Vector Quantization

- K-means complexity:
  - $M =$ number of training vectors
  - $L =$ number of codewords
  - $N =$ dimension of vectors
- With a full search algorithm:
  - Complexity of codebook design:
    - $MNL$ adds and mults per iteration
    - $(M+L)N$ storage
  - Complexity of the transmitter
    - $NL$ adds and mults per vector
    - $NL$ storage
Tree Codebooks

- $L = \text{number of codewords} = 2^p$
  - 1. Use "k-means" to divide $N$ dimensional span into 2 regions ($L = 2$ in "old" algorithm).
  - 2. Divide each of these 2 regions into 2 more regions using k-means.
  - 3. Repeat step 2 until there are $L$ reconstruction levels
Complexity of Tree Codebook

- Codebook design
  - $2NM \log_2 L$ operations
  - Storage is the same as for full search
- Operation complexity at transmitter
  - $2N \log_2 L$ operations per vector
  - Twice as much storage as full search
Second Generation Image Coding

- Code:
  - edges
  - textures

Arbitrary Shape Coding

- Useful for editing → extracting objects and backgrounds
Video Coding

- Want to take advantage of spatial and temporal redundancy.

The difference between images contains less energy, and is thus more efficient to code.