Thank you for taking the Week 1 : Assignment 1.

Week 1 : Assignment 1

Your last recorded submission was on 2024-02-07, 12:52 Due date: 2024-02-07, 23:59 IST. IST

1) The animated movie *Kung Fu Panda 2* used Dolby 7.1 Surround Sound which uses 8 audio channels. Consider an audio clip put together from all 8 channels, resulting in a matrix of dimensions 1024×8. The output of this audio stream is to be converted to a 2 channel stream while retaining the length of the audio clip. So, a matrix transformation is applied on the source to convert it into a 2 channel stream. The sizes of the final output matrix and the transformation matrix would be: ***1 point***

- $1024 \times 8, 8 \times 2$
- $1024 \times 8, 2 \times 8$
- $1024 \times 2, 8 \times 2$
- $1024 \times 2, 2 \times 8$

2) Consider the vectors $a_{N\times 1}$ and $b_{N\times 1}$. If $I_{N\times N}$ is the identity matrix of size $N \times N$ then the determinant of the matrix $I + ab^T$ is given by: ***1 point***

- $1 + ab^T$
- $1 + a^T b$
- $1 + a^T b^T$
- $1 + ab$

3) Consider a 5×5 matrix A with the following eigen values $(-1, 1, 0, -2, 2)$. What would be the eigen values of the matrix A^{-1}? ***1 point***

Assessment submitted.
X

- Artificial Intelligence (unit?unit=1&lesson=2)
- Overview of Machine Learning (unit?unit=1&lesson=3)
- Why Linear Algebra ? Scalars, Vectors, Tensors (unit?unit=1&lesson=4)
- Basic Operations (unit?unit=1&lesson=5)
- Norms (unit?unit=1&lesson=6)
- Linear Combinations Span Linear Independence (unit?unit=1&lesson=7)
- Matrix Operations Special Matrices Matrix Decompositions (unit?unit=1&lesson=8)
- Week 1 Feedback Form : Machine Learning for Engineering and Science Applications (unit?unit=1&lesson=144)

- $(1, -1, 0, 2, -2)$
- $(-1, 1, \infty, -0.5, 0.5)$
- $(-1, 1, 0, -2, 2)$
- None of the above. $A-1$ does not exist.

4) The solution to the system of equations given by : ***1 point***

$$\begin{bmatrix} 3 & 0 & 2 \\ 6 & 1 & 1 \\ 2 & 8 & 61 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

- $x_1 = 1, x_2 = 1, x_3 = 2$
- $x_1 = 0, x_2 = 0, x_3 = 0$
- $x_1 = 3, x_2 = -1, x_3 = -1$
- $x_1 = 0, x_2 = -2, x_3 = 4$

5) Consider an orthogonal matrix A with $A^T A = I$. If we define a vector $y = Ax$, where x is a column vector, which of the following are true about $\|y\|$ (where $\|y\|$ is the L2-norm of y)? ***1 point***

- $\|y\| > \|x\|$
- $\|y\| < \|x\|$
- $\|y\| = \|x\|$
- Could be any of the above, depending on the details of A and x.

6) Consider two matrices, A and B, where A is a 3x4 matrix and B is a 4x3 matrix. We perform the following operations sequentially: ***1 point***

i. Compute of the product of A and B, resulting in matrix C.
ii. Take transpose of the matrix C.
iii. Perform an element-wise (Hadamard) product of the transposed matrix C with a 3x3 identity matrix.
iv. Add a 3x3 matrix D, all of whose elements have the value 2.
What is true about the resulting matrix after performing the above operations?

- A 3x3 matrix where each element is the sum of the corresponding row in matrix A.
- A 3x3 matrix with diagonal elements equal to the sum of the corresponding row in matrix A, and off-diagonal elements are equal to 2.
- A 3x3 matrix where each element is the sum of the corresponding column in matrix B.
- A 3x3 matrix with diagonal elements equal to the sum of the corresponding column in matrix B, and off-diagonal elements are equal to 2.

7) Consider three vectors in $\mathbb{R}^3$: ***1 point***

Assessment submitted.
X

Quiz: Week 1 : Assignment 1 (assessment?name=206)

Week 2 ()

Week 3 ()

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$v_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}, v_2 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}, v_3 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$

Are these vectors linearly independent?

- Yes, because they form a basis for $\mathbb{R}^3$.
- **No, because one of the vectors can be written as a linear combination of the others.**
- Yes, because each vector has a component that is not present in the other vectors.
- It cannot be determined from the given information.

8) In an experiment, data is represented by a matrix M, which records the interaction intensities between four different particles. The matrix is given as: ***1 point***

$M = \begin{bmatrix} 3 & 7 & 4 & 1 \\ 5 & 2 & 6 & 8 \\ 9 & 10 & 1 & 3 \\ 4 & 8 & 5 & 6 \end{bmatrix}$

The trace of the matrix M is used to calculate the total intensity of self-interactions among particles. You are also given the transpose of the matrix M, denoted as M^T. What is the relationship between the total intensity of self-interactions calculated using M and M^T?

- The total intensity calculated using M is greater than that calculated using M^T.
- The total intensity calculated using M is less than that calculated using M^T.
- **The total intensity calculated using M is the same as that calculated using M^T.**
- The relationship cannot be determined without further information about the interactions.

9) Consider the following 3x3 matrix: ***1 point***

$C = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 2 & 4 & 6 \end{bmatrix}$

Is the matrix C invertible?

- Yes, because all its elements are non-zero.
- No, because it is not a diagonal matrix.
- Yes, because it is a square matrix.
- **No, because its determinant is 0.**

10) ***1 point***

Consider the vector $v = \begin{bmatrix} -3 \\ 4 \\ 0 \\ 1 \\ -2 \end{bmatrix}$. For which of the following norms will the norm of vector v be the minimum?

- L^2 norm
- L^1 norm
- L^∞ norm

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X

L^3 norm

You may submit any number of times before the due date. The final submission will be considered for grading.

Submit Answers