

Math 477/877 - Source Coding and Quantization

Winter 2007

- Instructor:** Tamas Linder - Jeffery Hall 401
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- Course Web Site:** <http://www.mast.queensu.ca/~math477>
All important announcements will be posted here.
- Time/Place:** Slot 1 (Monday 8:30, Tuesday 10:30, Thursday 9:30) Jeffery Hall 422
- Office Hours:** Monday 10–11:30 am (tentative)
- Text:** Class notes (posted on the course web site)
A. Gersho and R. M. Gray, *Vector Quantization and Signal Compression* Kluwer, Boston, 1992.
- Grading:** 20% homework, 20% mid-term test, 60% final exam.
Undergraduate students will receive a reduced load.
- Prerequisite:** Information Theory (Math 474/874)

Course Outline

The objective of source coding (a.k.a. data compression) is to give a compact representation of information bearing signals (such as speech, still image, and video) for the purpose of storage or transmission. In this course the fundamentals of the theory and practice of source coding will be studied, with main emphasis on lossy source coding. The following is a list of topics that will be covered in more or less detail.

- *Scalar Quantization:* uniform and nonuniform quantization, predictive quantization.
- *Frequency Domain Coding:* Transform coding, bit allocation, subband coding, wavelet coding.
- *Vector Quantization:* Optimality conditions, geometric structure, design algorithms (Lloyd-Max and related methods).
- *High Resolution Theory:* Companding quantization, Bennett's integral, the Zador-Gersho formula.
- *Fundamentals of Rate-Distortion Theory:* The rate-distortion function and its properties, the lossy source coding theorem.
- *Structured Vector Quantization:* Lattice quantization, multistage and tree-structured vector quantization, trellis coded quantization.
- *Variable Rate Quantization:* Entropy coded quantization, greedy growing and pruning of tree structured vector quantizers.
- *Standards:* JPEG, JPEG 2000, CELP, MPEG