -2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$2, 8$