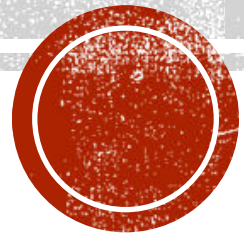
MACHINE LEARNING
CS 229 / STATS 229

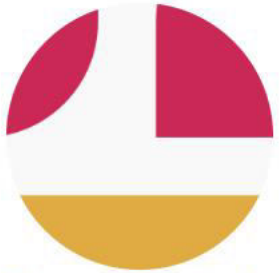


INTRODUCTION

Anand Avati

Teaching Assistants

Carolyn Kim



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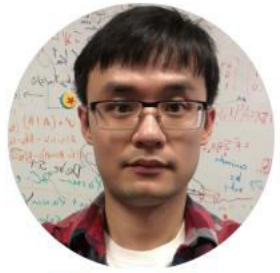


Zhenglin Geng

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***

- Subfield of Artificial Intelligence (AI)
  - The hottest subfield - reinvigorated interest in AI due to deep learning!

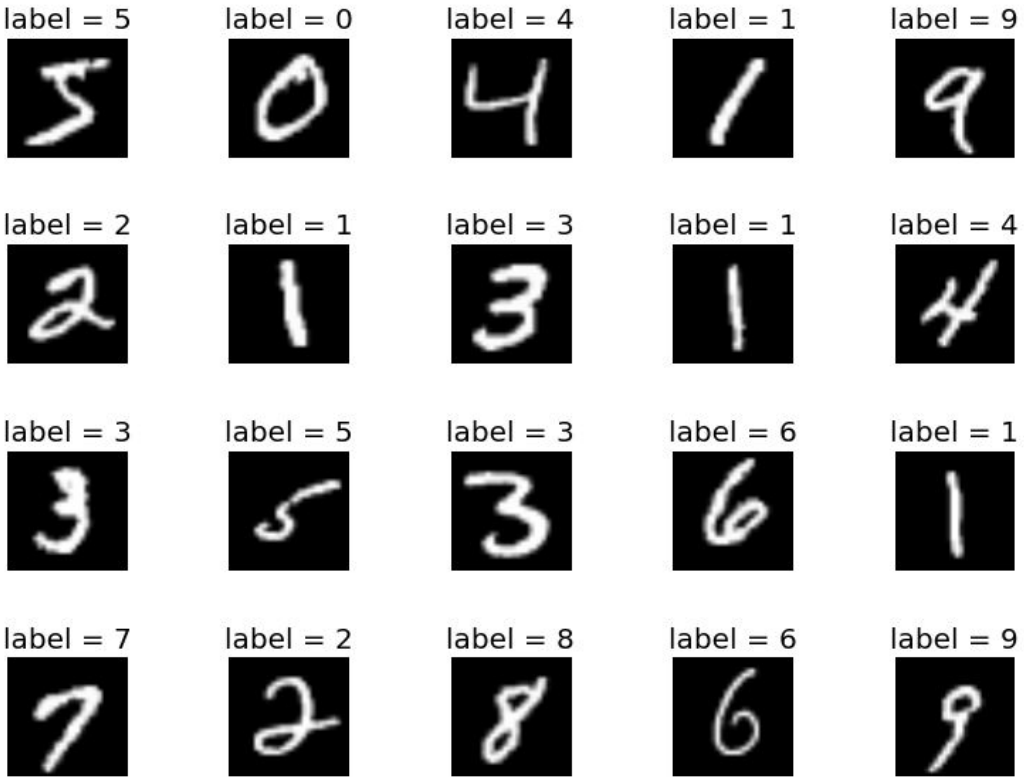
RECENT PROGRESS

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

COURSE PREVIEW

- 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]

PREVIEW - SUPERVISED



PREVIEW – UNSUPERVISED (ICA)

Mixed

Separated

PREVIEW – UNSUPERVISED (ICA - II)

Mixed

Separated

PREVIEW – REINFORCEMENT LEARNING