

**EECS 651 Source Coding Theory
Winter 2001**

Proposed Syllabus

Numbers in parentheses are estimated numbers of lectures.

1. Introduction (2)
 - JPEG image coding
 - Overview of the course
2. Fixed-rate lossy coding (10)
 - Vector quantization (VQ) as the lossy coding paradigm
 - partition, codebook, rate, distortion (MSE), opta functions
 - Examples (structured and unstructured)
 - Bennett's high-resolution analysis of distortion
 - Zador's high-resolution analysis of the opta function
 - Summary of Shannon's rate-distortion analysis of the opta function
 - Comparison of high-resolution and Shannon analyses
3. Lossless coding (6)
 - Block and conditional variable-length coding
 - Entropy theory
4. Variable-rate lossy coding (4)
 - Vector quantization as the paradigm
 - partition, codebook, binary codebook, distortion, rate, opta functions
 - Examples (structured and unstructured)
 - High-resolution analysis of rate
 - Zador high-resolution analysis of the opta function
 - Comparison with fixed-rate analyses.
5. Specific lossy source codes (fixed and variable-rate) (10)
 - Complexity -- arithmetic operations & storage
 - Scalar quantizers -- uniform and nonuniform
 - Transform coding -- KLT, DCT and wavelet based transforms
 - Predictive coding -- DPCM, Δ -mod
 - Fast quantization of unstructured VQ.
 - Structured VQ: tree-structured, multistage, polar, pyramid, lattice, hierarchical table lookup, ...
6. Speech, audio, imagery and video (6)
 - CELP speech coding
 - MP3-like perceptual audio coders
 - JPEG-2000 wavelet-based image coding
 - MPEG-like video coding
7. Structured lossless codes (3)
 - Lempel-Ziv
 - Arithmetic coding
 - JPEG lossless
8. Source coding for noisy channels