

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)