Pyramid Vector Quantization for Video Coding

draft-valin-videococodec-pvq-00

Jean-Marc Valin
Motivations

- Pyramid vector quantization is a key technique used in Opus (both SILK and CELT parts)
- Investigate PVQ for a video codec (Daala)
- Potential advantages
  - Preserves energy (details) even when details are imperfect (instead of blurring)
  - Implicit activity masking
  - Better representation of coefficients
Transform Codec

16x16 DCT

256-D vector
Gain-Shape Quantization

- Split 256-D vector into sub-vectors
  - All AC coefs, octave split, horizontal/vertical, ...
- Represent as magnitude multiplied by unit-norm vector (radius + point on sphere)
  - Amount of texture vs exact details
- Code magnitude separately
- Code unit-norm vector with a resolution that depends on the magnitude
  - Implicit activity masking (better resolution for smooth areas)
2-D Projection

- Input
2-D Projection

- Input+prediction
2-D Projection

- Input+prediction
- Compute reflection plane
2-D Projection

- Input+prediction
- Compute reflection plane
- Apply reflection
2-D Projection

- Input+prediction
- Compute reflection plane
- Apply reflection
- Compute/code angle
2-D Projection

- Input+prediction
- Compute reflection plane
- Apply reflection
- Compute/code angle
- Code other dimensions
Results

Source code at: http://xiph.org/daala/

JPEG

Daala (R&D)

Same bitrate
IPR

• Mozilla/Xiph.Org considering filing for patents on these techniques
• Will make IPR disclosure when filed
• Will be RF, similar to Xiph.Org Opus license