Group Project

Introduction to Signal and Image Processing

Handout: 02.05.2018, 14h15

Handin1: 29.05.2018, 14h00
Handin2: 30.05.2018, 14h15

Context

Retinal microsurgery (RM) is one of the few available treatments options for many blinding eye conditions. During surgery, the operating surgeon uses a stereo microscope to visualize the retina and manipulates a set of surgical instruments (*i.e.* tipped forceps or picks) to perform the procedure, as depicted in Figure 1.

Given its importance and the demanding nature of the surgery, several new technologies have focused on improving aspects of RM. Some of these technologies have included a steady-hand robot or an instrument capable of visualizing anatomical structures below the surface of the retina via optical coherence tomography. Yet, for these technologies to fully develop and ultimately be incorporated into clinical environments, one missing component is the ability to accurately and reliably estimate the location of an instrument when in the camera field of view.

To this end, your project will be to detect and track the center of the surgical instrument in each frame in image sequences.

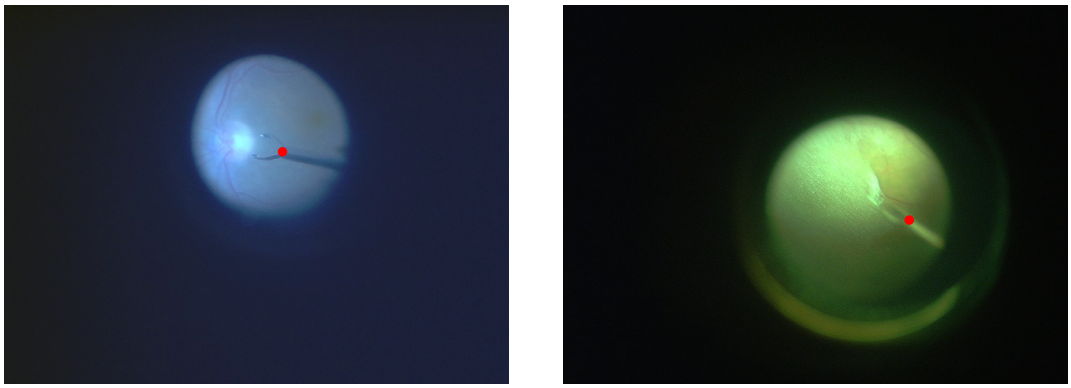

Figure 1: Example images of surgical instrument in two cases.

Data and annotations

We are providing you with two separate image sequences: A and B. Both contain images of size 640 x 480 pixels. A and B contain 100 images, each.

Your task is to determine the location of the (x,y) location of the central tweezer structure in all 100 images of both sequence (shown in red).

For set A, the first location is (348,191). For set B, the first location is (439, 272).
We have also provided you with 8 additional examples (*i.e.* training cases) for each sequence.

Instructions

Your task will be to develop a method to locate the central (x,y) location of the instrument tweezer for each frame of the 100 images per sequence.

- It is up to you to decide if you use the training examples provided.
- Assume that the location of the instrument center is given on the first frame of each sequence. That is, you only need to find the remaining 99 locations.
- Your method does NOT need to be real time.
- Use your own code or any of the python libraries and inbuilt functions used in class.

Handin's

Handin of your project will be done in two phases.

Phase 1, due 29.05.2018, 14h00: submit via ILIAS two text files with the following format:

image_name x-location y-location
(Repeat this for each image in a sequence)

Hence this text file should have 100 lines, including the given 1st frame. The same should be done for sequence A and B.

Phase 2, due 30.05.2018, 14h00: In class presentation of your method and approach. Prepare a 5-minute presentation that you will do in class.

Your slides should highlight your thinking, your method and the challenging encountered. Show some results to highlight your methods qualities and its limitations. You should also suggest some things you could have tried had you had more time.