

Image Processing and Computer Vision (MPHY39600/CS35600) (Kenji Suzuki)

Problem Set 6 (Due: the class after the next class)

Solutions should include relevant images and original code (written in your favorite computer language, e.g., C, C++, Matlab, IDL, etc.) of the algorithms developed, along with any discussion requested. All the images are on the Chalk website at <http://chalk.uchicago.edu> and in the uncompressed TIFF format.

- (1) What is the Fourier descriptor of a circle with radius r and the center at $(0, 0)$?
- (2) Show that the first two moments, M_{10} and M_{01} , are always zero.
- (3) Calculate the first three moments (M_{00}, M_{02}, M_{20}) of the white (binary) object in the image, `img_moment.tif`.
- (4) In the Fourier descriptor, most of the important invariants are confined to the first two coefficients, $Z(0)$ and $Z(1)$. More precisely, the Fourier descriptor normalized by $Z(1)$ shown below is invariant to (1) translation, (2) rotation, and (3) scaling. Prove this property.

$$Z(k) / Z(1), k = 1, \dots, N-1$$

Note that $k = 0$ is NOT included in the above expression. N is the number of discrete points on the original contour.