EE769 Introduction to ML
Welcome to the course

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Why make machines learn?

$Input_i$ → **Models** → $Output_i$

- Defining models is tedious
- Defining models is inflexible
- Useful models are unknown, but…
- We may know something about the output
- ML algorithms discovering useful approximate models for complex mappings

You will learn to

- Assess whether a problem is suited for ML
- Map problems to popular ML frameworks
- Precisely define and describe ML models
- Code and train ML models
- Compare ML models
- Follow basic proofs of guarantees in ML
- Identify directions for advanced ML R&D

Prerequisites

- Basic linear algebra
  - Matrix-vector products, dot products, eigen vector definition, …
- Intermediate probability
  - Continuous random variable, PDF, conditional distribution, marginalization
- Basic calculus
  - Derivatives, partial derivatives, maxima of a function
- Intermediate programming
  - Loops, functions, arrays, i/o, file i/o, graph plotting

Books

- Pattern Recognition and Machine Learning, by Christopher Bishop

- Understanding Machine Learning: From Theory to Algorithms, by Shalev-Shwartz and Ben-David

Topic plan

- Linear regression
- Nonlinear regression
- Sparse models
- Linear classification
- Nonlinear classification
- Optimization
- Feature Engineering
- Intro to deep learning
- Combining models
- Dimension reduction
- Clustering
- Modeling densities
- EM algorithm
- Intro to graphical models
- Intro to RL
- Intro to learning theory

Evaluation plan

Item	Wt.
Class notes and tutorial problems (10 to 12)	15
Programming assignments (4 to 5)	20
Mid-sem exam	20
End-sem exam	30
Group Project	20
Total (incl. 5 mark bonus)	*105*

Min. marks	Grade
90	AA
80	AB
70	BB
60	BC
50	CC
40	CD
30	DD
30	AU

Evaluation items

- Precise understanding of concepts
- Express concepts mathematically
- Make basic mathematical derivations
- Program diligently
- Design experiments diligently
- Interpret results
- Zero tolerance for academic malpractice

How to get the most out of this course

- Listen to pre-recorded lectures
  - Take notes while listening to lectures
- Read books and internet resources
- Attempt problems
- Discuss with classmates
- Become comfortable with programming
- Ask TAs and instructors any remaining doubts

Weekend task

- **Python:**
  - https://www.learnpython.org/
- **Numpy and Google CoLab:**
  - https://cs231n.github.io/python-numpy-tutorial/
- **Linear algebra and calculus:**
  - https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus
- **Probability:**
  - https://stanford.edu/~shervine/teaching/cs-229/refresher-probabilities-statistics