Outline

• Human Visual System Model
• Just-noticeable-distortion (JND) Profile
• A Novel Perceptual Distortion Measure
• JND Based Video Codec
• Perceptual Channel Coding System
Human Visual System Model

Distortion sensitivity is used to describe the human visual model.

There are four sensitivities under research for gray-scale images:

– Brightness Sensitivity
– Texture Sensitivity
– Frequency Sensitivity
– Temporal Sensitivity

One sensitivity is explored in its elementary stage for color images:

– Color Sensitivity
Perceptual Source Coding

• Object of Signal Coding
  – removal of redundancy (e.g. transform, predictive coding) and removal of irrelevancy (quantization)

• Perceptual Coding
  – match the quantizer to the human visual system (HVS), with the goal of either minimizing perceived distortion, or driving it to zero where possible
  – not correspond to the maximization of SNR or the minimization of MSE
  – a human visual model is required
Perceptual Channel Coding

• Channel Coding
  – Rate compatible punctured convolutional (RCPC) code for unequal error protection. RCPC coding rates are selected based on JND profiles for each subband
  – Reed-Solomon code and Ramsay interleaving for spatial LLLL temporal L subband (subband 0)
  – Cyclic redundancy check (CRC) for other subbands

• Slicing
  – Slicing is used to confine the propagation of error from noisy channel. It is also based on JND energy
Human Perceptual Distortion Measure (based on JND profile) versus PSNR

Decoded Frame of "Claire",
$\Delta_G = 2.38$, PSNR=30.80dB
(Distortion is less)

Decoded Frame of Claire",
$\Delta_G = 3.07$, PSNR=30.15dB
(Distortion is larger)
Transmission over Satellite Channel

Distortion of the Decoded Frames over Noisy Channel with Object Distortion Index=1

Distortion of the Decoded Frames over Noisy Channel with Object Distortion Index=5