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

Announcements Course Ask a Question Progress Mentor FAQ

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

Course outline

How to access the portal

Week 1 : Introduction to properties of Vectors, Norms, Positive Semi-Definite matrices and Gaussian Random Vectors

DOWNLOAD VIDEOS

Week 2: Introduction to Convex Optimization – Convex sets, Hyperplanes/ Half-spaces etc. Application: Power constraints in Wireless Systems

Week 3 : Convex/ Concave Functions

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 $\bar{y} = \bar{h}x + \bar{n}$, with the noise samples in \bar{n} i.i.d. zero-mean of variance σ^2 and channel vector $\bar{h} = [1 \ 1 \ 1 \ 1]^T$. The optimal maximal ratio combining vector that ensures unity signal gain is **1 point**

- $[1 \ 1 \ 1 \ 1]^T$
- $\frac{1}{2} [1 \ 1 \ 1 \ 1]^T$
- $\frac{1}{4} [1 \ 1 \ 1 \ 1]^T$
- $\frac{1}{\sqrt{2}} [1 \ -1 \ -1 \ 1]^T$

No, the answer is incorrect.

Score: 0

Accepted Answers:

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

2) Consider the multi-antenna system $\bar{y} = \bar{h}x + \bar{g}x_i + \bar{n}$, with the noise samples in \bar{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 $\bar{h} = [1 \ 1 \ 1 \ 1]^T$ **1 point**

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A project of



In association with



Funded by

Multi-User
Wireless,
Cognitive Radio
Systems

ce De

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

Week 4 : Convex
Optimization
problems, Linear
Program,
Application:
Power allocation
in Multi-cell
cooperative
OFDM

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

Week 5:
Jensen's
Inequality,
Operations that
preserve
Convexity,
Examples,Beamforming
in Multi-antenna
Wireless
Communication

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

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

No, the answer is incorrect.

Score: 0

Accepted Answers:

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

Week-6: Maximal
Ratio Combiner
(MRC), Multi-
antenna
Beamforming
with Interfering
User,
Zero-Forcing
(ZF)
beamforming,Robust
beamformer
Design

3) Consider the multi-antenna system $\bar{\mathbf{y}} = \bar{\mathbf{h}}x + \bar{\mathbf{g}}x_i + \bar{\mathbf{n}}$, with the noise **1 point** 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 $\bar{\mathbf{h}} = [1 \ 1 \ 1 \ 1]^T$ and $\bar{\mathbf{g}} = [1 \ -1 \ -1 \ 1]^T$ 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

Week-7:Optimization
for signal
estimation, LS,
WLS,
Regularization.
Application:
Wireless
channel
estimation,
Image
Reconstruction-
Deblurring,Representatic
of Convex
Optimization
problem

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

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

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

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

No, the answer is incorrect.

Score: 0

Accepted Answers:

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

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

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

Week 9-
Application:

Compressive Sensing, Sparse Signal Processing, OMP (Orthogonal Matching Pursuit), LASSO (Least Absolute Shrinkage and Selection Operator) for signal estimation, SVM

- Lec 55- Practical Application: Compressive Sensing
- Lec 56- Practical Application: Compressive Sensing -II
- Lec 57- Practical Application- Orthogonal Matching Pursuit (OMP) algorithm for Compressive Sensing
- Lec 58- Example Problem: Orthogonal Matching Pursuit (OMP) algorithm
- Lec 59- Practical Application : L1 norm minimization and regularization approach for Compressive Sensing Optimization problem
- Lec 60- Practical Application of Machine Learning and Artificial Intelligence: Linear Classification, Overview and Motivation
- Lec 61- Practical Application: Linear

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

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

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

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

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

No, the answer is incorrect.

Score: 0

Accepted Answers:

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

5) Consider the design of the robust beamformer $\bar{\mathbf{w}}$, with the estimated **1 point** channel vector $\hat{\mathbf{h}}$ and the true channel vector belonging to the uncertainty set $\{\hat{\mathbf{h}} + \mathbf{P}\bar{\mathbf{u}} \mid \|\bar{\mathbf{u}}\| \leq 1\}$ 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

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

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

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

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

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**

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

Classifier
(Support Vector
Machine)
Design

- Quiz :
Assignment-9
- Assignment -9
Solution

Week 10-
Application:
Compressive
Sensing, Sparse
Signal
Processing,
OMP
(Orthogonal
Matching
Pursuit), LASSO
(Least Absolute
Shrinkage and
Selection
Operator) for
signal
estimation

Week 11 :
Application:
Radar for target
detection, Array
Processing,
MUSIC,
MIMO-Radar
Schemes for
Enhanced Target
Detection

Week 12:
Application:
Convex
optimization for
Big Data
Analytics,
Recommender
systems, User
Rating
Prediction and
Optimization for
Finance

Transcripts



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



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



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

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**



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



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



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



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

No, the answer is incorrect.

Score: 0

Accepted Answers:

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



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