

MATH 6397
Information Theory with Applications
Fall 2008

- Class:** TuTh 10:00am-11:30am, PGH 350
- Instructor:** Bernhard Bodmann, bgb@math.uh.edu
- Office:** Tu 2:30-3:20pm, We 2-3pm, PGH 636
- Objectives:** The first part of the course is dedicated to the traditional, statistical formulation of source and channel coding (compression and noise-insensitive transmission) of scalar sources. The second part concerns the generalization for vector-valued sources, which is fundamental for streaming media and wireless communications. Apart from mathematics, this course has relevance for applications in physics, statistics, computer science and electrical engineering. The emphasis will be on understanding the main ideas with a view to applications. Some group projects involving simulations will be given, but no extensive computer programming experience will be assumed.
- Course Content:** Basics of Information Theory (Entropy, Joint entropy, Conditional entropy, Mutual information, Kullback-Leibler divergence), Coding theory (Source coding, Information rate and ergodicity, Arithmetic codes, Channel capacity, Inequalities for data processing, Channel capacity of particular model channels), Applications to other fields (Cryptography, Pseudo-random number generation), Vector-valued generalizations (Vector quantization, Sphere packing and asymptotics, Sigma-delta quantization, Frame design for multiple-description channels)
- Prerequisites:** Graduate standing or consent of instructor. Knowledge of Matlab useful, but not a strict prerequisite.
- Recommended Texts:** T.-S. Han and K. Kobayashi, Mathematics of Information and Coding, AMS, 2001 (approx \$90); R. Gray, Entropy and Information Theory, Springer, 1991, available online (free).
- Assessment:** There will be one midterm (worth 30 points), a final exam (40 points) as well as 4 take-home problem sheets (30 points in total).
- Exam Dates:** Midterm on Th, Oct 23, 2008; Final exam on Th, Dec 4, 2008