

G80.3122-001 – Fall, 2009

Representation and Analysis of Visual Images

- Instructor:** Eero Simoncelli
- Info:** Time: Tuesdays, 10-12, starting 8 September.
Location: Meyer Hall 1024, 4 Washington Place
Web: <http://www.cns.nyu.edu/~eero/imrep-course/>
- Brief Description:** A graduate-level lecture course on theory and tools for representing, manipulating and analyzing visual images on digital computers.
- Prerequisites:** Linear algebra and vector calculus, linear systems theory, basic probability and statistics. Matlab programming experience is also expected.
- Text:** There is no book for the course. I'll provide some handouts (notes, articles, book chapters, etc) throughout the semester.
- Grading:** Grades will be based on homework assignments.
- Topics:**
1. Image generation (brief)
 - light & surfaces: sources, absorption, reflectance, transparency
 - The Plenoptic function
 - sensors, display devices
 2. Basic tools (brief)
 - point operations, geometric operations, linear transformations
 - Fourier tools in multiple dimensions
 - statistical estimation and decision
 3. Analysis
 - estimation of discrete multi-dimensional derivatives
 - rotation-invariance, orientation estimation, edge detection
 - matching/alignment/registration of image content, motion estimation
 - multi-scale / Coarse-to-fine methods
 - image comparison: texture classification, perceptual quality metrics
 4. Representation
 - multi-scale bases (wavelets)
 - classical and modern estimation/restoration
 - texture synthesis
 - statistically optimal representation, PCA, ICA, etc.
 - rate-distortion theory, image compression