Psychology 610: Seminar in Information Processing in the Nervous System

Methods in Visual Psychophysics

Bosco S. Tjan, Ph.D.

Fall 2006

(**Mondays, 1:00-3:50 pm**, Conference Room, Dornsife Neuroscience Imaging Center)

Visual psychophysics refers to a large class of empirical techniques where a subject's performance in a specific task is measured as a function of certain physical properties of the visual stimuli. Results are used to construct functional models that describe the neuro-computations underlying visual perception. As a major source of empirical data and theories in the field, visual psychophysics has always been an important tool in vision science.

This hands-on class will provide a comprehensive overview of the core empirical techniques and analytical methods in visual psychophysics. Students will gain both practical and theoretical understanding of the subject matters. The course is suitable for graduate students of all levels in all disciplines of vision science (psychology, biology, engineering). Students with programming experience and general competency in at least one of the following areas will benefit most from the class: linear algebra, probability theory, statistics.

Reading materials: selected research articles
Exams: three random quizzes, no final
Final project, presented on the final-exam day, may be either an implementation of a psychophysical procedure, or a concrete proposal of an experiment.
Grades based on: class presentation - 25%, quizzes - 15%, homework and programming assignments - 30%, final project - 30%. >90% A, >80% B, >70% C, >=60% D, <60% F.

Class will meet once a week for 3 hours, including lectures, student presentations and labs. **Bring a laptop with Matlab (student's version will do) to class.**

Lecture Plan:

8/21: Organizational Meeting
8/28: Overview of visual system, methods and apparatus
9/11: Linear system analysis, Fourier analysis, and a very brief introduction to image processing
9/18: Computer-based stimulus presentation, monitor calibration I: luminance & contrast control
9/25: Signal-detection theory, internal noise, nonlinearities, and psychometric functions
10/2: Method of constant stimuli, adaptive methods, and the human contrast sensitivity function
10/9: Human color perception, monitor calibration II: color
10/16: Presentation of motion stimuli, monitor calibration III: timing and phosphor delay rate, human spatiotemporal sensitivity function
10/23: Spatial resolution of a monitor, aliasing and anti-aliasing, achieving subpixel resolution, and alignment threshold (vernier acuity) measurements
10/30: Pattern recognition, signal-in-noise method, and ideal-observer analysis
11/6: High-level visual-cognition experiments, counter-balancing, methods for measuring response time, computer-based event timing, speed-accuracy trade-off methods
11/13: Eye movement, eye-tracking, and saccadic-contingent display
11/20: Stereoscopic displays and disparity thresholds
11/27: 3D rendering, perception of 3D shape, and Bayesian analysis of cue combination

12/13, 11am – 1pm: Final project presentation