

Pyramid Vector Quantization for Video Coding

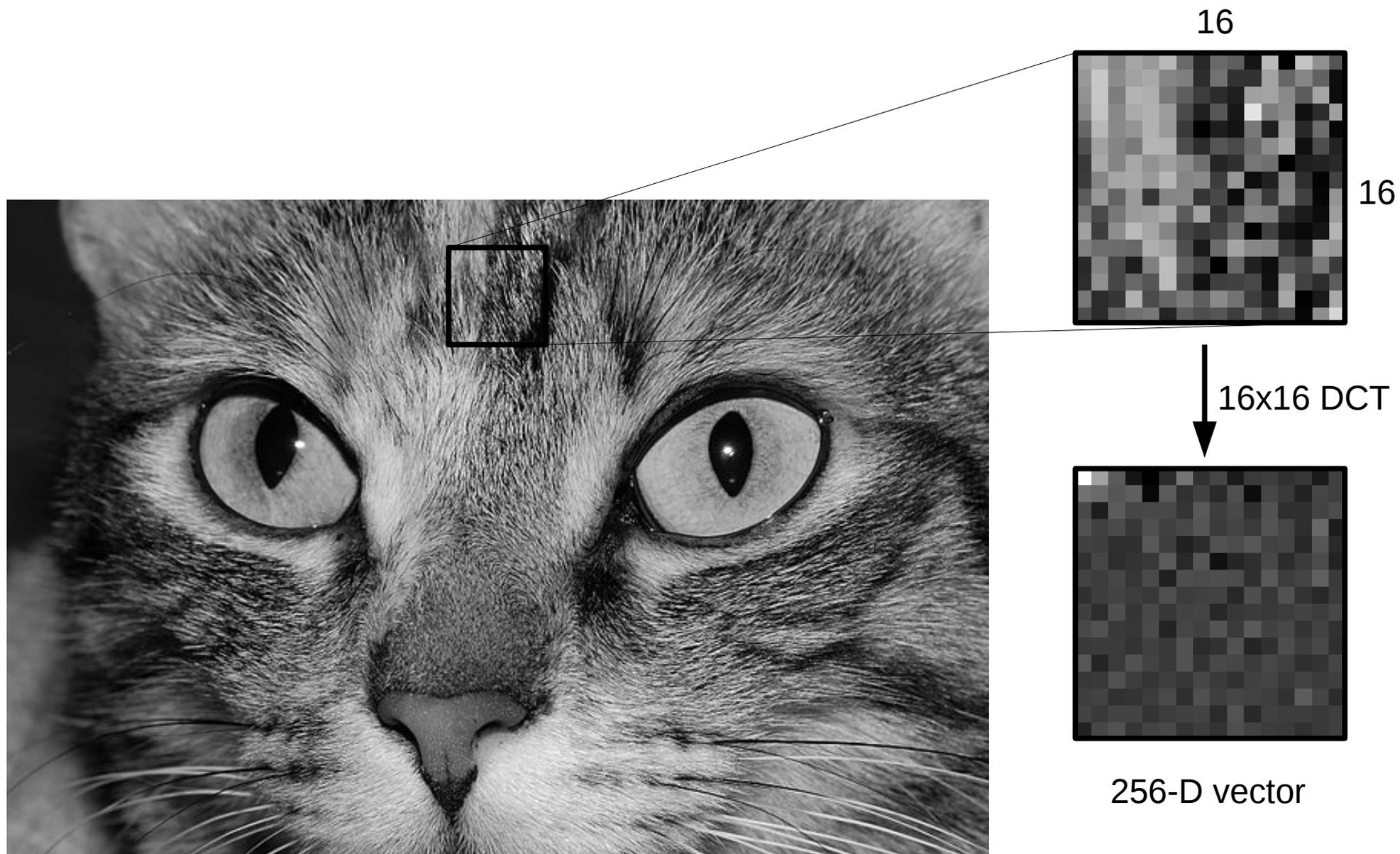
`draft-valin-videocodec-pvq-00`

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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

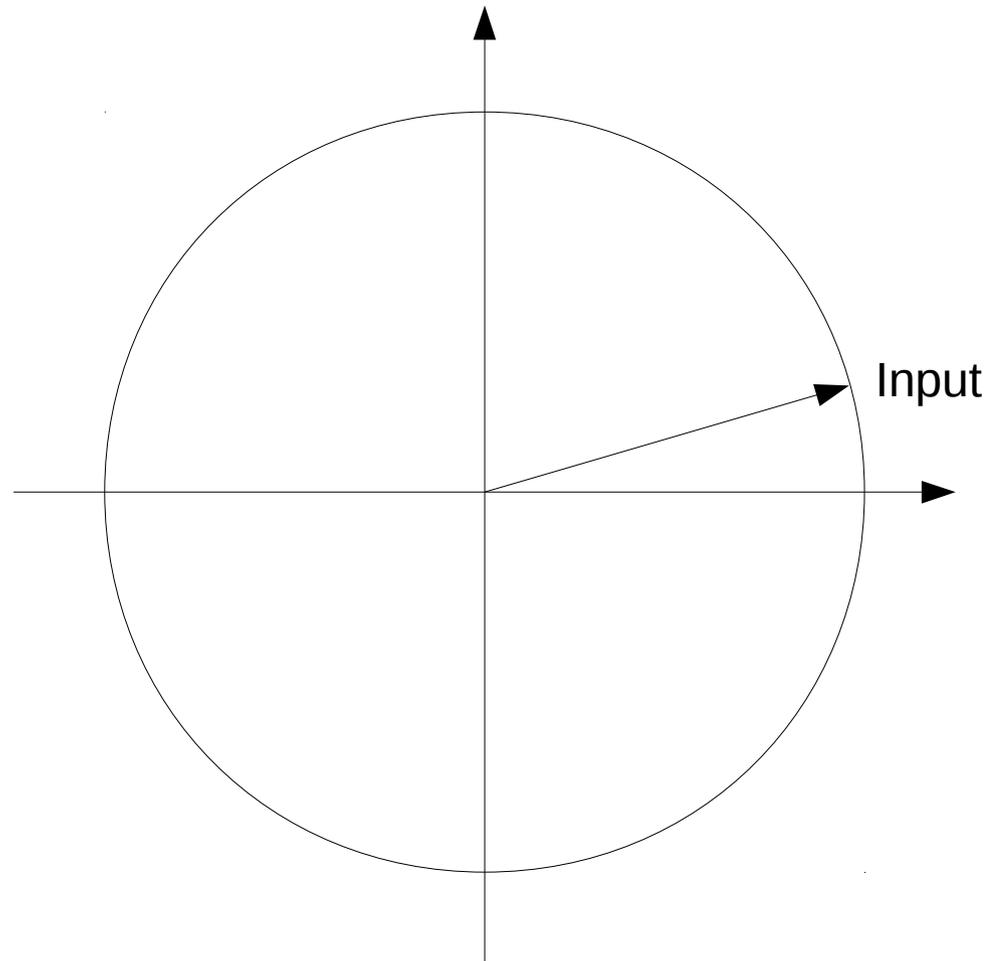


Gain-Shape Quantization

- 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)

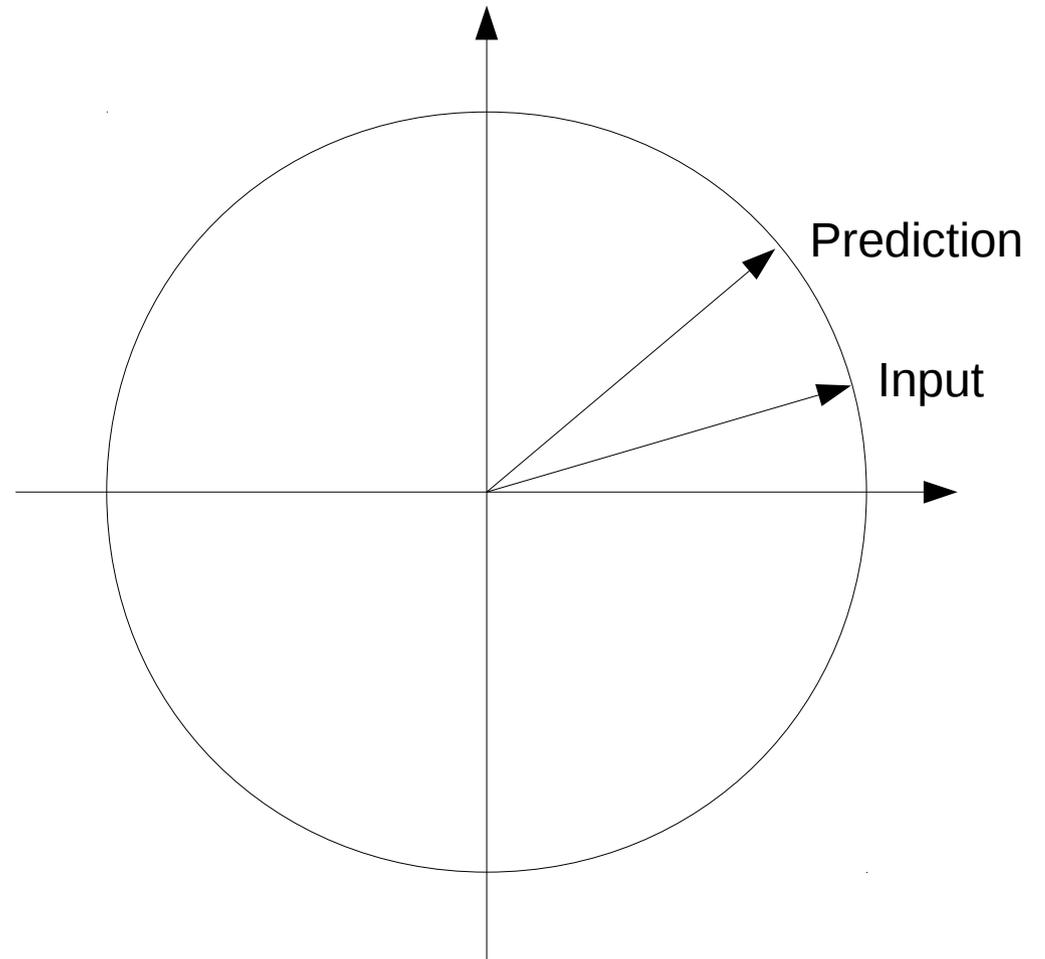
2-D Projection

- Input



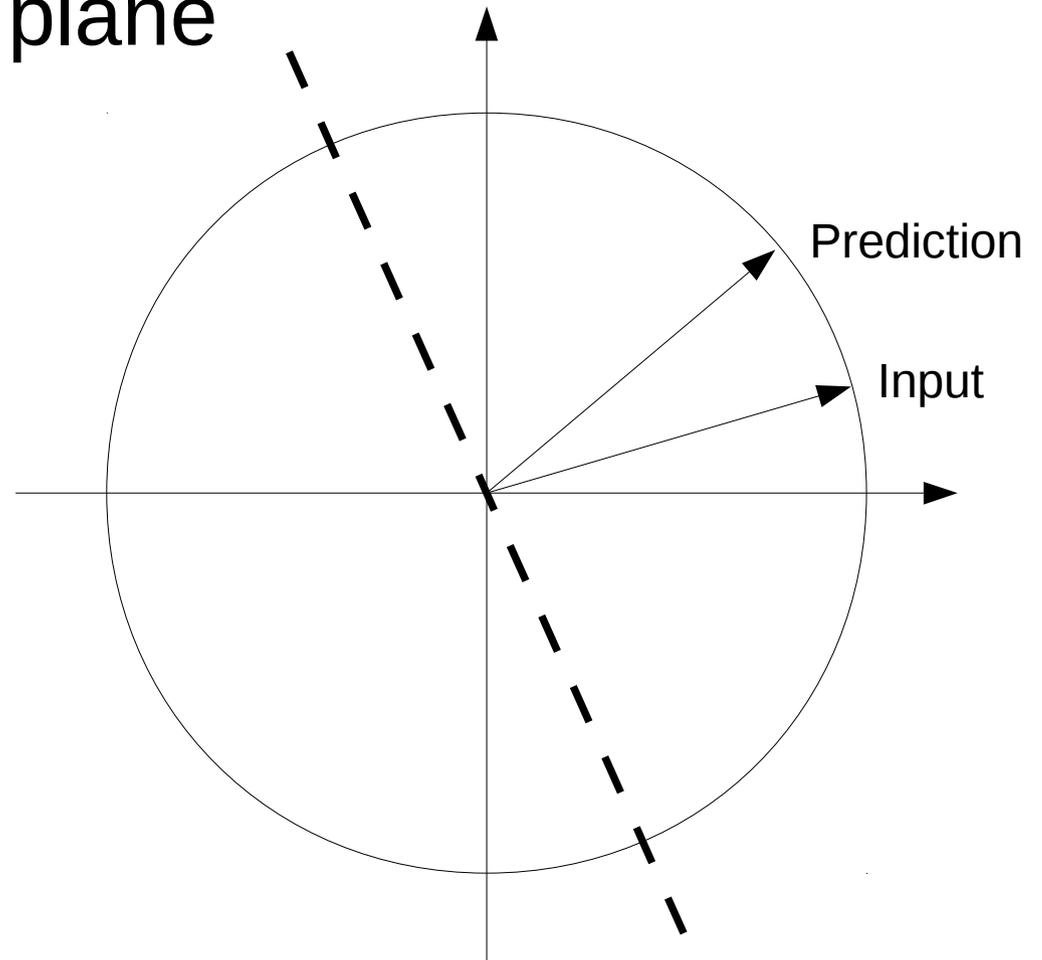
2-D Projection

- Input+prediction



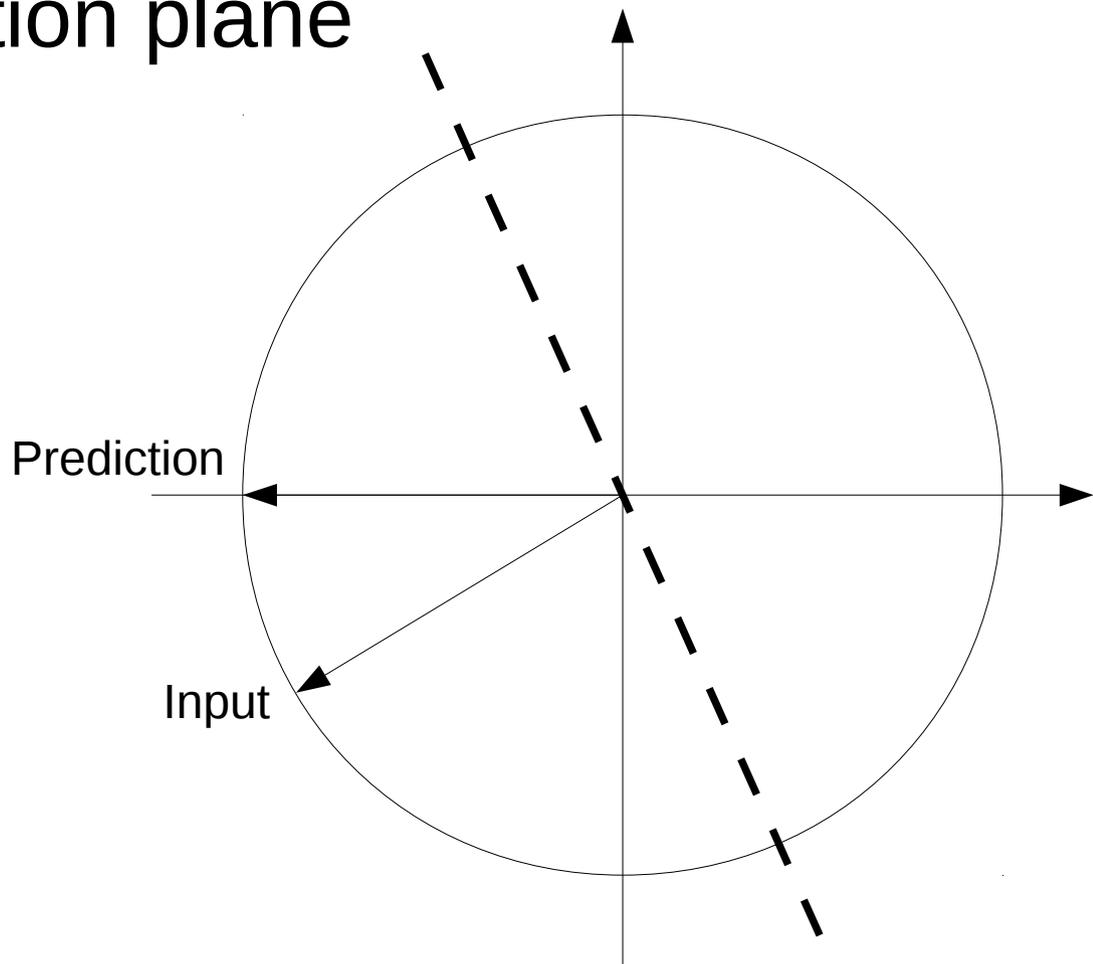
2-D Projection

- Input+prediction
- Compute reflection plane



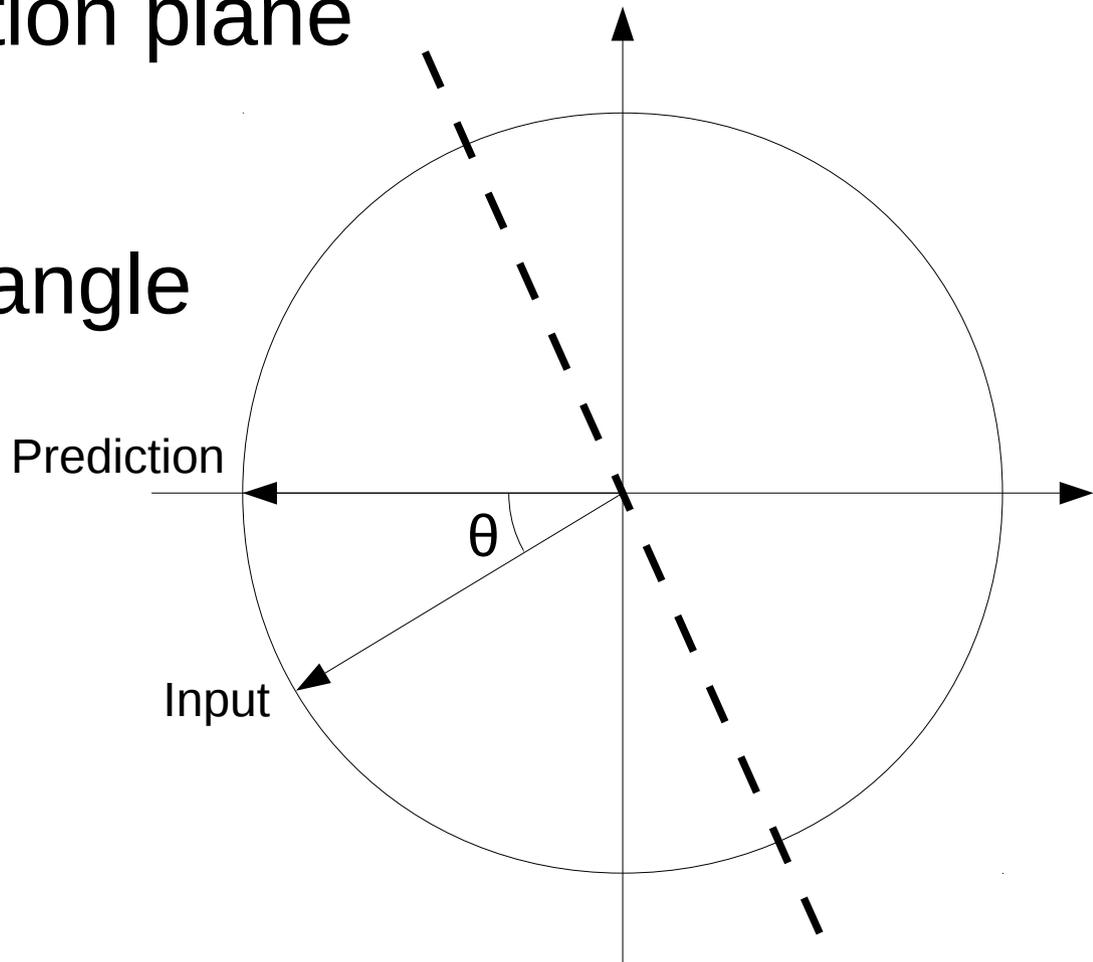
2-D Projection

- Input+prediction
- Compute reflection plane
- Apply reflection



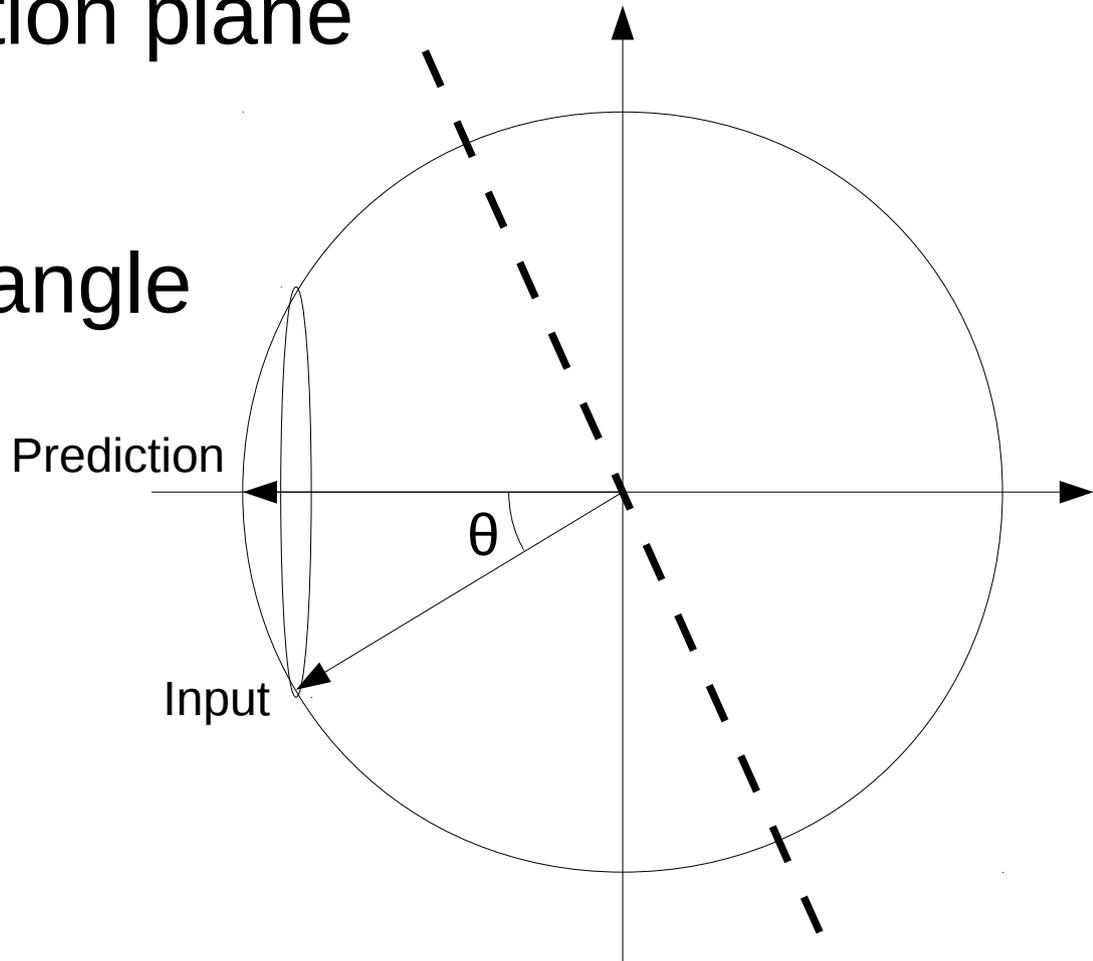
2-D Projection

- Input+prediction
- Compute reflection plane
- Apply reflection
- Compute/code angle



2-D Projection

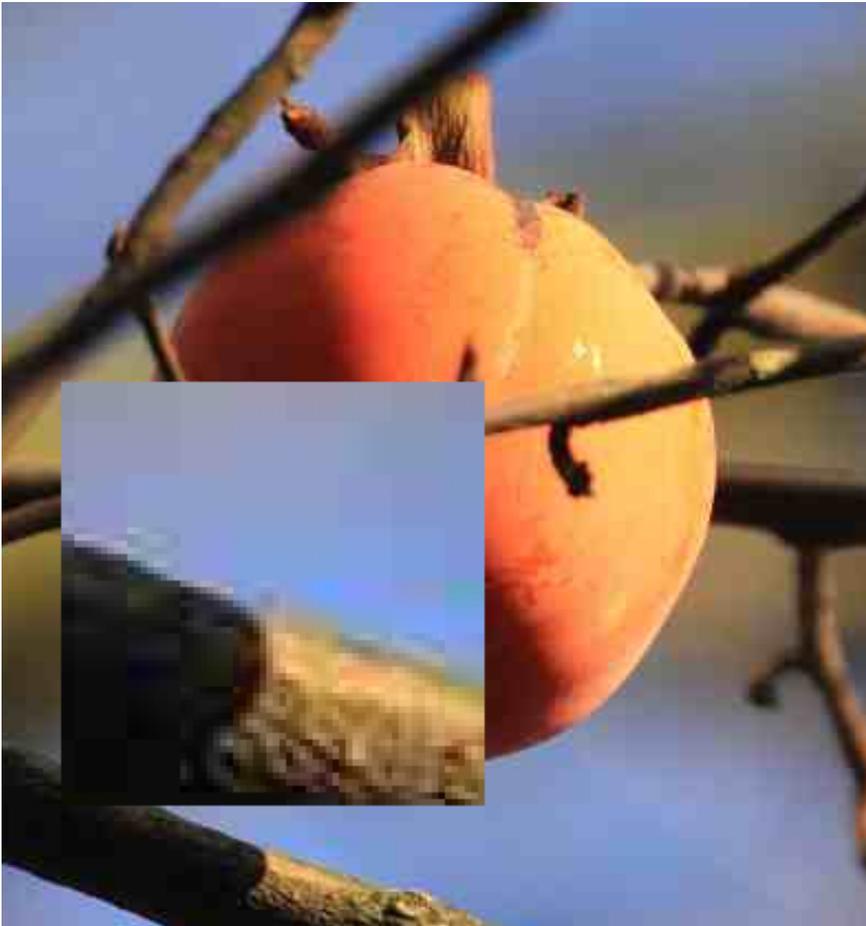
- Input+prediction
- Compute reflection plane
- Apply reflection
- Compute/code angle
- Code other dimensions



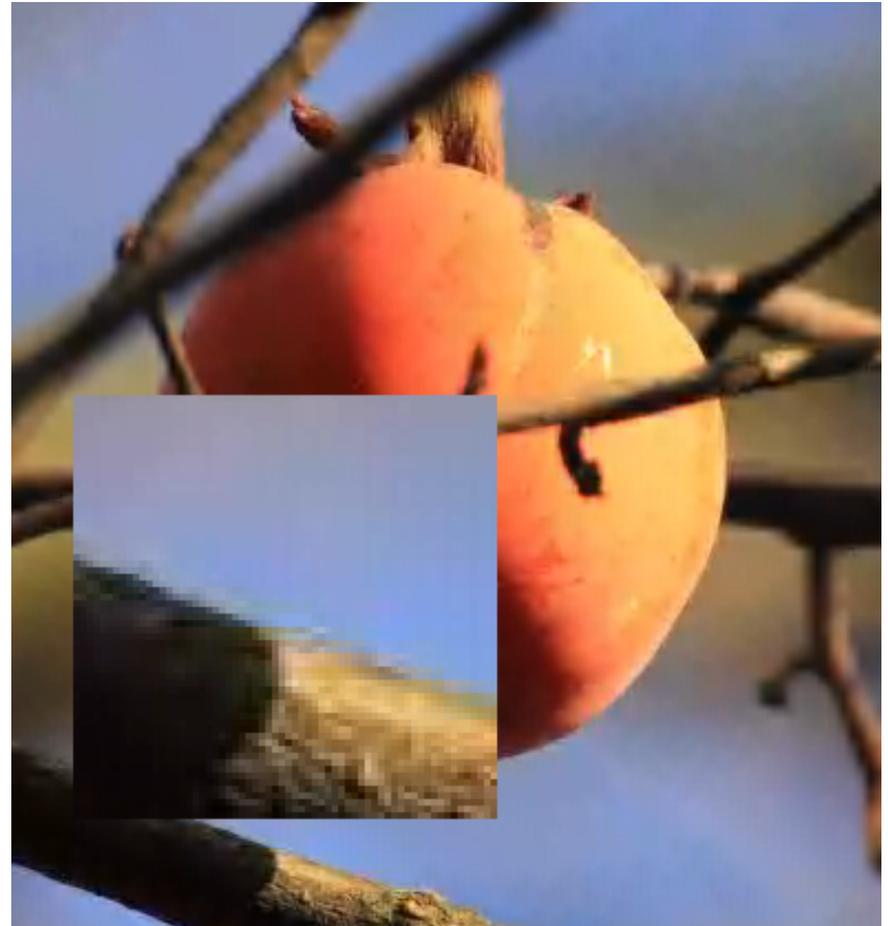
Results

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