Midterm Exam

- Closed book, notes, computer
  - BUT you may bring notes (index card both sides)
  - You may also want a calculator.
- Similar to test 1 in format:
  - Some questions from daily quizzes
  - Some extensions of quizzes
  - Some applications of image-processing algorithms
  - Some questions asking about process you followed in lab
- Also a few MATLAB questions, like writing a function
- Questions on format?
- Sample questions are on later slides

The main ideas are feature extraction (image processing) and classifier concepts. I will likely take some exam questions from this, although the list is by no means exhaustive.

- Describe how Matlab stores images as matrices.
- Describe and explain the difference between various color spaces, such as RGB, HSV, and LST. Be able to sketch pictures and providing clear (non-circular) definitions of each of the three bands in the HSV space.
- Understand 1D and 2D filters for smoothing (box and Gaussian filters) and edge finding.
  - Describe basic mathematical properties of each (e.g., why smoothing filters must sum to 1).
  - Be able to apply them to images manually.
- Describe the process of computing the edge magnitude and direction in a grayscale image.
- Compute each of the four morphological operations on simple image elements.
- Use morphological operators to aid object recognition.
- Describe appropriate times for a classifier to reject a sample.
- Define and compute the various accuracy measures on test sets (e.g., recall, false positive rate).

- Compute shape features (e.g., area, perimeter, circularity, extent) for various binary shapes.
- Sketch gray-level mapping functions that increase contrast, decrease contrast, and invert images.
- Draw a radial representation of a shape.
- Compute and describe the computation procedure for the covariance matrix of an image element, as used to determine principal axes and elongation, and plot major and minor axes given a set of eigenvectors.
- Other, if we have discussed them in lecture or assignments this term:
- Show how inner boundary tracing (Sonka, p 142-3) works on a given region.
- Describe an algorithm to compute the area of a region without holes, given only its perimeter pixels, without regenerating the binary image.

Exam 2 questions

- Use Bayesian probability. For example, interpret an intensity histogram and compute an optimal threshold from probability density functions of the foreground and background.
- Use the MAP principle to find the most likely class, given evidence.
- Describe the principles used by the Hough transform
- List parameters used to detect various shapes using a Hough transform
- Draw the voting space for a Hough transform
- Describe the steps of the K-means algorithm.
- Describe how cross-correlation can be used to match templates.
- PCA: dimensions? Computations? What are eigenfaces?
- Compute motion vectors.
- Other, if we discuss them this term:
- Describe the concept of boosting.
- Kalman filtering
- Normalized cuts