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

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Unit 10 - Week 8 : Application: Convex optimization for Machine Learning, Principal Component Analysis (PCA), Support Vector Machines

Assignment-8

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment.

Due on 2018-09-26, 23:59 IST.

1) Which of the following statements is true regarding beamforming with weight vector $\bar{\mathbf{w}}$ *1 point*

i. It is termed electronic steering
ii. It is termed mechanical steering
iii. It is time consuming & expensive
iv. It has low complexity and high precision

- i and iii
- ii and iv
- i and iv
- ii and iii

No, the answer is incorrect.
Score: 0

Accepted Answers:
i and iv

2) 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. The noise power at the output of the beamformer denoted by $\bar{\mathbf{w}}$ is *1 point*

- σ^2

$\sigma^2 \bar{\mathbf{w}}\bar{\mathbf{w}}^T$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sigma^2 ||\bar{\mathbf{w}}||^2$

3) 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. The optimization problem for the optimal beamformer $\bar{\mathbf{w}}$ can be formulated as *1 point*

- $\min \sigma^2 ||\bar{\mathbf{w}}||^2$ s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} = 1$
- $\min \bar{\mathbf{w}}^T\bar{\mathbf{h}}$ s.t. $||\bar{\mathbf{w}}||^2 = 1$
- $\max \sigma^2 ||\bar{\mathbf{w}}||^2$ s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} = 1$
- $\max ||\bar{\mathbf{w}}||_1$ s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} \leq 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\min \sigma^2 ||\bar{\mathbf{w}}||^2$
s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} = 1$

4) 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. The optimization problem for the optimal beamformer is a *1 point*

- Linear Program
- Quadratic Program
- Second Order Cone Program
- Semi-Definite Program

No, the answer is incorrect.
Score: 0

Accepted Answers:
Quadratic Program

5) 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. The optimal beamformer $\bar{\mathbf{w}}$ that ensures unity signal gain while minimizing the noise variance is *1 point*

- $\frac{\bar{\mathbf{h}}}{||\bar{\mathbf{h}}||}$

$\bar{\mathbf{h}}$

$\bar{\mathbf{h}}^H$

$\frac{\bar{\mathbf{h}}}{||\bar{\mathbf{h}}||^2}$

No, the answer is incorrect.
Score: 0

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

6) 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. The optimal beamformer $\bar{\mathbf{w}}$ is also termed *1 point*

- Orthogonal Beamformer
- Maximal Ratio Combiner
- Generalized Optimal Beamformer
- Zero-Forcing Combiner

No, the answer is incorrect.
Score: 0

Accepted Answers:
Maximal Ratio Combiner

7) 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 σ^2, and interference symbols x_i of power σ_i^2. The vectors $\bar{\mathbf{h}}$ and $\bar{\mathbf{g}}$ denote the channel vectors of the desired and interfering user, respectively. The noise plus interference covariance is given as *1 point*

$(\sigma_i^2 + \sigma^2)\mathbf{I}$

$\sigma_i^2||\bar{\mathbf{g}}||^2 + \sigma^2$

$\sigma_i^2\bar{\mathbf{g}}\bar{\mathbf{g}}^T + \sigma^2\mathbf{I}$

$\sigma_i\bar{\mathbf{g}} + \sigma$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sigma_i^2\bar{\mathbf{g}}\bar{\mathbf{g}}^T + \sigma^2\mathbf{I}$

8) 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 σ^2, and interference symbols x_i of power σ_i^2. The noise plus interference covariance is denoted by $\mathbf{R}$. The vectors $\bar{\mathbf{h}}$ and $\bar{\mathbf{g}}$ 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*

$$\frac{\mathbf{R}^{-1}\bar{\mathbf{h}}}{\bar{\mathbf{h}}^T\mathbf{R}^{-1}\bar{\mathbf{h}}}$$

$\mathbf{R}\bar{\mathbf{h}}$

$\mathbf{R}^{-1}\bar{\mathbf{h}}$

$$\frac{\mathbf{R}\bar{\mathbf{h}}}{\bar{\mathbf{h}}^T\mathbf{R}\bar{\mathbf{h}}}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{\mathbf{R}^{-1}\bar{\mathbf{h}}}{\bar{\mathbf{h}}^T\mathbf{R}^{-1}\bar{\mathbf{h}}}$$

9) 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 σ^2, and interference symbols x_i of power σ_i^2. The noise plus interference covariance is denoted by $\mathbf{R}$. The vectors $\bar{\mathbf{h}}$ and $\bar{\mathbf{g}}$ denote the channel vectors of the desired and interfering user, respectively, with $\mathbf{C} = [\bar{\mathbf{h}} \quad \bar{\mathbf{g}}]$. The optimization problem for the optimal zero-forcing beamformer $\bar{\mathbf{w}}$ is *1 point*

$\min \bar{\mathbf{w}}^T\bar{\mathbf{g}}$
s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} = 1$

$\min \bar{\mathbf{w}}^T\bar{\mathbf{h}}$
s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{g}} = 0$
$||\bar{\mathbf{w}}||^2 = 1$

$\min \sigma^2||\bar{\mathbf{w}}||^2$
s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} = 1$
$\bar{\mathbf{w}}^T\bar{\mathbf{g}} = 0$

$\min \sigma^2||\bar{\mathbf{w}}||^2$
s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} = 0$
$\bar{\mathbf{w}}^T\bar{\mathbf{g}} = 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\min \sigma^2||\bar{\mathbf{w}}||^2$
s.t. $\bar{\mathbf{w}}^T\bar{\mathbf{h}} = 1$
$\bar{\mathbf{w}}^T\bar{\mathbf{g}} = 0$

10) 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 σ^2, and interference symbols x_i of power σ_i^2. The noise plus interference covariance is denoted by $\mathbf{R}$. The vectors $\bar{\mathbf{h}}$ and $\bar{\mathbf{g}}$ denote the channel vectors of the desired and interfering user, respectively, with $\mathbf{C} = [\bar{\mathbf{h}} \quad \bar{\mathbf{g}}]$. The optimal zero-forcing *1 point*

beamformer $\bar{\mathbf{w}}$ is

- $\mathbf{C}(\mathbf{C}^T\mathbf{C})^{-1}\begin{bmatrix}1\\0\end{bmatrix}$
- $(\mathbf{C}^T\mathbf{C})^{-1}\mathbf{C}\begin{bmatrix}1\\0\end{bmatrix}$
- $\mathbf{C}(\mathbf{C}\mathbf{C}^T)^{-1}\begin{bmatrix}0\\1\end{bmatrix}$
- $\mathbf{C}^{-1}\begin{bmatrix}0\\1\end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathbf{C}(\mathbf{C}^T\mathbf{C})^{-1}\begin{bmatrix}1\\0\end{bmatrix}$

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