Term: 2024 Spring / Full Term

Instructor: [Heng (Hank) Yang](#)

Teaching Fellow: [Safwan Hossain](#)

Meeting Time: Monday / Wednesday 2:15PM - 3:30PM

Classroom: SEC 1.413

Enrollment Limit: N/A

Course Description:

This course teaches the theory, computation, and applications of semidefinite optimization and relaxation, a paradigm that leverages convex semidefinite programming (SDP) for approximately (and sometimes exactly) solving nonconvex optimization and decision-making problems. The theoretical focus will be the celebrated moment and sums-of-squares (SOS) hierarchy, its sparse variants, and its extensions to min-max optimization. The computational focus will be numerical algorithms for solving SDPs, such as interior-point methods and more recent low-rank solvers. Applications from applied mathematics, control, computer vision, and robotics are used to illustrate the practical usefulness of the theory and algorithms.

Syllabus:

https://docs.google.com/document/d/1H6Wqht_PVw_n8Jl0kXN3HjZfHkeZJYqYWT4ayxvqRlU/edit?usp=sharing

Lecture Notes:

https://hankyang.seas.harvard.edu/Semidefinite/

Prerequisites:

Familiarity with linear algebra (at the level of Math 21b), probabilistics, calculus, and basic programming (Matlab, Python etc). It is recommended to have basic knowledge about convex optimization (e.g., CS 128), and control and robotics (e.g., [ES/AM 158](#)), though this is not strictly necessary.

Contact:

Please email Heng Yang (hankyang@seas.harvard.edu) for questions and comments related to the course.