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Source Coding and Quantization

MATH-477*

Textbook: *Vector Quantization and Signal Compression*
by A. Gersho and R. M. Gray (Kluwer, Boston, 1992)
Class Notes

Instructors: T. Linder and D. Nagy

Prerequisite: MATH-474*

Evaluation:	Homework	20%
	Midterm Test	20%
	Final Examination	60%

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