395T Visual Recognition: Outline of lecture for Sept 7, 2012

I. Basics in feature extraction: filtering
   a. Digital images format
   b. Linear filters
      i. Smoothing: box filter, Gaussian filter
      ii. Gradients: finite differences, derivative of Gaussian, Laplacian of Gaussian
      iii. Template matching

II. Invariant local features
   a. Overview of local feature matching pipeline
   b. Interest point operators
      i. Harris corner detector
      ii. Laplacian of Gaussian blob detector (~Difference of Gaussians)
   c. SIFT descriptors
      i. Definition
      ii. Invariance properties
   d. Feature matching
      i. Finding neighbors
      ii. Lowe's ratio test to eliminate ambiguous matches

III. Specific object recognition with local feature matching
   a. Target applications
   b. Visual words for feature matching
      i. Forming a visual vocabulary
      ii. Inverted file index
      iii. Bag-of-words representation for an image
      iv. Vocabulary trees for large vocabularies
   c. Spatial verification
      i. RANSAC
         1. Line fitting
         2. Translation-only transformation
         3. Affine transformation
      ii. Generalized Hough Transform
         1. Main idea of voting
         2. Line detection as an example
         3. Hough for SIFT matches, Lowe's approach

Note: Assignment 1 out, due Sept 21.