Linear Algebra Library Junior C++

Algoritmos y Estructuras de Datos

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Problem Description

- Difficulty to represent and perform operations between mathematical objects, such as vectors and matrices.

LA.jpeg

Solution

Implementation of a basic linear algebra library with classes **Cvector** and **Cmatrix**

1. “push", “insert", “erase", “clear"
2. +, -, * and /
3. ==, !=, >=, <=, <, >.
4. Dot product, cross product
5. norm, normalization
6. angle and projections.
7. Gram-Schmidt
8. Transpose and Inverse.
9. LUP and QR decompositions
10. Determinant and Eigen values.

Vector Operations

1. a) Dot Product

1a.png

Vector Operations

1. b) Dot Product

1b.png

Vector Operations

2. a) Cross Product

2a.png

2. b) Cross Product

2b.png

Vector Operations

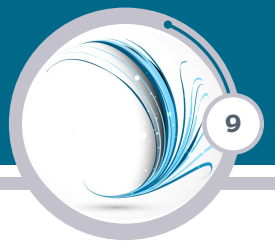
3. a) Norm

3a.png

Vector Operations

3. b) Norm

3b.png



4 a) Normalization

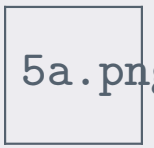
4a.png

4. b) Normalization

4b.png

Vector Operations

5 a) Angle



5. b) Angle

5b.png

6. a) Projection

6a.png

6. b) Projection

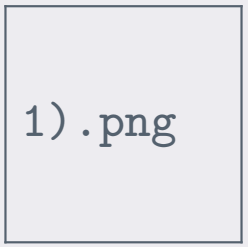
6b.png

7. Gram Schmidt

GS.png

Matrix Operations

1) Transpose



Matrix Operations

M1.png

Some Basic Matrices

- 2) Lower Triangular
- 3) Upper Triangular

Matrix Operations

Easy Matrices

- 4) Identity 10 x 10
- 5) Null 4 x 5
- 6) 1s Matrix 5 x 4
- 7) Random Matrix

Matrix Operations

M1.png

Modifiers

- Swaps

10) Determinant

10).png

Matrix Operations

+

Matrix Operations

–

Matrix Operations

Exponents

^.png

Matrix Operations

Matrix-Vector Multiplication

*1.png

Matrix Operations

Vector-Matrix Multiplication

*2.png

Matrix Operations

Matrix-Matrix Multiplication

*3.png

Matrix Operations

Exponentiation

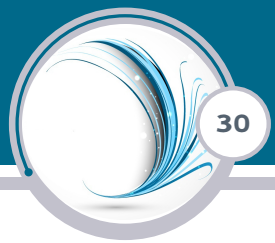
*4.png

12) Inverse

12).png

13) QR Decomposition

QR.png



14) LU Decomposition

LU.png

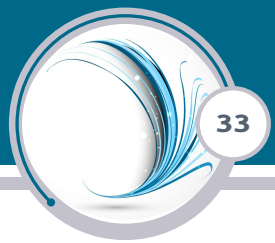
15) Eigen Values

Challenges

- Templates
- Data Conversion
- Computational Complexity
- Objects Structure

W.jpg

What is next?



- Generalization for non-square matrixes
- Easy Vector and Matrix Constructors
- Reduce Computational Complexity