15:750
Algorithms in the Real World

Instructor
Prof. Rashmi Vinayak

Lecture 1

Today

- Introduction
- Course overview
- Logistics
- Start with the topics

Course Staff

Instructors: Rashmi Vinayak

TAs:

Yash Savani

Billy Yan

Instructors

Rashmi Vinayak
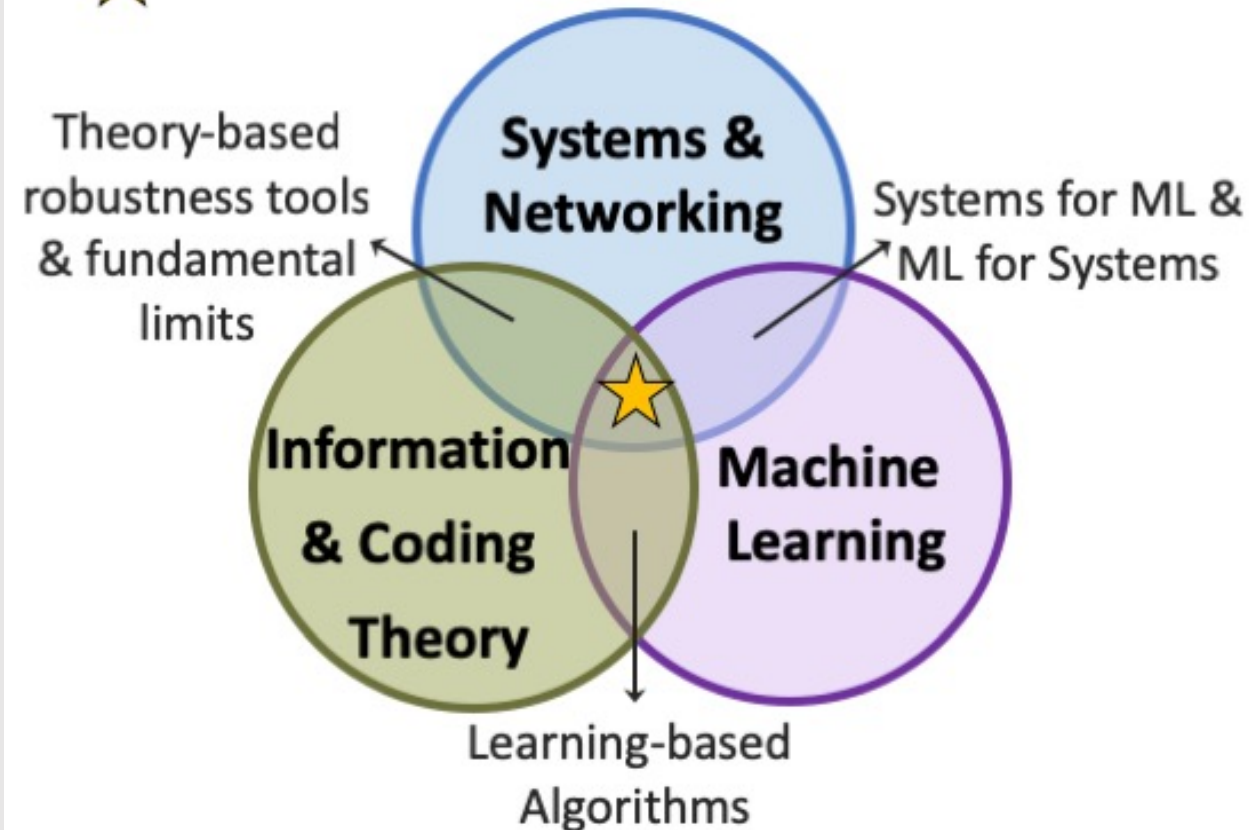
http://www.cs.cmu.edu/~rvinayak/

TheSys Lab
Research on both Theory and Systems

On Information & Coding Theory:
We formulate & solve theory problems based on real-world system challenges

Robust and efficient next-generation data systems

Theory-based robustness tools & fundamental limits

Systems & Networking

Systems for ML & ML for Systems

Information & Coding Theory

Machine Learning

Learning-based Algorithms

Course content overview

Learning goals

Cover algorithms and tools that give students the ability to

- recognize which tool or method to apply to problems,

- to become reasonably proficient at using these tools, and

- to be able to reason about the correctness and performance of the resulting algorithms

Topics

- A refresher on basic algorithmic principles:
  - greedy, divide-and-conquer, dynamic programming, and their applications
- Hashing and Randomization
- Streaming algorithms (a.k.a. algorithms for big data)
- High-dimensional data: dimensionality reduction, nearest neighbor
- Flows and Cuts
- Linear Programming and Duality
- Convex Programming
- Error Correcting Codes
- Compression
- Optimization (including gradient descent)
- … potentially more topics…

Required preliminaries

Basic linear algebra and probability

- E.g., matrix/vector operations, conditional probability

Basic algorithms

- Any undergraduate level algorithms course

Course website has some resources

Course logistics

Communication

Piazza: all course related communication

- All technical questions should be discussed via Piazza

- Let's not use private messages unless necessary—if you have a question it is very likely other students have it too! (You can be anonymous to other students, of course.)

Office hours

- TA office hours: Shown on the calendar on the course webpage

- Rashmi Vinayak's office hours will be by appointment

  - Please send Rashmi a private Piazza message along with a brief description of what you would like to discuss

Course materials

- No mandatory textbook
- We will provide lecture notes / reading from books / slides on the course website
  - https://www.cs.cmu.edu/~15750/
- Course website lists some good books that you can use as reference
- Lecture materials will be added after each lecture

Evaluation

32% for take-home midterm (**October 12**)

32% for take-home finals (**December 8**)

32% for homeworks (~6 HWs, roughly one every 2 weeks)

4%   for attendance/class participation in lecture or Piazza

Homework policy

- Need to write own solutions. Cite all sources!

- Submissions on Gradescope

- For each homework, there will be a two-day (48 hours) no-questions-asked extension.

  - Can use this extension for any valid reason without having to ask the instructors.

  - No additional extensions (except for exceptional circumstances)

Questions?