EECS 431
Human Perception and Electronic Media
Lecture 1

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TOPICS

- Human Perception
  - Visual
  - Acoustic
  - Tactile
  - Smell, taste
- Electronic Media
  - Signal Capture and Display
  - Signal Analysis and Understanding
  - Human Computer Interaction
  - Sense Substitution

TOPICS

- Visual Imaging and Perception
  - Basics of the Human Visual System (HVS)
  - Perceptual effects and illusions
  - Multiscale decompositions
  - Subband analysis and wavelets
  - Markov random fields
  - Color processing and perception
  - Color spaces
  - Color constancy

TOPICS

- Visual Imaging and Perception
  - Preattentive texture discrimination (Julesz)
  - Linear-nonlinear-linear (LNL) texture models
  - Perceptual texture similarity
  - Texture scale, directionality, regularity
  - Texture contrast, roughness, glossiness
  - Visual perception of material and surface properties
  - Shape

TOPICS

- Visual Imaging and Perception
  - Perceptual quality metrics
  - Structural similarity metrics
  - Structural texture similarity metrics
  - Quality evaluation for scalable compression
  - Perceptually lossless compression
  - Structurally lossless compression
  - Bilevel image compression
  - Incremental parsing
  - Image restoration
  - Digital image halftoning

TOPICS

- Visual Imaging and Perception
  - Adaptive clustering
  - Perceptual color-texture segmentation
  - Spatio-temporal segmentation
  - Background subtraction
  - Semantic classification
  - Content-based image retrieval
  - Pattern recognition
  - Visual organization

TOPICS

- Acoustic perception and media
  - Fundamentals of acoustic perception
  - Distortion/quality measures
  - Perceptually lossless compression
  - Objective and subjective evaluation of loudness, roughness, and sharpness
  - Pitch, timbre
  - Auditory localization: interaural time differences and HRTFs (Head Related Transfer Functions)

TOPICS

- Tactile Display and Perception
  - Fundamentals of human tactile perception
  - Haptic perception of real and synthetic materials
  - Tactile dimensions: roughness, regularity, directionality
  - Tactile devices
  - Signal processing for tactile display

TOPICS

- Multimodal Processing and Perception
  - Roughness in sound and vision
  - Joint perception of visual, acoustic, and tactile signals
  - Acoustic-tactile representation of visual signals
- Virtual Reality
- Art and Aesthetics

BOOKS

- Stephen E. Palmer, *Vision Science: Photons to Phenomenology*, MIT Press, 1999
- Eberhard Zwicker and Hugo Fastl, *Psychoacoustics: Facts and Models*, Springer Information Sciences, 2006
- William Hartmann, Signals, Sound and Sensation, Springer, 1997
- Roberta L. Klatzky and Susan J. Lederman, "Touch," Chapter 6, *Handbook of Psychology, Volume 4: Experimental Psychology*, A. F. Healy and R. W. Proctor, Eds., John Wiley and Sons, 2003
- Donald D. Hoffman, *Visual Intelligence: How We Create What We See*, Norton, 1998
- George Mather, *Essentials of Sensation and Perception*, Routledge, 2011

EECS Lectures

- Meet the EECS Faculty
- EECS Distinguished Lectures
- EECS Meets NU Faculty
- Wednesdays 2:00-3:00 pm, ITW Room

Course Assignments

- Paper presentations (30%)
  - Present 2 related papers to class
    - From list of suggested papers
  - 15 minute presentation, 10 minute discussion
  - Class participation
- Quiz (20%)
  - Based on lecture material
- Project (50%)
  - Project preparation/presentation
  - Critique of another presentation

Paper Presentation & Project Topics

- Visual texture
  - Textons
  - Analysis/synthesis
  - Texture compression
  - Segmentation, segmentation evaluation
  - Roughness, glossiness
  - Material perception
- Visual equivalence in compression and graphics
- Natural image statistics
  - Image quality based on natural image statistics

Paper Presentation & Project Topics

- Eye movements and visual saliency
- Image restoration
- Scene analysis
- Image retrieval
- Color analysis, color naming

- Tactile analysis and perception
- Tactile texture analysis
- Haptic and visual perception of texture

Paper Presentation & Project Topics

- Variable friction displays

- Acoustic roughness perception
- Reverberation
- Spatial sound, spherical head models, HRTFs
- Auditory scene analysis
- Multimodal signal analysis