EE 4830 Digital Image Processing **Homework #5**

Due Date: May 5, 2005

Readings: Sec. 9 of Jain reference book and Chap 9 and 10 of textbook G&W

Problem #1: Morphological Image Processing (20%)

basic morphological operations. Problem 9.7 in the textbook (part (b) and (d) only).

Problem #2: Image Region Representation Using Moments (40%)

In the lecture, we defined the representation of segmented regions using central moments. Note in the lecture we used summation. Here we assume the image is defined over the continuous space and the summation can be changed to integral.

$\mu_{p,q} = \iint (x-\bar{x})^p (y-\bar{y})^q f(x,y) dxdy$ where $\bar{x}$ and $\bar{y}$ are the center locations of the region, and *f(x,y)* is the binary function indicating the support of the region.

$$f(x,y) = \begin{cases} 1, & if\,(x,y) \in R \\ 0, & if\,(y,y) \notin R \end{cases}$$ where R is the region.

In this problem, we would like to study the effect of scaling on the central moments and derive some features that are invariant to scaling.

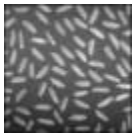
(1) How will the central moments $\mu_{p,q}$ be affected if the region is scaled by a factor of α?

(i.e., compute the (p+q)-th central moment of $f(\alpha x, \alpha y)$)

(2) Prove the following feature is invariant to scaling.

$\mu_{p,q} \Big/ (\mu_{0,0})^{\frac{p+q+2}{2}}$ (i.e., this term is the same for both $f(x,y)$ and $f(\alpha x, \alpha y)$)

Problem #3: Image Segmentation (40%)



The image (HW5-sp05-image.jpg available on the class web site) includes objects of rice grains of different orientations over a dark background. In this problem, you are asked to develop a system to (a) detect the rice grain objects and (b) compute the average size of the rice grains.

Two Matlab example programs are placed on the class web site – 'morph2' uses morphological operators to detect a cell object; 'morph3' uses preprocessing functions and the watershed function to detect regions in an atomic force microscope image of a surface coating. Play with these two examples and become familiar with the various functions. Then develop a complete system to detect the objects corresponding to the grains. The 'regionprops' function in Matlab can be used to compute useful features of each detected region.

Plot an image to indicate the outlines of the detected objects. Compute the average size of the rice grains. Submit your programs with sufficient explanations and discussions.