

# Deep Learning

4DV661

Applied Math Basics

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# Course structure

1. Introduction
2. Applied Math Basics
3. Deep Feedforward Networks
4. Regularization for Deep Learning
5. Optimization for Training Deep Models
6. Convolutional Networks
7. Sequence Modeling: Recurrent and Recursive Nets
8. Practical Methodology
9. Applications

# Applied Math Basics

- Linear Algebra
- Probability and Information Theory
- Numerical Computation

# Agenda for part 1

- Scalars, Vectors, Matrices and Tensors
- Multiplying Matrices and Vector
- Identity and Inverse Matrices
- Linear Dependence and Span
- Norms
- Special Kinds of Matrices and Vectors
- Eigen decomposition
- Singular Value Decomposition
- The Moore-Penrose Pseudoinverse
- The Trace Operator
- The Determinant
- Principal Components Analysis (PCA)

# Applied Math Basics

- Linear Algebra
- Probability and Information Theory
- Numerical Computation

# Agenda for part 2

- Why Probability?
- Random Variables
- Probability Distributions
- Joint and Marginal Probability
- Conditional Probability
- Chain Rule
- Bayes' Theorem
- Independence and Conditional Independence
- Expectation, Variance and Covariance
- Common Probability Distributions
- Information Theory
- Structured Probabilistic Models / Bayesian Networks

# Applied Math Basics

- Linear Algebra
- Probability and Information Theory
- Numerical Computation

# Agenda for part 3

- Overflow and Underflow
- Poor Conditioning
- Gradient-Based Optimization
- Constrained Optimization
- Example: Linear Least Regression



# Assignment 2

- Create a new Jupyter notebook with text and Python code by following the instructions and the example of **one** of the following
  - "Assignment2-DL-Matlab.pdf" (PCA and Eigendecomposition)
  - "Assignment3-DL-Matlab.pdf" (Probability and Information Theory)
  - "Assignment4-DL-Matlab.pdf" (Numerical Linear Regression)
- Watch the videos of and read Chapter 6 Deep Feedforward Networks
  - Video <https://www.youtube.com/watch?v=oFa0Xe6fcBk> ca 1h 35 min
  - Book 80 pages
- Deadline: 2025-04-15, 15:00 (before the next lecture)