

DIP Final Project

Pupil Detection

Reporter: Bo-I Chuang

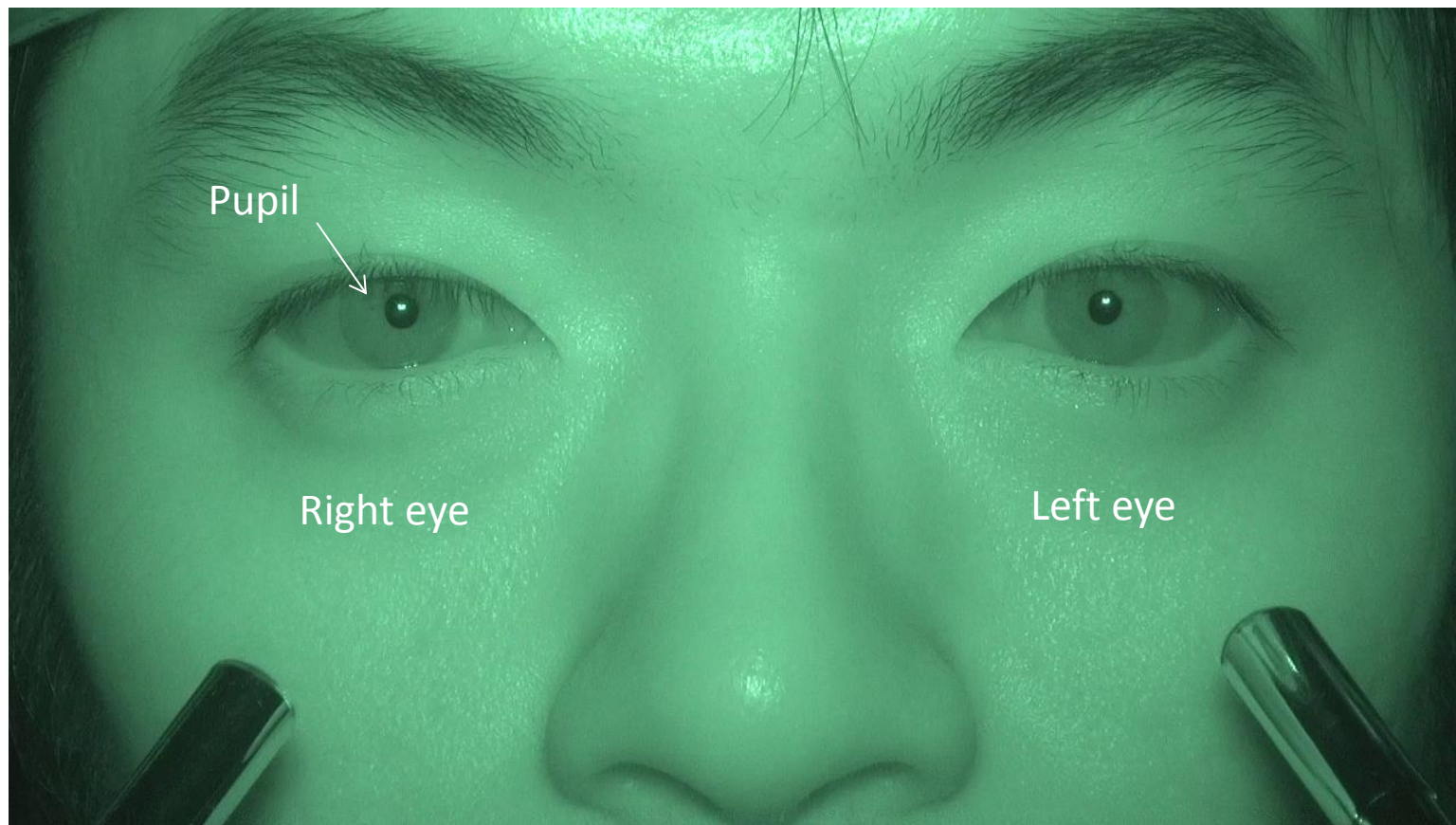
Background

- Pupil is a hole inside the iris which makes the light strike the retina.
- The pupil size and its response are the important basis of ocular diseases and neuropathies.
- The symptom pupil will have slower or smaller response than normal pupil in several pupil diseases like relative afferent pupillary defect (RAPD) and Adie's tonic syndrome.

Background

- In this project, we will provide the infrared image sequence.
- The sequence contains forty continuous eye images (resolution: 1280x720).
- Lighting and eye blink may occur in the sequence.

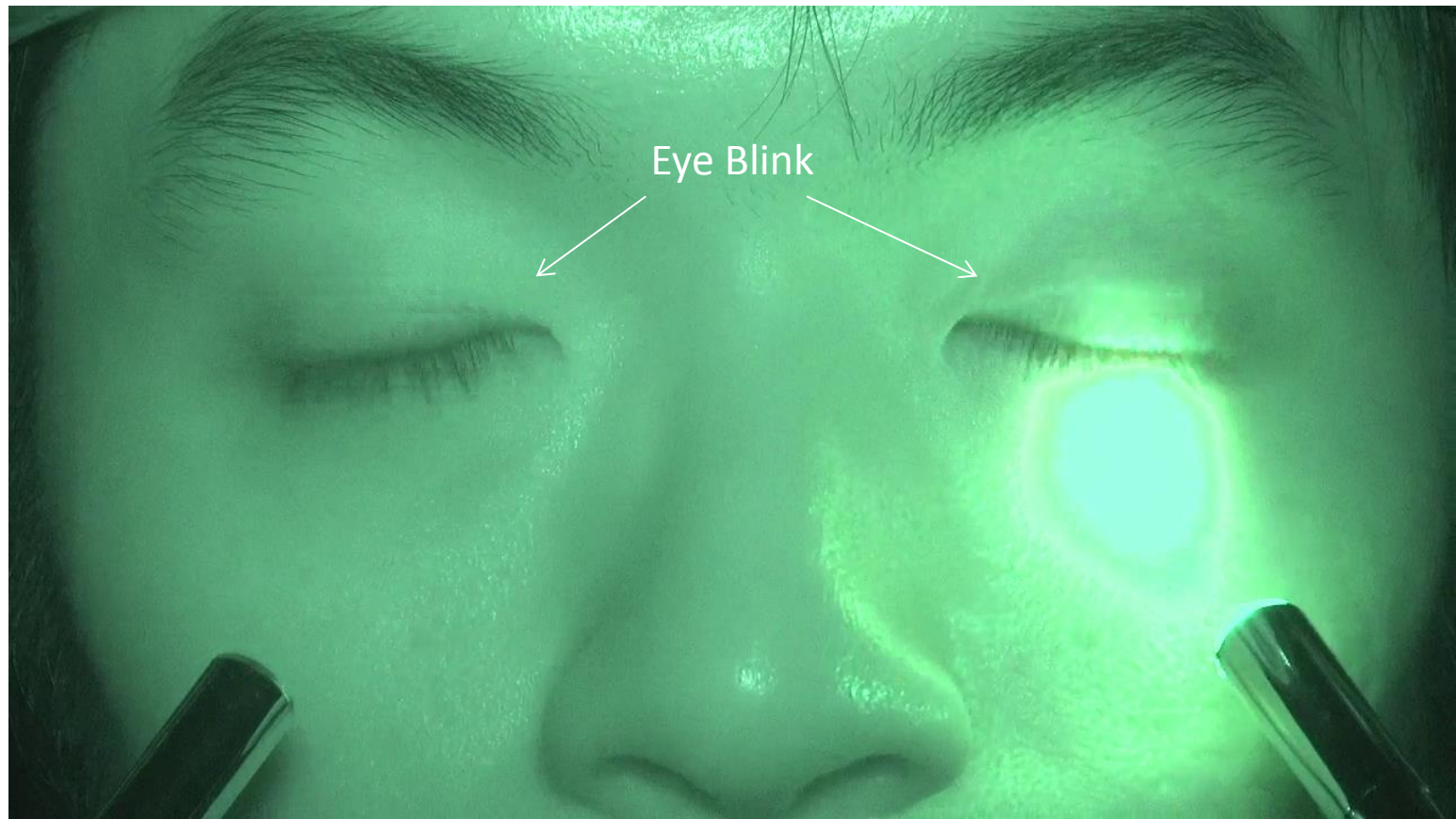
Data



Data



Data



Objective

- Input an infrared image sequence, and segment the pupil of both eyes in each frame.
- Show the segmentation result (in yellow) and ground truth (in red, given in a file) in the same image.
- Output the center and radius of segmented result of each frame for validation.
- Record the total computation time for processing the whole image sequence.

Possible Solution

You may need to have some preprocessing steps, and then perform the pupil detection and segmentation. For the detection part, you have to think of a method to locate the pupils. And for the segmentation part, you can use edge based or intensity based methods. The following methods are for your reference.

- **Canny Edge Detector**
- **Active Contour Model**
- **Circular Hough Transform**
- **Circle Matching**

Display the Results

- Both segmentation result and the given ground truth need to be displayed in the same image with different colors.
- You should design the user interface that can be used to control the display of different resulting image on the screen with the image index on it.
- Pupil contour does not need to be drawn if eye blink is detected. (You need to detect the eye blink automatically)

Display the Results



Yellow:
Segmented result

Red:
Ground truth

5/40

Time: 2464ms

Output the Results

- The results of an image sequence should be outputted as a text file.
- The format of output file:
 - Each line shows the results of one frame.
 - Format of line:

Radius of right eye, Tab character(\t), X coordinate of right eye center, Tab character(\t), Y coordinate of right eye center, radius of left eye, Tab character(\t), X coordinate of left eye center, Tab character(\t), Y coordinate of left eye center.

※ Please use a Tab character instead of a space to separate the parameters.
 - If eye blink is detected, set all parameters as 0.

Output the Results

- The output file should look like:

```
19 346 265 18 964 262
```

```
16 347 267 15 961 263
```

```
0 0 0 0 0 0
```

- In this case:
 - In the first frame, the radius values are 19 (right eye) and 18 (left eye), and the center points are (346, 265) (right eye) and (964, 262) (left eye).
 - In the third frame, the eye blink is detected.

Reference

- Circular Hough Transform
 - Pedersen, Simon Just Kjeldgaard. "Circular hough transform." Aalborg University, Vision, Graphics, and Interactive Systems 123 (2007).
- Active Contour Model
 - Kass, Michael, Andrew Witkin, and Demetri Terzopoulos. "Snakes: Active contour models." International journal of computer vision 1.4 (1988): 321-331.

Notice

- The report should be written in Chinese or English at least four pages, and includes the questions, methods, results, discussion and conclusion.
- The project and the report should be uploaded before 2017/01/08(Sun.) 23:59:59.
- The demonstration will be held in Vision System Lab (65702) during 2017/01/16 (Mon.)~17 (Tue.). The demo schedule will be announced on the course website.

Notice

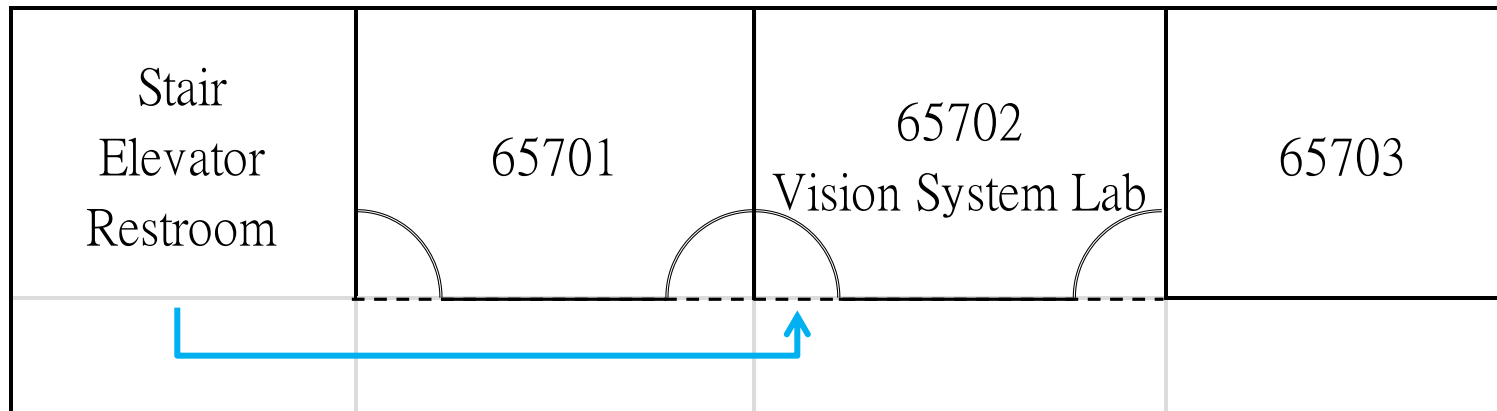
- If you need to change your demo time, please inform the teaching assistant one week earlier.
- Matlab is allowed for non-EE and CSIE student.
- EE or CSIE students should use Visual Studio C# or C++, image processing related library is not allowed.
- It is not allowed to copy the project from anyone, but discussions are encouraged.

FTP Information

- Please compress your project, execution file(release mode) and report as a zip file and upload it to FTP.
 - IP: ftp://140.116.247.97 port:21
 - ID: imagehw2
 - Password: imagehw2
- The format of the filename :
 - [IDE version]_[student id].zip
 - e.g. VS2012_P78901234.zip or MATLAB2015b_Q78901234.zip.
 - Please append the version number if you want to update your file
 - e.g. VS2012_P78901234_v02.zip

Where is Vision System Lab (65702)?

7F



Contact Information

- Teaching assistants
 - 莊柏逸: p7897135@mail.ncku.edu.tw
 - 郭振鵬: shinyakuok@gmail.com
- Website:
 - <http://vision.csie.ncku.edu.tw/image/?chap=course&sec=1>