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Information and Communication Complexity

Instructor

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Department: Electrical communication engineering

Course Time:

Lecture venue:

Detailed Course Page: http://www.ece.iisc.ernet.in/~htyagi/course-E2206-2017.html

Announcements

Brief description of the course

How many bits must two (or more parties) communicate to compute a function of their collective data? This fundamental problem of communication complexity, besides being of independent interest, has emerged as a standard tool for establishing lower bounds for computation complexity, circuit complexity, memory requirements for streaming algorithms and many more problems in theoretical computer science. E2206 is a graduate level course aimed at introducing communication complexity to information theorists. In addition to covering the basic concepts, special emphasis will be placed on the use of information theoretic techniques. In particular, we shall cover the recent developments based on relating information complexity to communication complexity.

Prerequisites

A course on Information Theory or Computational Complexity Theory. Basic mathematical maturity and working familiarity with probability calculations.

Syllabus

1. Deterministic communication complexity; Randomized communication complexity

2.Distributional communication complexity; Yaoâ€™s minimax theorem

3.Interactive data compression and function computation

4.Variable partition model: Computation over networks and Complexity of implementing VLSI circuits

5.Set disjointness: Space complexity of streaming algorithms

6.Communication complexity of relations: Circuit complexity

7.Lower bounds for deterministic communication complexity

8.Reduction based lower bounds

9.Partition lower bound

10.Information complexity based lower bounds

Course outcomes

This course is meant for second or third year graduate students who already have encountered communication complexity and information theory in their research. On completion of this course, a student is expected to understand various measures of communication complexity and relation between them. He or she should be able to identify the communication complexity bottlenecks in various theory problems and should develop the art of showing optimality using communication complexity lower bounds. The student should have a good exposure to recent developments in this fundamental field and also to various use-cases.

Grading policy

Homework: 60%; Literature review and project: 30%; Class Participation: 10%

Assignments

Resources