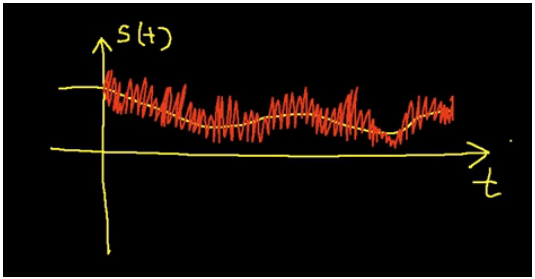
IIT Jodhpur

Biological Vision and Applications
Module 04-04: Image quality perception

Hiranmay Ghosh

Signal and Noise

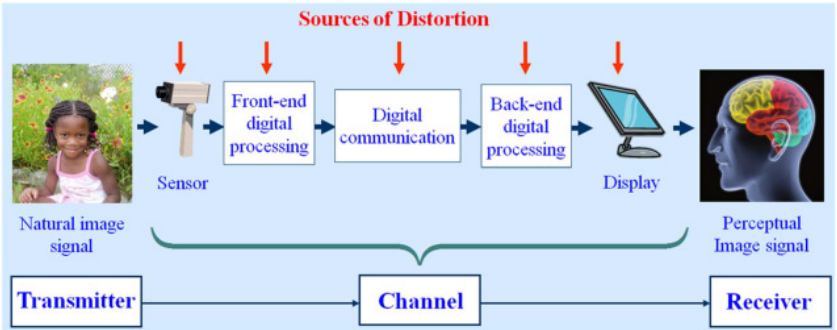
Signal processing view



- Measures of distortion
  - MSE: Mean Square Error (time-domain)
  - SNR: Signal to Noise Ratio (frequency-domain)

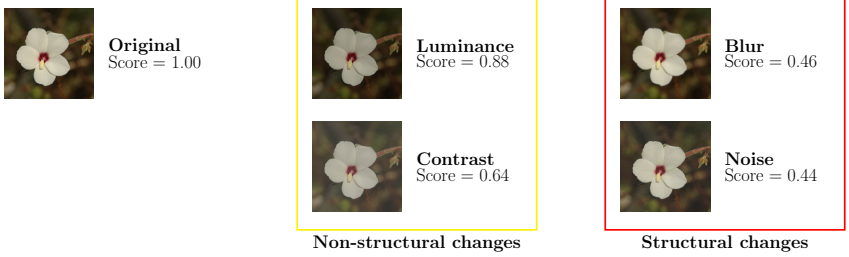
Signal-to-noise ration (YouTube)

How is noise introduced in images



Experimental data

How do we perceive distortion



- Human eye is sensitive to structural information in an image
  - Recall discussions on Natural Scene Statistics
  - Robust against non-structural distortions (normalization mechanism)

Structural Similarity Index Measure

- Measures structural similarity between original and distorted image
- Based on concepts of Natural Scene Statistics
- The original and the distorted images are treated as two probability distributions,
  - Generalized Gaussian Distributions: $p(x)$ and $q(x)$
- $SSIM = KLD(p(x), q(x))$
- A measure of perceptual similarity

- General Gaussian Distribution (Wikipedia) (detailed)
- Kullback-Leibler Divergence

Measurement approaches

- Full reference
  - Both original and distorted images are available
  - Straight-forward
- No reference
  - Original image is not available
    - TV Signal at your home
  - The statistical distribution of the original image is predicted from meta-knowledge about scene statistics
- Reduced reference
  - Some statistical parameters of original image is available
    - Transmitted over a narrow-band channel (assumed to be lossless)
  - The statistical distribution of the original image is predicted by fitting the available parameters to the meta-knowledge

Quiz

No quiz for module 04-04

End of Module 04-04