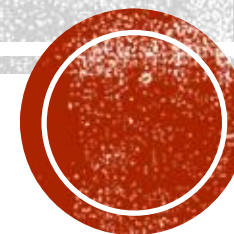


MACHINE LEARNING

CS 229 / STATS 229



INTRODUCTION



Anand
Avati

Teaching Assistants



Carolyn
Kim



Chenru (Helen)
Liu



Hojat
Ghorbani



Jian
Zhang



Nandita
Bhaskhar



Ruiyang
Song



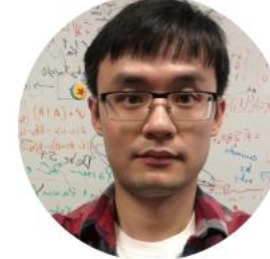
Sandeep
Chinchali



Shaimaa
Bakr



Soyeon
Jung



Zhenglin
Geng



GOALS

By the end of the course,

- Be an expert in ML (understand the internals of ML algorithms)
- Be able to build ML applications (know which algorithms to use when)
- Be able to start ML research (read research papers)



PREREQUISITES

- Basic computer science principles
 - Big-O notation
 - Comfortably write non-trivial code in Python/numpy
- Probability (CS 109, STATS 116 etc.)
 - Random Variables
 - Expectations
 - Distributions
- Linear Algebra & Multivariate/Matrix Calculus (MATH 51, etc.)
 - Gradients and Hessians
 - Eigenvalue/vector



HONOR CODE

- Form study groups (strongly encouraged!)
- Independently write-up homework and code
- **It is an honor code violation to intentionally refer to a previous year's assignments.**



COURSE STRUCTURE

- 3 Homeworks : 60% (3 x 20%)
- Final exam (take home) : 40%



LOGISTICS

- Course website (calendar, deadlines, notes) - <http://cs229.stanford.edu>
- Piazza
- Gradescope



WHAT IS ML?

- Term “Machine Learning” coined by Arthur Samuel in 1959.
 - Samuel Checkers-playing Program
- Common definition (by Tom Mitchell):
 - **Machine Learning is the study of computer algorithms that improve automatically through experience** → prior data, examples from past training set
- Subfield of **Artificial Intelligence (AI)** → ML is a subset of AI
 - The hottest subfield - reinvigorated interest in AI due to deep learning!

Building program which operate level of performance
ML is one approach of how to implement that program



RECENT PROGRESS

- Computer Vision / Image Recognition
 - ImageNet
 - Convolutional Neural Networks
 - Autonomous driving
- Speech Recognition
 - Voice assistants
- Language Translation
 - Google Translate ? so suck
 - Unsupervised Translation
- Game Playing / Deep Reinforcement Learning
 - ATARI
 - AlphaGo



COURSE PREVIEW

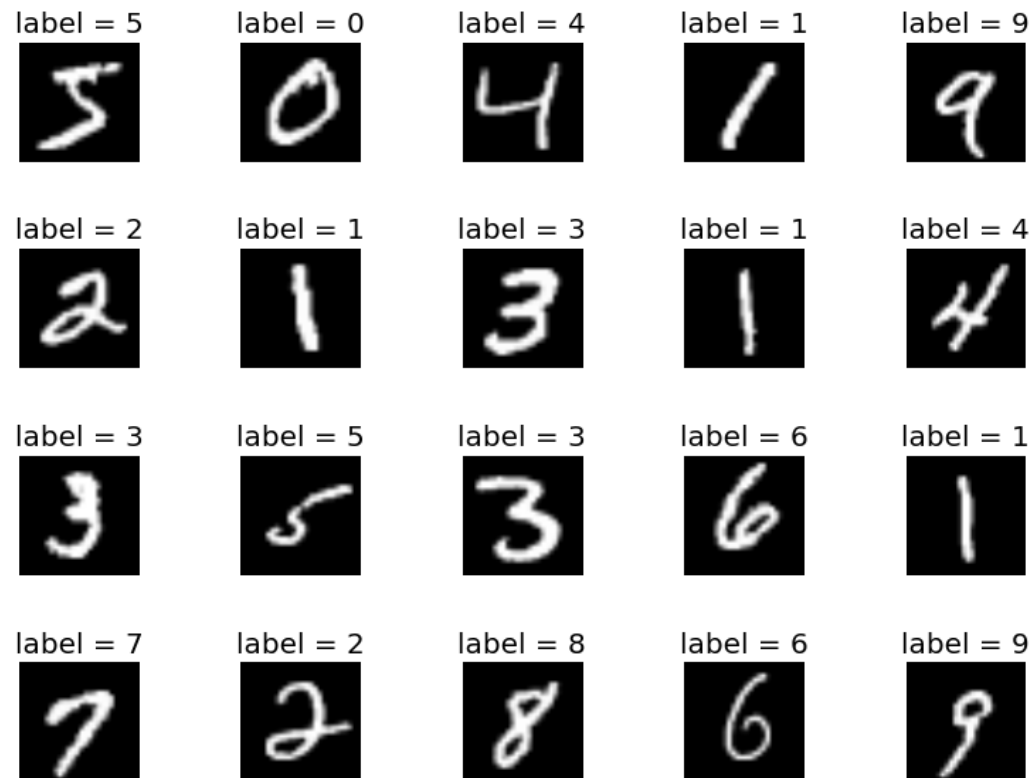
telling algorithm what output is

- Supervised learning [Input -> Output mapping]
 - Classification vs Regression
 - Parametric vs Non-parametric
 - Generative vs Discriminative
 - Probabilistic vs Non-probabilistic
- Unsupervised learning [Learn interesting structures in the data]
 - Clusters vs Subspaces
 - Probabilistic vs Non-probabilistic
- Deep Learning [Learning representations]
 - Our focus: supervised setting
- Learning Theory
 - Bias-Variance Tradeoff
 - Generalization and Uniform Convergence
- Reinforcement Learning [Sequential Decision Making]

give data partition



PREVIEW - SUPERVISED



PREVIEW — UNSUPERVISED (ICA)

Mixed



Separated



PREVIEW — UNSUPERVISED (ICA - II)

Mixed



Separated



PREVIEW — REINFORCEMENT LEARNING

