

Portland State University
Systems Science Ph.D. Program
Fall 2004

SySc 545/645 ECE 563/663
CH 400A
Tues. & Thurs. 2:00-3:50

INFORMATION THEORY

- Instructor:** Andy Fraser, andy@sysc.pdx.edu or 725-4989.
Office: Harder House, RM #3 at PSU.
- Web Site:** <http://www.ece.pdx.edu/~andy/info1>
- Text:** *Elements of Information Theory*, by Cover and Thomas.
- Prerequisites:** Vector calculus, probability or statistics, computer literacy, and exposure to Fourier transform techniques.

Information Theory establishes theoretical limits on the performance of techniques for compression or error correction of signals. Initially the field seemed theoretical and not closely related to engineering applications, but with the declining cost of processing power, higher performance signaling techniques that approach the theoretical limits have been implemented. The key to developing or understanding these techniques is familiarity with Information Theory.

A core of common ideas links the fields of Information Theory, Ergodic Theory, Statistics, and Statistical Mechanics, and the text dedicates several chapters to these links. While I will touch on these links in the course, I will concentrate on communications applications, specifically source coding and channel coding for discrete signals. I will certainly cover the material in chapters 1 through 5, and chapter 8 of the text. In the remaining time I may examine part of the generalization to continuous signals (chapters 9, 10, 12, and 13).

The sequence of topics will be:

- Entropy and Mutual Information.
- Asymptotic Equipartition: the Ergodic Theorem of Information Theory.
- Entropy Rates of Information Sources.
- Data Compression.
- Channel Capacity.
- Additional Topics.