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Courses » Applied Optimization for Wireless, Machine Learning, Big-Data

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Unit 11 - Week 9- Application: Compressive Sensing, Sparse Signal Processing, OMP (Orthogonal Matching Pursuit), LASSO (Least Absolute Shrinkage and Selection Operator) for signal estimation,SVM

Assignment-9

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2018-10-03, 23:59 IST.

1) Consider the multi-antenna system $\bar{\mathbf{y}} = \bar{\mathbf{h}}x + \bar{\mathbf{n}},$ with the noise samples in $\bar{\mathbf{n}}$ i.i.d. zero-mean of variance σ^2 and channel vector $\bar{\mathbf{h}} = \begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix}^T$. The optimal maximal ratio combining vector that ensures unity signal gain is *1 point*

- $\begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix}^T$
- $\frac{1}{2}\begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix}^T$
- $\frac{1}{4}\begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix}^T$
- $\frac{1}{\sqrt{2}}\begin{bmatrix} 1 & -1 & -1 & 1 \end{bmatrix}^T$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{4}\begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix}^T$

2) Consider the multi-antenna system $\bar{\mathbf{y}} = \bar{\mathbf{h}}x + \bar{\mathbf{g}}x_i + \bar{\mathbf{n}},$ with the noise samples in $\bar{\mathbf{n}}$ i.i.d. zero-mean of variance $\sigma^2 = 0$ dB, and interference symbols x_i of power $\sigma_i^2 = 3$ dB. The vectors $\bar{\mathbf{h}} = \begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix}^T$ *1 point*

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 3 & -2 & -2 & 2 \\ -2 & 3 & 2 & -2 \\ -2 & 2 & 3 & -2 \\ 2 & -2 & -2 & 3 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 2 & 2 & 2 \\ 2 & 1 & 2 & 2 \\ 2 & 2 & 1 & 2 \\ 2 & 2 & 2 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 2 & 2 & 2 \\ 2 & 3 & 2 & 2 \\ 2 & 2 & 3 & 2 \\ 2 & 2 & 2 & 3 \end{bmatrix}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\begin{bmatrix} 3 & -2 & -2 & 2 \\ -2 & 3 & 2 & -2 \\ -2 & 2 & 3 & -2 \\ 2 & -2 & -2 & 3 \end{bmatrix}$$

3) Consider the multi-antenna system $\bar{\mathbf{y}} = \bar{\mathbf{h}}x + \bar{\mathbf{g}}x_i + \bar{\mathbf{n}},$ with the noise samples in $\bar{\mathbf{n}}$ i.i.d. zero-mean of variance $\sigma^2 = 0 \text{ dB},$ and interference symbols x_i of power $\sigma_i^2 = 3 \text{ dB}$. The vectors $\bar{\mathbf{h}} = [1 \quad 1 \quad 1 \quad 1]^T$ and $\bar{\mathbf{g}} = [1 \quad -1 \quad -1 \quad 1]^T$ denote the channel vectors of the desired and interfering user, respectively. The optimal beamformer $\bar{\mathbf{w}}$ that ensures unity signal gain while minimizing the noise + interference is *1 point*

$\frac{1}{2}[2 \quad -1 \quad -1 \quad 2]^T$

$-\frac{1}{2}[1 \quad -2 \quad -2 \quad 1]^T$

$\frac{1}{4}[1 \quad 1 \quad 1 \quad 1]^T$

$\frac{1}{4}[1 \quad -1 \quad -1 \quad 1]^T$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{4}[1 \quad 1 \quad 1 \quad 1]^T$

4) Consider the multi-antenna system $\bar{\mathbf{y}} = \bar{\mathbf{h}}x + \bar{\mathbf{g}}x_i + \bar{\mathbf{n}}$, with the noise samples in $\bar{\mathbf{n}}$ i.i.d. zero-mean of variance $\sigma^2 = 0 \text{ dB}$, and interference symbols x_i of power $\sigma^2 = 3 \text{ dB}$. The vectors $\bar{\mathbf{h}} = [1 \quad 1 \quad 1 \quad 1]^T$ and $\bar{\mathbf{g}} = [1 \quad -1 \quad -1 \quad 1]^T$ denote the channel vectors of the desired and interfering user, respectively. The optimal *1 point*

zero-forcing beamformer $\bar{\mathbf{w}}$ is

- $\frac{1}{2}\begin{bmatrix}2 & -1 & -1 & 2\end{bmatrix}^T$
- $-\frac{1}{2}\begin{bmatrix}1 & -2 & -2 & 1\end{bmatrix}^T$
- $\frac{1}{4}\begin{bmatrix}1 & 1 & 1 & 1\end{bmatrix}^T$
- $\frac{1}{4}\begin{bmatrix}1 & -1 & -1 & 1\end{bmatrix}^T$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{4}\begin{bmatrix}1 & 1 & 1 & 1\end{bmatrix}^T$

5) Consider the design of the robust beamformer $\bar{\mathbf{w}}$, with the estimated channel vector $\hat{\mathbf{h}}$ and the true channel vector belonging to the uncertainty set $\{\hat{\mathbf{h}} + \mathbf{P}\bar{\mathbf{u}} \| \|\bar{\mathbf{u}}\| \leq 1\}$The constraint to ensure signal gain greater than equal to unity for all channel vectors belonging to the uncertainty set can be equivalently represented as *1 point*

- $\bar{\mathbf{w}}^T\hat{\mathbf{h}} - 1 \geq \|\mathbf{P}^T\bar{\mathbf{w}}\|$
- $\bar{\mathbf{w}}^T\hat{\mathbf{h}} \geq 1$
- $\bar{\mathbf{w}}^T\mathbf{P}\hat{\mathbf{h}} \geq 1$
- $\|\mathbf{P}^T\bar{\mathbf{w}}\| \geq 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\bar{\mathbf{w}}^T\hat{\mathbf{h}} - 1 \geq \|\mathbf{P}^T\bar{\mathbf{w}}\|$

6) The optimization problem $\min \|\bar{\mathbf{y}} - \mathbf{A}\bar{\mathbf{x}}\|^2$ is known as the *1 point*

- Least norm problem
- Regularized problem
- Second order cone program
- Least squares problem

No, the answer is incorrect.
Score: 0

Accepted Answers:
Least squares problem

7) The optimal solution $\hat{\mathbf{x}}$ to the problem $\min \|\bar{\mathbf{y}} - \mathbf{A}\bar{\mathbf{x}}\|^2$, for a tall full column rank matrix $\mathbf{A}$, is *1 point*

- $\left(\mathbf{A}\mathbf{A}^T\right)^{-1}\mathbf{A}^T\bar{\mathbf{y}}$

$\left(\mathbf{A}^T\mathbf{A}\right)^{-1}\bar{\mathbf{y}}$

$\mathbf{A}^T\left(\mathbf{A}\mathbf{A}^T\right)^{-1}\bar{\mathbf{y}}$

$\left(\mathbf{A}^T\mathbf{A}\right)^{-1}\mathbf{A}^T\bar{\mathbf{y}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\left(\mathbf{A}^T\mathbf{A}\right)^{-1}\mathbf{A}^T\bar{\mathbf{y}}$

8) The optimal solution $\hat{\mathbf{x}}$ to the problem $\min \|\bar{\mathbf{x}}\|^2$ subject to $\bar{\mathbf{y}} = \mathbf{A}\bar{\mathbf{x}}$, for a wide full row rank matrix $\mathbf{A}$, is *1 point*

$\left(\mathbf{A}\mathbf{A}^T\right)^{-1}\mathbf{A}^T\bar{\mathbf{y}}$

$\left(\mathbf{A}^T\mathbf{A}\right)^{-1}\bar{\mathbf{y}}$

$\mathbf{A}^T\left(\mathbf{A}\mathbf{A}^T\right)^{-1}\bar{\mathbf{y}}$

$\left(\mathbf{A}^T\mathbf{A}\right)^{-1}\mathbf{A}^T\bar{\mathbf{y}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathbf{A}^T\left(\mathbf{A}\mathbf{A}^T\right)^{-1}\bar{\mathbf{y}}$

9) The optimal solution $\hat{\mathbf{x}}$ to the problem $\min \|x\|^2$ subject to $\bar{\mathbf{y}} = \mathbf{A}\bar{\mathbf{x}}$ *1 point*

Least norm problem

Regularized problem

Second order cone program

Least squares problem

No, the answer is incorrect.
Score: 0

Accepted Answers:
Least norm problem

10) Consider a full rank tall matrix $\mathbf{A}$, i.e., it has more rows than columns. Its pseudo-inverse is *1 point*

$\mathbf{A^T}(\mathbf{A}\mathbf{A^T})^{-1}$

$(\mathbf{A^T}\mathbf{A})^{-1}\mathbf{A^T}$

$\mathbf{A}^T(\mathbf{A}^T\mathbf{A})^{-1}$

$(\mathbf{A}^T\mathbf{A})^{-1}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$(\mathbf{A}^T\mathbf{A})^{-1}\mathbf{A}^T$

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