Linear Least Squares

Cuestionario Calificado

Vencimiento 25 de jun. 23:59 PDT

1. **1 / 1 punt**

What is the length $\|\mathbf{v}\|$ of the given $\mathbf{v}$?

$$\left\| \begin{bmatrix} 1 \\ 2 \end{bmatrix} \right\| =$$

Correcto

2. Inner product between two vectors **1 / 1 punt**

$$[1 \;\; 2] \cdot \begin{bmatrix} 3 \\ 4 \end{bmatrix} = ?$$

Correcto

3. You enter a room at the southwest corner (origin x=0, y=0). A light bulb is located in the middle of the room at x=5 feet east **1 / 1 punt**

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✓ **Correcto**

3. You enter a room at the southwest corner (origin x=0, y=0). A light bulb is located in the middle of the room at x=5 feet east and y=6 feet north of the entrance, 10 feet above the floor. You must change the bulb, and need a ladder to reach the bulb. Where do you place the ladder on the floor to be closest to the bulb so you can reach the bulb? **1 / 1 punt**

✓ **Correcto**

4. Q: **1 / 1 punt**

In the SVD, the U & V matrices are called "orthogonal" because their columns are all mutually orthogonal to each other and have length 1. These are exactly the matrices that preserve the length of any vector to which they are multiplied: $\|U\mathbf{x}\|_2 = \|\mathbf{x}\|_2$ for any vector $\mathbf{x}$ (where $\|\mathbf{x}\|_2 = \sqrt{\mathbf{x}^T\mathbf{x}} = \sqrt{x_1^2 + \cdots x_n^2}$ = the length of $\mathbf{x}$). Which of the following matrices have this property of being orthogonal?

✓ **Correcto**

Approximate Curve Fitting

Cuestionario Práctico • 30 min • 2 total de puntos

¡Felicitaciones! ¡Aprobaste!

Calificación recibida 100 %

Para Aprobar 80 % o más

Ir al siguiente elemento

1. **1 / 1 punto**

t:	-1	0	1
y:	2	2	1

fit straight line $p(t) = at + b$

- ○ a = 0.5, b = -6
- ○ a = 2, b = 0.3
- ◉ a = -0.5, b = 1.67
- ○ a = 5, b = 6

Correcto

Approximate Curve Fitting

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fit straight line $p(t) = at + b$

- ○ a = 0.5, b = -6
- ○ a = 2, b = 0.3
- ◉ a = -0.5, b = 1.67
- ○ a = 5, b = 6

✓ **Correcto**

2. **1 / 1 punto**

t:	-1	0	1	2
y:	1	2	-1	2

fit $p(t) = at^2 + bt + c$

- ○ a = -0.5, b = 2, c = 0.5
- ○ None of the above
- ◉ a = 0.5, b = -0.5, c = 0.5
- ○ a = 1, b= 0.5, c = 2.5

✓ **Correcto**

Normal equations

Cuestionario Práctico • 30 min • 2 total de puntos

2. Given the following table of values **1 / 1 punto**

$t:$	-1	0	1
$y:$	2	2	1

we wish to fit a straight line of the form $y = p(t) = at + b$.

Give the set of normal equations for the two unknowns a and b:

○ answer =

$$\begin{bmatrix} 14 & 6 \\ 6 & 3 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$$

○ answer =

$$\begin{bmatrix} 14 & 6 \\ 6 & 3 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$$

◉ answer =

$$\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix}$$

Normal equations

Cuestionario Práctico • 30 min • 2 total de puntos

1. Given the following table of values **1 / 1 punto**

$t:$	-1	0	1
$y:$	2	2	1

we wish to fit a straight line of the form $y = p(t) = at + b$.

Give the over-determined system of equations for the two unknowns a and b:

(note: the equations can be written with the unknowns a & b in either order)

○ answer =

$$\begin{bmatrix} 1 & 1 \\ 2 & 1 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

◉ answer =

$$\begin{bmatrix} -1 & 1 \\ 0 & 1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}$$

○ answer =

$$\begin{bmatrix} 2 & 1 \\ 1 & 1 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

Linear Least Squares

Cuestionario Práctico • 3 total de puntos

¡Felicitaciones! ¡Aprobaste!

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Para Aprobar 80 % o más

Ir al siguiente elemento

1. which of these statements are true for a linear least squares problem

1 / 1 punto

min $||Ax-b||$, where A is a given nxm matrix, b is a given n-vector and x is a m-vector of unknowns.

- [ ] The solution, if it exists, is always unique
- [ ] If the system of linear equations $Ax=b$ has no solution, then the least squares problem $||Ax-b||$ also has no solution.
- [x] If A is square and invertible, then the solution to the least squares problem is the same as the solution to the system of linear equations $Ax=b$.

Correcto

x solves the system of equations

Linear Least Squares

Cuestionario Práctico • 3 total de puntos

- [x] The linear least squares problem always has a solution

Correcto

yes, but there could be more than one.

2. How many solutions (x,y) are there that exactly solve a system of linear equations that fits a straight line going through the three points A, B, C? **1 / 1 punto**

	A	B	C
x	1	3	12
y	3	9	36

- ○ Many solutions
- ○ No exact solution
- ◉ One solution

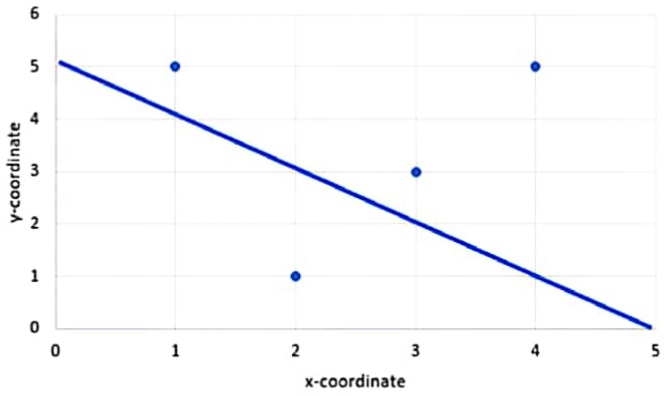
Correcto

3. What is the sum of squares of the discrepancies between the straight line **1 / 1 punto**

One solution

Correcto

3. What is the sum of squares of the discrepancies between the straight line p(x) = 5-x and the four blue points with (x,y) coordinates: (1,5), (2,1), (3,3), (4,5): **1 / 1 punto**



- (●) 22
- ( ) 10
- ( ) 5 * sqrt(2)
- ( ) none of the other answers are correct.

Correcto

Orthogonality and Inner Product

Cuestionario Práctico • 2 total de puntos

¡Felicitaciones! ¡Aprobaste!

Calificación recibida 100 %

Para Aprobar 80 % o más

Ir al siguiente elemento

1. Compute the inner product for the following vectors x and y **1 / 1 pun**

$$x = \begin{bmatrix} 1 \\ 0 \\ 4 \\ 0 \\ 3 \end{bmatrix} \qquad y = \begin{bmatrix} 0 \\ -2 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

- ○ 4
- ◉ 0
- ○ 5
- ○ 9

Correcto

Orthogonality and Inner Product

Cuestionario Práctico • 2 total de puntos

$$x = \begin{bmatrix} 1 \\ 0 \\ 4 \\ 0 \\ 3 \end{bmatrix} \qquad y = \begin{bmatrix} 0 \\ -2 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

- ○ 4
- ◉ 0
- ○ 5
- ○ 9

✓ **Correcto**

2. Vector x is perpendicular to vector y **1 / 1 punt**

$$x = \begin{bmatrix} -3 \\ 2 \\ 1 \\ 0 \\ -1 \end{bmatrix} \qquad y = \begin{bmatrix} 0 \\ 1 \\ 3 \\ -2 \\ 5 \end{bmatrix}$$

- ○ False
- ◉ True

✓ **Correcto**

Linear Least Squares

Cuestionario Práctico • 3 total de puntos

1. Which of the following is true for Linear Least Squares? **1 punto**

- [ ] The over-determined system in one variable x

  x = 1

  x = 2

  has no least squares solution

- [x] It finds a solution yielding the best fit to an over-determined systems when the number of equations exceeds the number of unknowns.

- [ ] It can solve over-determined systems of linear equations

- [x] It can find a solution to an under-determined system of equations (the number of equations is less than the number of unknowns)

- [x] It can find an exact solution when the number of equations matches the number of unknowns, if such a solution exists.

2. How many solutions (x,y) are there that **1 punto**