Coding Theory for Theoretical Computer Science

EECS 598/498, Fall 2019
Instructor: Mahdi Cheraghchi

Since the seminal work of Shannon in 1948 that introduced a mathematical notion of information, the theory of error-correcting codes has served as a proxy to provide effective mechanisms to translate the theoretical predictions of information theory into practical engineering systems. Over the past few decades, however, coding theory has found vast applications outside its intended domain, notably in various aspects of theoretical computer science.

The aim of this course is to provide an introduction to coding theory from a theoretical computer science perspective, and showcase the fascinating interplay between the two topics.

A tentative list of topics to be covered includes: basics of codes, linear codes, fundamental bounds on codes, composition of codes, algebraic codes, combinatorial and algorithmic list decoding, applications to cryptography and learning theory, locally testable and locally decodable codes, expander graphs and graph-based codes, hardness and randomness, list recovery and soft decision, randomness extractors, sparse signal processing and sparse transforms.

Prerequisites: Graduate or senior standing, or permission of the instructor.
Recommended: EECS 203, EECS 301, EECS 376, Math 217, or equivalents.