

Introduction to Video Compression

Insight, Analysis, and Advice on Signal Processing Technology



Introduction to Video Compression

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Outline

- **Motivation and scope**
- Still-image compression techniques
- Motion estimation and compensation
- Reducing artifacts
- Color conversion
- Conclusions

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Motivation and Scope

- Consumer video products increasingly rely on video compression
 - DVDs, digital TV, personal video recorders, Internet video, multimedia jukeboxes, video-capable cell phones and PDAs, camcorders...
- Video product developers need to understand the operation of video “codecs”
 - To select codecs, processors, software modules
 - To optimize software
- This presentation covers:
 - Operation of video codecs and post-processing
 - Computational and memory demands of key codec and post-processing components



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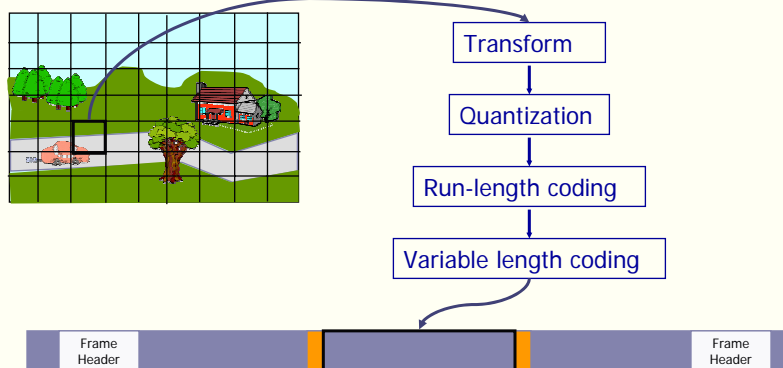


Still-Image Compression

- Still-image compression
 - Still-image techniques provide a basis for video compression
 - Video can be compressed using still-image compression individually on each frame
 - E.g., "Motion JPEG" or MJPEG
- But modern video codecs go well beyond this
 - Start with still-image compression techniques
 - Add motion estimation/compensation
 - Takes advantage of similarities between frames in a video sequence

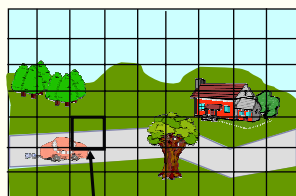


Still-Image Compression



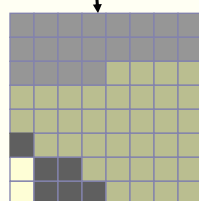
Typical Still-Image Compression Data Flow

Block Transform: 8x8 DCT



Y values

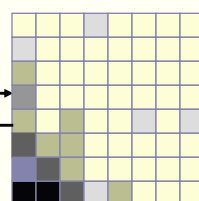
- 8x8 DCT blocks applied on Y, U, and V planes individually
- The energy is concentrated in the low frequencies
- Perceptual information also concentrated in low frequencies



Spatial domain

8x8 DCT

8x8 IDCT

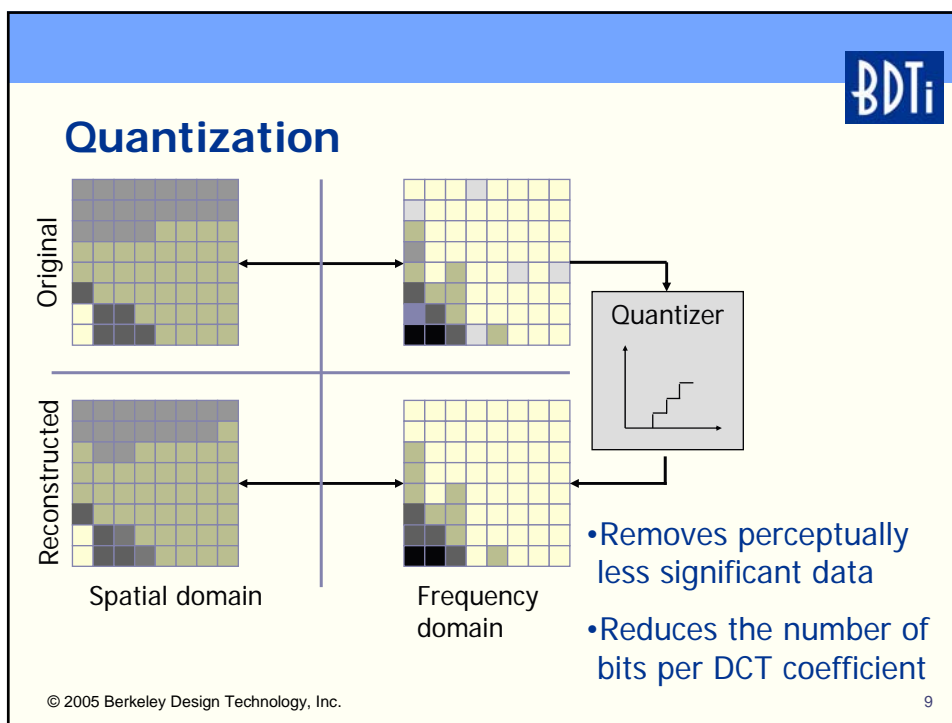


Frequency domain

■ High energy
□ Low energy

Block Transform: Resource Reqt's

- Compute load:
 - Up to 30% of total video decoder processor cycles
 - MPEG-4 CIF (352x288) @ 30 fps:
 - 71,280 DCTs/s
 - ~40 MHz on a TMS320C55x DSP
 - ~10 MHz if using TMS320C55x DCT accelerator
 - Many implementation and optimization options
 - Can make compute requirements hard to predict
- Memory usage: negligible



Quantization: Resource Reqt's

- Quantization (encoder) and dequantization (decoder and encoder) have similar compute loads
- Compute load:
 - From 3% to about 15% of total decoder processor cycles
 - Typically near the lower end of this range
 - MPEG-4 CIF (352x288) @ 30 fps:
 - ~10 MHz on a TMS320C55x DSP (estimated)
- Memory usage: negligible

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