

Course outline

How does an NPTEL online course work?

Week-0

Week-1

Week-2

Week-3

Week-4

Week-5

Week-6

Week-7

Week-8

Week-9

Week-10

Week-11

- Lec 56- Introduction to Stochastic Processes and Markov Chains

- Lec 57- Discrete Time Markov Chains and Transition Probability Matrix

- Lec 58- Discrete Time Markov Chain Examples

- Lec 59- m-STEP Transition Probabilities for Discrete Time Markov Chains

- Lec 60- Limiting Behavior of Discrete Time Markov Chains

- Lec 61- Least Squares Revisited: Rank Deficient Matrix

- Lec 62- Least Squares using SVD

 Quiz : Assignment-11

- Feedback for Week 11

- Solution-11

Week-12

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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 $\bar{\mathbf{x}}(j), j = 1, 2, \dots, m$. 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 $\bar{\mathbf{x}}(j), j = 1, 2, \dots, m$. 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**

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

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**

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

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:

$$2, 8$$