Contents

matrix Gaussian Elimination

factorization $A = LU$

two other matrices

The matrices L and U are simpler than A.

Matrix is a bunch of numbers between some brackets

$$\begin{bmatrix} 1 & 2 & 6 \\ -2 & 3 & 0 \\ 5 & 1 & -2 \end{bmatrix}$$

$$L = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 5 & 0 \\ -1 & 7 & 13 \end{bmatrix}$$

lower triangular

interpretation is that a matrix represent a linear function...

Algebra means we have rules to add and multiply matrices...

function composition...

focus

Vector spaces

will be used in chapter 5

Important in diff. eq and many other places

use determinants

$$A = SDS^{-1}$$

diagonal matrix

inverse function of the function corresponding to S.

$$D = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & -7 \end{bmatrix}$$

$$f(x,y,z) = (2x, 4y, -7z)$$

$$AA = SD\underline{S^{-1}S}DS^{-1}$$

$$AA = SDDS^{-1}$$

$$DD = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 16 & 0 \\ 0 & 0 & 49 \end{bmatrix}$$

optimization problems

Gram-Schmidt.

$$A = QR$$

orthogonal matrix

upper triangular matrix

$$Q^T = Q^{-1}$$

switch rows with columns.

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

$f(x,y,z) = (2x, 4y, -7z)$

DD means compose $f \circ f$

$(f \circ f)(x,y,z) = f(f(x,y,z)) = f(2x, 4y, -7z) = (2(2x), 4(4y), -7(-7z)) =$

$= (4x, 16y, 49z)$

$$DD = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 16 & 0 \\ 0 & 0 & 49 \end{bmatrix}$$

diagonal

$A = U\Sigma V^T$

orthogonal

orthogonal

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Chapter 8 The Geometry of Vector Spaces 437

Chapter 9 Optimization (Online)

Chapter 10 Finite-State Markov Chains (Online)

Appendixes