Homework 1

16-311: Introduction to Robotics

Contents

1 Learning Objectives

1. Practice using MATLAB to manipulate an image.
2. Identify objects of interest in an image.

2 Image Manipulation

The goal of this section is to find a simplified Waldo figure in a series of images.

Create a MATLAB function that can read a .png file (that will be saved in the same directory as your program) and output a .txt file containing the x (horizontal) coordinate of the center of Waldo, a space, and then the y (vertical) coordinate of Waldo where (0,0) is the top left of the image.

Figure 1 below shows the Waldo figure. Please note that the white space around the figure does not count as the figure and so there may be pixels that are not white in these spaces on a valid Waldo.

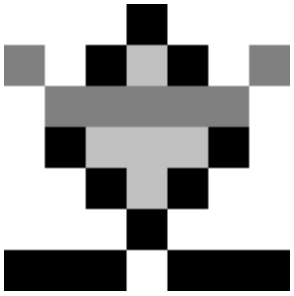

Figure 1: Large Waldo for illustrative purposes.

You can download the regular sized Waldo image from here: `http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/16311/www/current/hw/hw1/waldo.png`. This image will be in the same directory as your code for grading. Figure 2 shows a sample environment that you will be tasked to find waldo in.

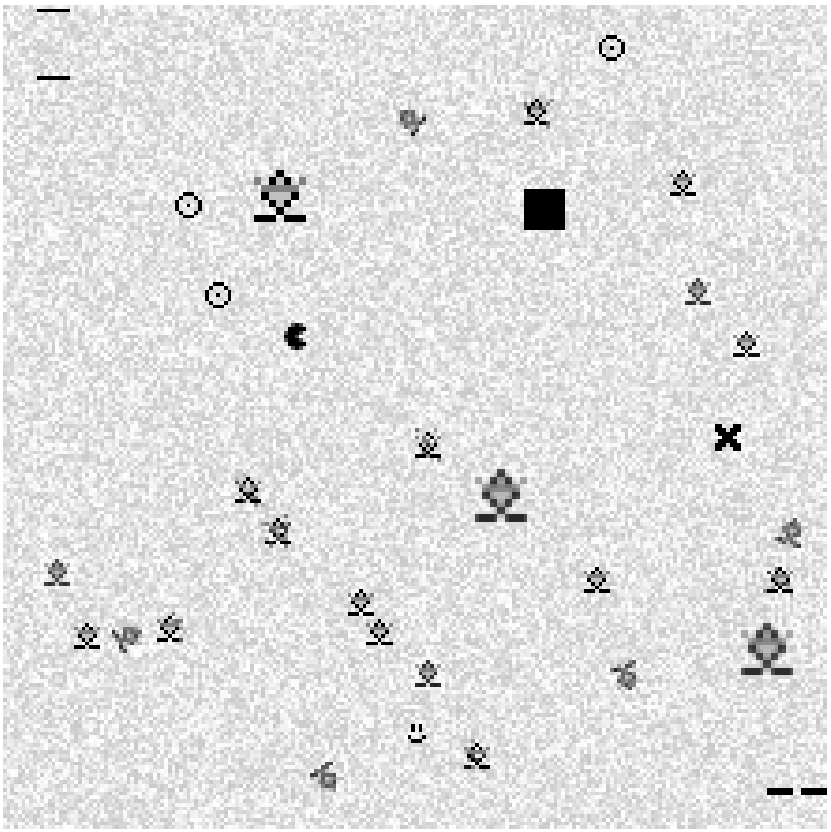

Figure 2: Sample environment for finding Waldos.

You can download the sample environment from here: `http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/16311/www/current/hw/hw1/newnew_waldoSearch01.png` and a text file with the positions of Waldo is here: `http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/16311/www/current/hw/hw1/new_waldos01.txt`.

You will be graded based on an image that has:

- 5 exact copies of Waldo
- 4 blurred copies of Waldo
- 7 copies of Waldo with noise
- 5 rotated copies of Waldo
- 1 double-size copy of Waldo
- 2 double and blurred copies of Waldo
- 6 not Waldos (like a smiley face)

You will be graded based on the number of coordinate pairs that are within 2 pixels of the center of a small Waldo and 4 pixels within the center of a double-sized Waldo.

- 50 points for finding between 1 and 4 Waldos
- 85 points for finding all 5 Waldos
- 90 points for finding 5 Waldos plus one more
- 100 points for finding all Waldos from three different varieties (i.e. all normal Waldos, all blurred Waldos and the unblurred double Waldo, etc.)
- -5 for every inaccurate position

You are not permitted to use library functions that trivialize the problem. This includes imrotate, imresize, etc.

You can start from this MATLAB code: `http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/16311/www/current/hw/hw1/waldo.m`.

Note: the origin for this assignment is the top left with x increasing to the right and y increasing down. Many image applications will specify row, column for the coordinates, but we will use (x,y) for this assignment.

Additional example: `http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/16311/www/current/hw/hw1/newnew_waldoSearch02.png` and a text file with the positions of Waldo is here: `http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/16311/www/current/hw/hw1/new_waldos02.txt`.

3 What To Submit

Submissions are due on Autolab by the date specified in the Schedule.

1. A program or .zip file called waldo with any helper files (email the head TA for clearance on using something other than MATLAB) that finds Waldos in an image and outputs a .txt file with Waldo coordinates as specified in Section 2.

2. Please ensure that your main program can be run as described.