Linear Algebra

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Linear Algebra

- Linear algebra is a branch of mathematics and continues to figure prominently in computer science and electrical engineering
  - Computation, geometry, theory, practical applications, to name just a few

- Simply put, linear algebra is the study of vectors, matrices, vector spaces and linear transformations

\[ a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n = b_1 \\
 a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n = b_2 \\
 \vdots \quad \vdots \quad \vdots \quad \vdots \\
 a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n = b_m \\
\]

\[ \begin{bmatrix}
  a_{11} & a_{12} & \cdots & a_{1n} & b_1 \\
  a_{21} & a_{22} & \cdots & a_{2n} & b_2 \\
  \vdots & \vdots & \vdots & \vdots \\
  a_{m1} & a_{m2} & \cdots & a_{mn} & b_m \\
\end{bmatrix} \]
Main Objectives

• Develop the definitions, concepts and theories associated with linear algebra
  – Fundamentals: vectors operations, matrices operations, determinants, Euclidean vector spaces, linear systems, etc.
  – Further topics: matrix diagonalization, matrix factorization, linear transforms, numerical methods, practical applications, etc.

• Learn to make effective use of linear algebra in dealing with practical issues of interest
  – E.g., multimedia (text, speech, music and image) processing

- Start with a matrix describing the intra- and Inter-document statistics between all terms and all documents
- Singular value decomposition (SVD) is then performed on the matrix to project all term and document vectors onto a reduced latent topical space
- In the context of information retrieval (IR), matching between queries and documents can be carried out in this topical space
Textbook & Course Website


  Website

- Course Website
  http://berlin.csie.ntnu.edu.tw/Courses/LinearAlgebra/2013F-LA_Main.htm
Reference Books

  – Website
    http://www.laylinalgebra.com/

  – Website
    http://www.athenasc.com/probbook.html
## Tentative Topic List

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<td>2.</td>
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<td>Euclidean Vector Spaces</td>
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<td>Diagonalization and Quadratic Forms</td>
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Grading (*Tentatively!*)

- Midterm and Final: 45%
- Quizzes (≥ 5 times) and Homework: 45%
- Attendance/Other: 10%

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