Linear Algebra from Scratch: Introduction

Instructor Anthony

"It does not matter how slowly you go as long as you do not stop." - Confucius

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Reference: Leon, 2014 [2]

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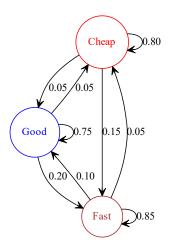# Matrices are not Digital Constructions of the Environment

A Matrix is a collection of elements

1. $a_1 \sim$ *Cheap*
2. $a_2 \sim$ *Good*
3. $a_3 \sim$ *Fast*

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1. $a_1 \sim$ *Cheap*
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4. The probability of changing to the i_{th} state to the j_{th} state can be expressed as:
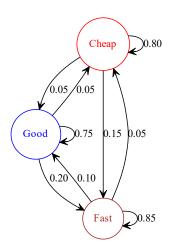
Reference: Leon, 2014 [2]

A Matrix is a collection of elements

1. $a_1 \sim$ *Cheap*
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4. The probability of changing to the i_{th} state to the j_{th} state can be expressed as:
5.

$$A' = \begin{bmatrix} 0.80 & 0.05 & 0.10 \\ 0.05 & 0.75 & 0.05 \\ 0.15 & 0.20 & 0.85 \end{bmatrix}$$
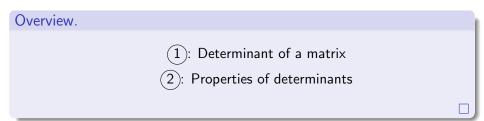
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A Matrix is a rectangular array of elements

Overview.

$\textcircled{1}$: Systems of Linear Equations

$\textcircled{2}$: Row Echelon Form

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Determinants can be calculated for square matrices.

Overview.

1: Determinant of a matrix

2: Properties of determinants

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Reference: Leon, 2014 [2]
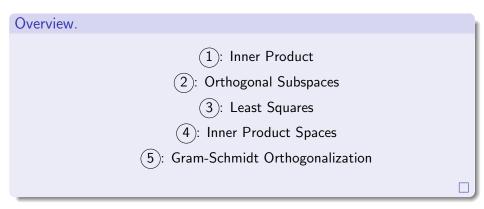
Vector Spaces preserve linearity

Overview.

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A Linear Transformation is a mapping

Overview.

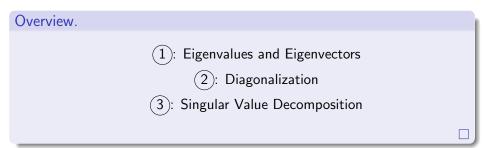1: Definitions and Examples

2: The Matrix representation of a linear transformation

3: Similarity between Matrices

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Orthogonality is the geometric generalization of perpendicular

Overview.

$\boxed{1}$: Inner Product

$\boxed{2}$: Orthogonal Subspaces

$\boxed{3}$: Least Squares

$\boxed{4}$: Inner Product Spaces

$\boxed{5}$: Gram-Schmidt Orthogonalization

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Solving the eigenvalue problem is useful to many applications

Overview.

(1): Eigenvalues and Eigenvectors

(2): Diagonalization

(3): Singular Value Decomposition

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Reference: Leon, 2014 [2]

Coding as an additional exercise for ambitious scholars

Overview.

The Matlab, Python, and other relevant course related content can be found at: **GitHub Link**

□

References I

[1] David Harville. *Matrix Algebra From a Statistician's Perspective*. New York: Springer-Verlag, 1997.

[2] Leon Stephen. *Linear Algebra with Applications (9th Edition) (Featured Titles for Linear Algebra*. London, England: Pearson, 2014.

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