

Information Theory and Reliable Communications

Tue Thu 3:50-5:10, Light Eng Rm 152

Instructor: Nam Phamdo

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Office Hours: Tue Thu 1:00 pm — 3:00 pm; also by appointment

Course Outline: Information theory is the mathematical theory of communication. It provides fundamental limits on the performance of various communication systems. It also has profound implications on other fields of science including physics, computer science, mathematics, economics and statistics. The emphasis of this course, however, is on the communication aspects of information theory. Topics to be covered include:

1. Measures of Information: entropy, relative entropy and mutual information. Chain rules, log-sum inequality and Fano's inequality.
2. Asymptotic Equipartition Property: typical and atypical sets, consequences of the AEP.
3. Lossless Source Coding: entropy rate of stochastic processes, Kraft's Inequality, Huffman code, lossless source coding theorem.
4. Coding for Discrete Channels: capacity of discrete memoryless channel, jointly typical sets, the channel coding theorem, data processing theorem, introduction to error control coding.
5. Continuous and Waveform Gaussian Channels: differential entropy, relative entropy and mutual information; capacity and waterfilling.
6. Rate-Distortion Theory: rate-distortion function and its significance.

Prerequisites: ESE 503 or basic understanding of probability and random processes.

Textbook: T. Cover and J. Thomas, *Elements of Information Theory*.

Reference Books: (1) R. Gallager, *Information Theory and Reliable Communication*, (2) R. Blahut, *Principles and Practice of Information Theory*.

Quizzes: A 30-minute quiz will be given every other week at the beginning of class. Quizzes will be given on the following Tuesdays: 2/8/98, 2/22/98, 3/7/98, 3/28/98, 4/11/98, 4/25/98. Only the five highest quiz scores will be counted toward the final grade. Any student who misses a quiz will automatically be given a "zero" for that quiz. Absolutely no make-up quiz will be given.

Grading:

Homework	10%
Project	10%
Quizzes	40%
Final Exam	40%
Total	100%

The Final Exam will be held on **Tuesday, May 16, 2000** at **12:00 – 3:00 pm**

If you have a physical, psychological, medical or learning disability that may impact on your ability to carry out assigned course work, I would urge that you contact the staff in the Disabled Student Services office (DSS), Room 133 Humanities, 632-6748/TDD. DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.