Midterm Exam Study Guide

• Point Processing Operations (how they work, linear/non-linear, representative examples, e.g., histogram equalization)

• Frame Processing Operations (how they work, representative examples, e.g., averaging)

• Geometric Processing Operations (how they work, representative examples, e.g., affine transformation, practical problems, forward/inverse mapping)

• Mask Processing
  - what is a mask, how to apply a mask on an image, convolution vs correlation
  - comparison with point processing methods
  - normalization of mask weights, practical problems
  - smoothing (mean, Gaussian -- study very well, median)
  - sharpening, use derivatives to define mask weights

• Segmentation Using Edge Detection
  - what is an edge, how it is formed, edge descriptors, edge models
  - main steps of edge detection
  - edge detection using gradient (1st derivative), gradient magnitude and direction, derive mask weights, gradient minima/maxima, isotropic property, practical issues (e.g., mask size, threshold, thinning, linking)
  - Canny edge detector, steps (study very well)
  - edge detection using laplacian (2nd derivative), derive mask weights, Laplacian of Gaussian (LOG), zero-crossings
  - Comparison between gradient and laplacian.
  - Multiscale edge detection (scale space)

• Local models for edge contour extraction (study main ideas, no need to memorize equations)

• Global models for edge contour extraction
  - Hough Transform, main ideas, steps, tradeoffs (study very well - need to remember the steps of the algorithm)
  - Generalized Hough Transform, main ideas, steps, tradeoffs (study very well - need to remember the steps of the algorithm)
  - Active contour models (snakes), main ideas, energy functional, meaning of different terms, approximation in discrete case, greedy algorithm (study well)

• Edge Contour Representation
  - what is the goal? why is it useful?
  - simple methods (chain codes, slope representation, slope density, centroidal profile)
  - interpolation vs approximation methods (study very well)
  - interpolation methods (polygonal approximation, merge, split, split and merge)
  - approximation methods (least-squares, robust regression methods - need to remember equations, understand how these methods work and be able to explain them in words)
  - contour representation at multiple scales (do not need to memorize equations, need to understand the main ideas and be able to describe them in words)