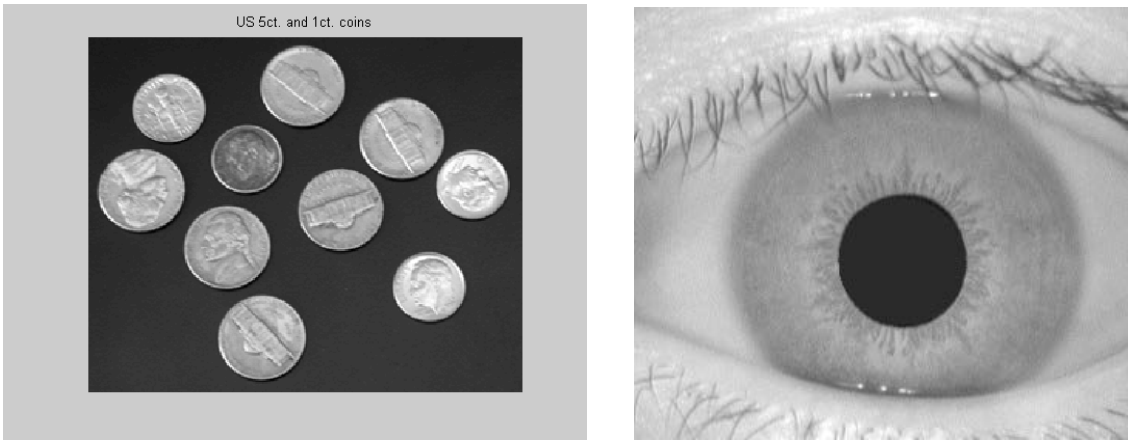
Homework 2:
Robust Estimation for Circular Shape Detection

In this assignment, you will write computer programs for circular shape detection. You are encouraged to use C/C++ programming. One classical robust technique is the circular Hough transform, as we discussed in the lecture. Basically, you will use the parametric Hough space for circular shape detection, which is a very useful technique in practice. A typical application is iris localization using the circular Hough transform. To detect circular shapes, you may use another robust technique, RANSAC, as learned from the lecture. So here there are two different robust estimation methods for circular shape detection. Some example images are shown below.



Some example images for circular shape detection. You can download some other example images at
http://www.cs.wisc.edu/~gdguo/courses/examples/Circle/
for your algorithm development.

You can use OpenCV, which is an open source computer vision library, for edge detection. Then use robust techniques for circular shape detection on edge images.

OpenCV provides a collection of algorithms and sample code for various computer vision problems. You may download OpenCV from http://sourceforge.net/projects/opencvlibrary/. You can read the OpenCV manual in order to use this library, but you may also read a simple on-line document to get quick access to OpenCV: http://www.cs.iit.edu/~agam/cs512/lect-notes/opencv-intro/opencv-intro.html

Part I

Call the Canny edge detector to detect edges for each input gray level image. If the input is a color image, just use the gray level information. Then write your own circular Hough transform programs to detect circles on the edge images.

Submission: You need to write a short report that contains your code, input and output images (circle detection results, you can draw red circles to show in the original images), simple descriptions of the canny edge detector and the circular Hough transform, how you choose the parameters for Hough transform, what difficulty you have in this assignment, and how you solve the problems. Please do not send your homework to me by emails unless you are notified. Your submission is hard copies.

Part II

You also need to write computer programs of the RANSAC algorithm to detect circular shapes, in addition to the Hough transform (Part I), and compare the two robust techniques in terms of the algorithms and results.

Submission: In addition to the submission requirement in Part I, you also need to write a simple description about the RANSAC method you used, how you set the parameters, and compare the RANSAC and Hough transform methods and results.

- Assigned on March 7, 2018
- Due date: March 21, 2018
- All submissions are hard copies, not emails.
- Your algorithms may be tested with new images.