

COEN 140 Machine Learning and Data Mining

Lab Assignment #2: Linear Algebra

Guideline: Submit to Camino a pdf report with answers to the following questions. Also submit all the source code needed to generate these answers as a separate zip file to Camino.

Note: matrix and vector operations can be found in lecture slides COEN140_02_LinearAlgebraReview.pdf.

1. Create a 2×5 matrix \mathbf{A} with elements as random float numbers from 0 to 1. Print the rank of \mathbf{A} .

Let $\mathbf{B} = \mathbf{A}\mathbf{A}^T$, find the shape and rank of \mathbf{B}

Let $\mathbf{C} = \mathbf{A}^T\mathbf{A}$, find the shape and rank of \mathbf{C}

2. Create a 3×5 matrix \mathbf{X} with elements as random integers from 0 to 10, and find the dimension (shape) of $\mathbf{A} = \mathbf{X}\mathbf{X}^T$ by coding;

Create a 3×1 column vector \mathbf{w} with elements as random integers from 0 to 10, and find the dimension of $\mathbf{A}\mathbf{w}$ by coding;

Find the dimension of $\mathbf{w}^T\mathbf{A}$ by coding;

Find the dimension of $\mathbf{w}^T\mathbf{A}\mathbf{w}$ by coding.

Find a way (by coding) to verify that $\mathbf{X}\mathbf{X}^T$ is symmetric.

Calculate \mathbf{A}^{-1} . Print $\mathbf{A}^{-1}\mathbf{A}$ and $\mathbf{A}\mathbf{A}^{-1}$.

3. Create a 5×1 column vector \mathbf{x} with elements as random float numbers from 0 to 1. Calculate $\mathbf{x}\mathbf{x}^T$ by coding. What do you think is the rank of $\mathbf{x}\mathbf{x}^T$?

4. Create a 5×5 identity matrix \mathbf{I} and print it.