Introduction to Robotics

Coursework 2 (20%)

Object segmentation and description

Out: 31st October 2023 | In: 21st November 2023

Task

Using your mobile phone camera to capture images consisting of at least 3 objects (we will provide final testing images). You can choose any objects. For simplicity, it is suggested that you choose simple objects of uniform colours and place them on a matte surface of a uniform colour.

Write a programme to perform the following (**you must write your own implementation of each task, calling existing functions or subroutines is not allowed**):

1. Converting an image to grayscale and then threshold it to create a binary image (assuming the image comes out of your camera is an RGB colour image). Your implementation should make the threshold adjustable (either manually or automatically). For this coursework, manually adjusting the threshold is acceptable, but works implementing automatic thresholding will be awarded credit.
2. For a good and clean binary image generated from above implementation, perform connected component labeling to segment out each individual objects.
3. For each object
    a. Calculate and plot its axis of least second moment (orientation equation).
    b. Find its boundary.
    c. Find and plot its bounding box.
    d. Find and plot the equation of the ellipse that best approximate the object shape.

What to summit

A technical report (both electronic and hard copies), which should include the following

1. An explanation of how you implemented each task.
2. Results of each task. Labelling each object with a different colour. Plotting the orientation equation, the bounding boxes, and the bounding ellipses ontop of the objects.

A demo

You must demonstrate your implementation to the TAs.