Course Description

Linear Algebra

Department of Computer Engineering

Sharif University of Technology

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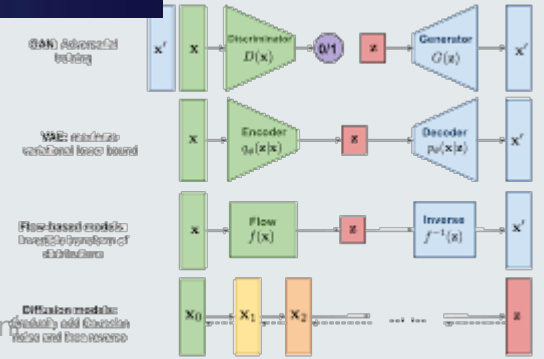
Data Scientist and Data Science

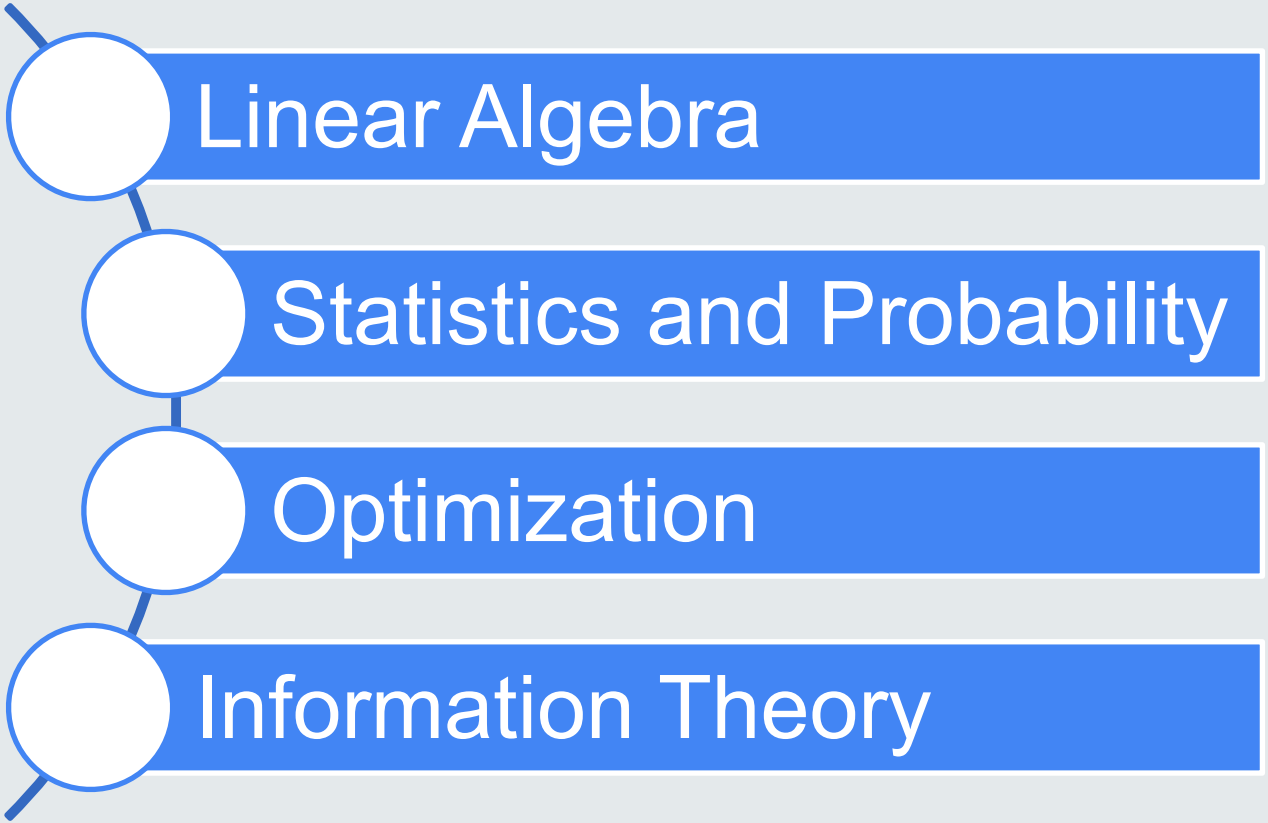

OpenAI
ChatGPT


Copilot


DEEPFAKE


GAN: Adversarial training
Discriminator
$D(\mathbf{x})$
0/1
Generator
$G(\mathbf{z})$
VAE: maximize variational lower bound
Encoder
$q_\phi(\mathbf{z}|\mathbf{x})$
Decoder
$p_\theta(\mathbf{x}|\mathbf{z})$
Flow-based models: Invertible transform of distributions
Flow
$f(\mathbf{x})$
Inverse
$f^{-1}(\mathbf{z})$
Diffusion models: Gradually add Gaussian noise and then reverse

Machine Learning Mathematics



Site

- Jabrekh.Github.io

Linear Algebra Home Materials Assignments Problem sets

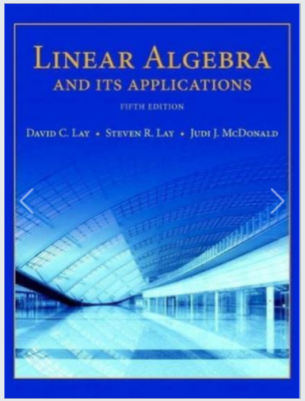
CE282: Linear Algebra

Fall 2023, Group 1; Computer Engineering Department, Sharif University of Technology, Tehran, Tehran Province, Iran

Classes: Sundays and Tuesdays, 13:30-15:00, Hall 3
TA Classes: Wednesdays, 17:00, Virtual class

This course covers matrix theory and linear algebra, emphasizing topics useful in other disciplines. Linear algebra is a branch of mathematics that studies systems of linear equations and the properties of matrices. The concepts of linear algebra are extremely useful in image processing, computer vision, data science, machine learning, bio-informatics, social networks, and neuroscience. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.

Syllabus



Instructors

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Course Method

Slides:

Example

Definition

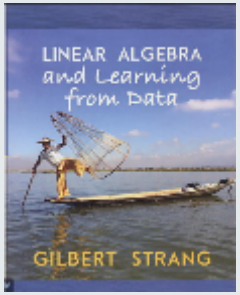
Notes

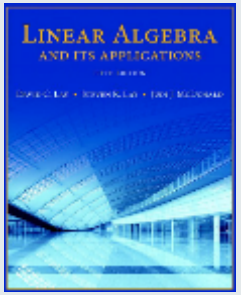
Theorem

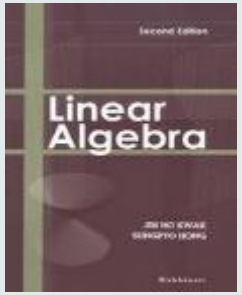
Board

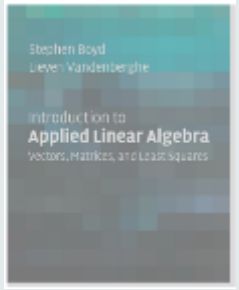
Geometric Interpretation and Intuition

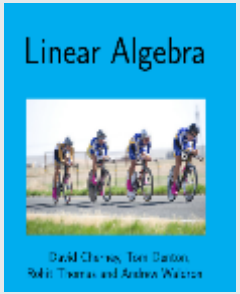
Course References

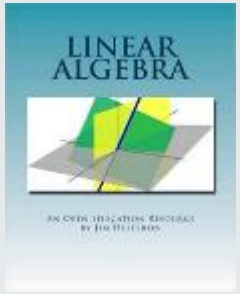


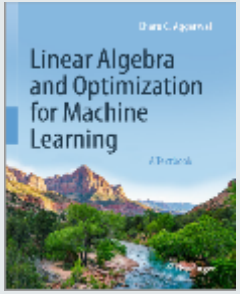


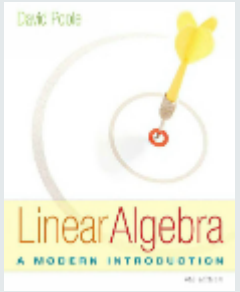


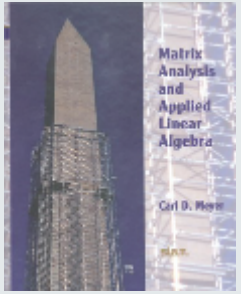












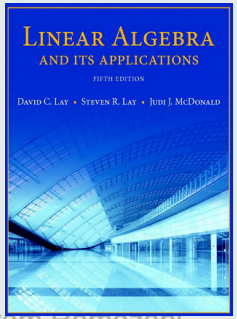
Reach Us!

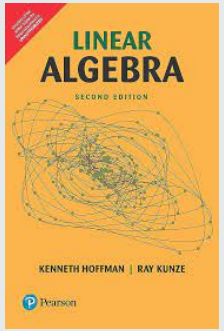
- Office Room: CE802-CE803
- Email:
  - Hamid R. Rabiee: (rabiee@sharif.edu)
  - Maryam Ramezani: (maryam.ramezani@sharif.edu)
- Course notes, homework and solutions, handouts, and other useful resources are available on the Quera page:
  - https://quera.org/course/14555/
  - Room: (Sunday & Tuesday: 13:30-15:00)
  - Hall Number 3
  - https://vc.sharif.edu/ch/rabiee
- Lead TA:
  - Amirhossein Abedi: (amirhoseinabedi80@gmail.com)
- Feedback
  - https://forms.gle/fhSHAzm69MS8ncpA7

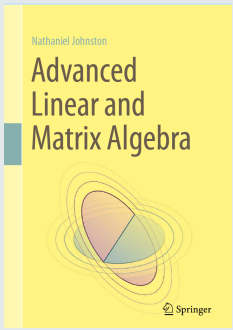
Resources

- Textbooks:
  - David C. Lay, Steven R. Lay, and Judi J. McDonald.Linear Algebra and Its Applications. Pearson, 2016.
  - Kenneth Hoffman and Ray A. Kunze.Linear Algebra. PHI Learning, 2004.
  - Stephen Boyd and Lieven Vandenberghe.Introduction to Applied Linear Algebra – Vectors, Matrices, and LeastSquares. Cambridge University Press, 2018.
  - Gilbert Strang. Introduction to Linear Algebra. Wellesley-Cambridge Press, 2016.
  - Gilbert Strang. Linear Algebra and Learning From Data. Wellesley-Cambridge Press, 2019.
  - Nathaniel Johnston, Advanced Linear and Matrix Algebra, Springer Nature, 2021.

+Other textbooks and course materials.







Structure of the Course

- Lectures
  - **Goal: To introduce concepts in linear algebra, and motivate their use and importance.**
  - **Note: We try to cover useful materials in class, but we recommend you reading more!**
- Assignments
  - **Purpose:** To give you a chance to exercise your mind, and to solidify the concepts introduced to you in class.
  - **Structure:** Six theorical problems, and one linear algebra practical problems.
  - **Importance**: Not important unless you want to learn the material and get a good grade.
- Project (Application)
- Exams: Two Midterms + Final

Lecture Notes

- Lecture slide will be uploaded.
- Many times we will write on board, in real-time, during lecture to prove a theory or answer a question or add some additional explanations. It will be your responsibility to take notes.
- Slides links will be provided on site.

Homework

- Five series
  - 6 theory questions
  - 1 practical question
    - Basic Python for programming
    - Basic NumPy for array manipulation
    - Basic programming with Pytorch
    - Learning linear algebra and application of machine learning.
- Assignments will be released on Friday every two weeks. Students will have 14 days for both theoretical and practical questions to submit answers in Quera
- Homework Upload:
  - https://quera.org/course/14555/

Homework Assignments and the Final Project Schedule

Assignment	Release	Submission	Solution Release	
1	1402/07/18	1402/08/05	1402/08/08	2 Weeks
2	1402/08/05	1402/08/19	1402/08/22	2 Weeks
3	1402/08/26	1402/09/17	1402/09/20	3 Weeks
4	1402/09/17	1402/10/01	1402/10/04	2 Weeks
5	1402/10/08	1402/10/22	1402/10/25	2 Weeks
Final Project	1402/09/24	1402/11/11		

Important: Note that this schedule is tentative and may be affected by unforeseen circumstances.

TA

- TA class: (Wednesdays 17:00 – 18:00(
  - Problem solving classes: Classes to solve additional questions will be held approximately every other week during the semester.
  - Exams Exclusive classes: In particular, for each of the midterm and the final exam, a TA class will be held so that students can prepare adequately for the exam.
  - Python workshops: For those students who are not familiar with Python and its related libraries, four workshop classes will be held to cover Python, NumPy and visualization libraries.
  - Virtual Class
  - https://vc.sharif.edu/ch/rabiee-ta

Date	Title
1402/07/26	HW1
1402/08/17	HW2
1402/08/24	Midterm 1
1402/09/15	HW3
1402/09/22	Midterm 2
1402/09/29	HW4
1402/10/20	HW5
1402/11/02	Final

Grading Scheme

Item	Grade
Homework	40% (8 points)
Final Project	5% (1 point)
Midterm Exams	35% (3.5+3.5 points)
Final Exam	25% (5 points) (Comprehensive)
Class Homework	😄
Total	21+ 😄

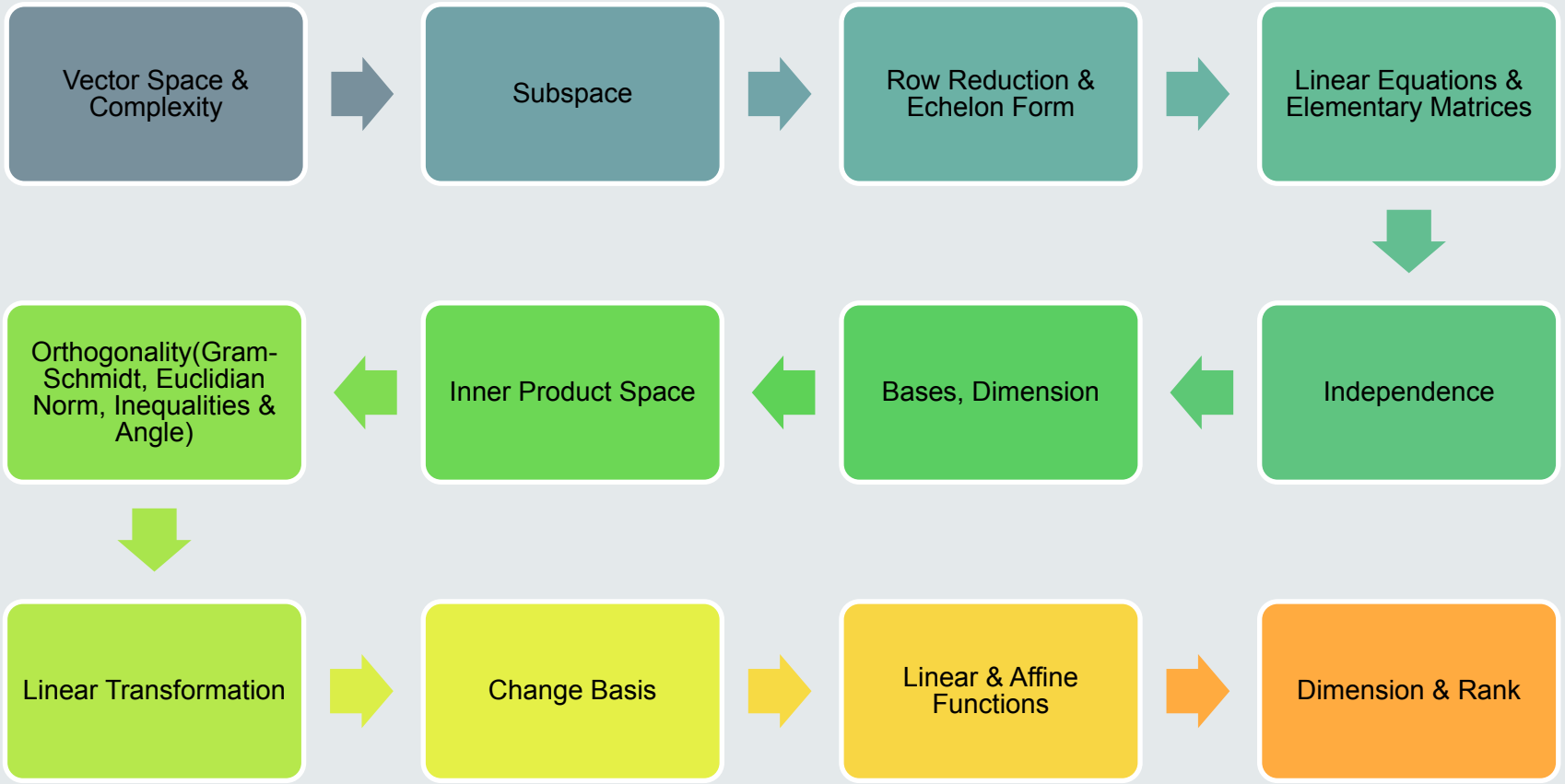
- Mid-Term 1 Exam: 17.5% (1402/08/25 9:00 AM)
- Mid-Term 2 Exam: 17.5% (1402/09/23 9:00 AM)
- Final Exam: 25% (Comprehensive) (1402/11/03 9:00 AM)

Homework Rules

- Homework and Project: 45%
  - Homework Assignments: 8 points, 5 series with 1.1 points for theoretical questions and 0.5 point for practical questions
  - Final Project: 1 point
    - You have a total 16 days of allowed late submission (for both theoretical and code part). 0.5% of the assignment grade will be subtracted for each hour of delay
- For each homework, you can use your late submission up to 3 days.

  No submissions are accepted after TA class.
- Discussing the problems with each other is encouraged. Copying each others assignments or submitting solutions/ answers on the web is strictly prohibited. First time, you will receive -100% of grade for the task at hand. If you are caught for a second time, you will fail the course.

Course Roadmap



Course Roadmap