Course Website

Course materials will be posted on the course website:

`http://www.cs.princeton.edu/~mbraverm/pmwiki/index.php?n=Site.InfoTheoryInCS2013`

Instructor and Lectures Info

Instructor	**Office**	**Email**	**Office Hours**
Mark Braverman	*CS Building 411*	`mbraverm@cs.princeton.edu`	*MW 4:30-5+pm or by appointment*

Lecture: *Time:* MW 3:00-4:20pm *Place:* CS 301

Outline

In this research-oriented seminar we will explore information theory and recent research in computer science that applies information-theoretic techniques or connects to the information-theoretic way of thinking. We will start by developing the basic notions from information theory, such as Shannon's entropy, mutual information etc. We will then proceed to explore applications in several areas including combinatorics, communication complexity, and data structure lower bounds. In addition, we will discuss the relatively new area of information complexity. The second half of the course will consist of presentations by students on topics of interest related to the course topic. A secondary objective of the seminar is to develop participants' presentation skills for technical results in TCS.

The tentative list of topics to be covered (not necessarily in this order) includes:

- Basic information theory;
- Communication complexity;
- Distributed computing and multi-terminal communication;
- Information complexity;
- Data structure and streaming lower bounds;
- Interactive error correction.

Additional topics that may be covered depending on interests (possibly by students):

- Coding theory;
- Message passing algorithms and connections to learning and inference;
- Basics of spectral graph theory;
- Quantum communication complexity;
- Kolmogorov complexity and applications.

Reference materials

- "Elements of Information Theory" by Cover and Thomas (a key reference on information theory basics);
- "Communication Complexity" by Kushilevitz and Nisan (a bit outdated, but still the only reference specifically on communication complexity);
- "Information Theory, Inference, and Learning Algorithms" by MacKay;
- Additional books and especially papers TBD.

Grading

The grading will be based on three components:

- $\approx$ 2 assignments – 25%;
- participation (which may include scribing) – 30%;
- a presentation and report – 45%.