

電腦視覺與深度學習

(Computer Vision and Deep Learning)

Homework 2

TA:

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Office Hour: 19:00~21:00, Mon.

09:00~11:00, Wed.

At CSIE 9F Robotics Lab.

Notice (1/2)

- ❑ Copy homework is strictly prohibited!! **Penalty: Grade will be zero for both persons!!**
- ❑ If the code can't run, you can come to our Lab within one week and show that your programming can work. Otherwise you will get zero!!
- ❑ Due date => **2020/01/01 (Wed.) 23:59:59**
 - No delay. If you submit homework after deadline, you will get 0.
- ❑ Upload to => **140.116.154.1 -> Upload/Homework/HW2**
 - **User ID: cvdl2019 Password: cvdl2019**
- ❑ Format
 - Filename: Hw2_StudentID_Name_Version.rar
 - Ex: Hw2_F71234567_林小明_v1.rar
 - If you want to update your file, you should update your version to be v2, ex: Hw2_F71234567_林小明_v2.rar
 - Content: **project folder***(including the pictures)
 - *note: remove your “Debug” folder to reduce file size

Notice (2/2)

❑ C++ (check MFC guide in ftp)

- OpenCV 3.3.1 (<https://opencv.org/release.html>)
- Visual Studio 2015 (download from <http://www.cc.ncku.edu.tw/download/>)
- UI framework: MFC

❑ Python

- Python 3.7 (<https://www.python.org/downloads/>)
- Tensorflow 2.0 / PyTorch 1.3.0
- opencv-contrib-python (3.4.2.17)
- Matplotlib 3.1.1
- UI framework: pyqt5 (5.11.3)

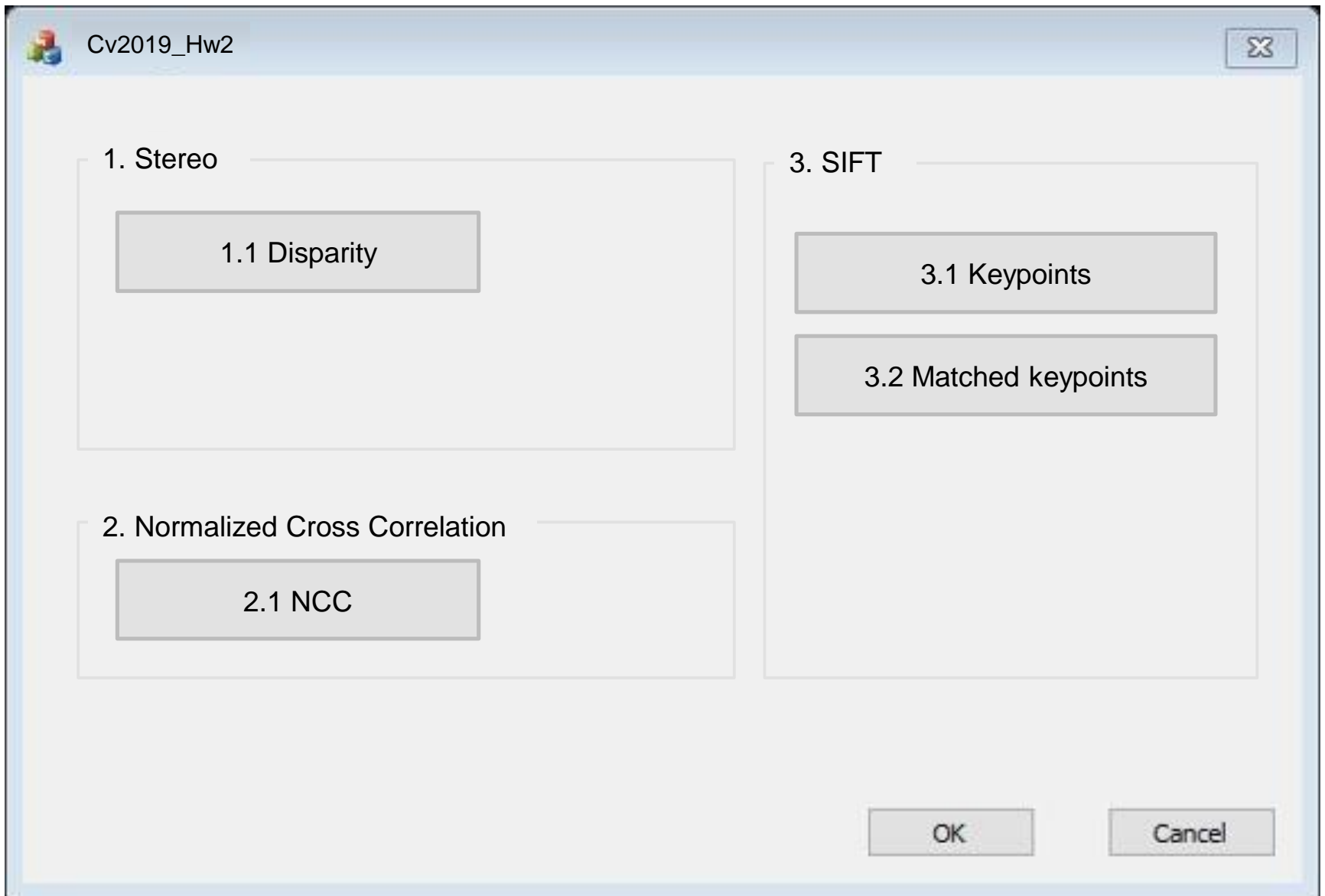
Grading

0. Homework Format

1. (30%) Stereo – Disparity Map (出題 : Kris)
2. (30%) Normalized Cross Correlation (出題 : Jang)
3. (40%, reference) SIFT (出題 Michael)
 - 3.1 Show keypoints (20%)
 - 3.2 Show matched keypoints (20%)

0. Homework Format

- ❑ Use MFC to create GUI like following picture



1. (30%) Stereo Disparity Map

(出題 : Kris)

❑ User interface for the first question:



1. (30%) Stereo Disparity Map

(出題 : Kris)

- ❑ Given: a pair of images, imL.png and imR.png (have been rectified)
- ❑ Q: Find **the disparity map/image** based on Left and Right stereo images.



imL.png

Left Image (Reference Image)



imR.png

Right Image

1.1 (30%) Disparity Map

❑ Q: 1) Click button “1.1” to show the disparity map

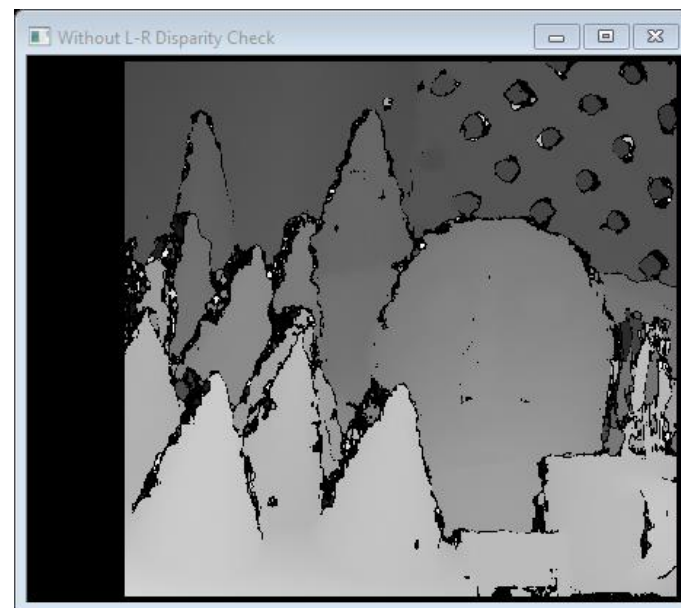
❑ Guides:

(1) Window Size: $9 = 3 \times 3$ pixel

(2) Search range and direction:

- Disparity range: 0~64 pixels.
 - Map disparity range 0~64 pixels to gray value range 0~255 for the purpose of visualization.
- If the **left image** is the **reference image** (the one used to cal. depth info for each pixel of that img), then **the search direction** at **right image** will go **from the right to left** direction.

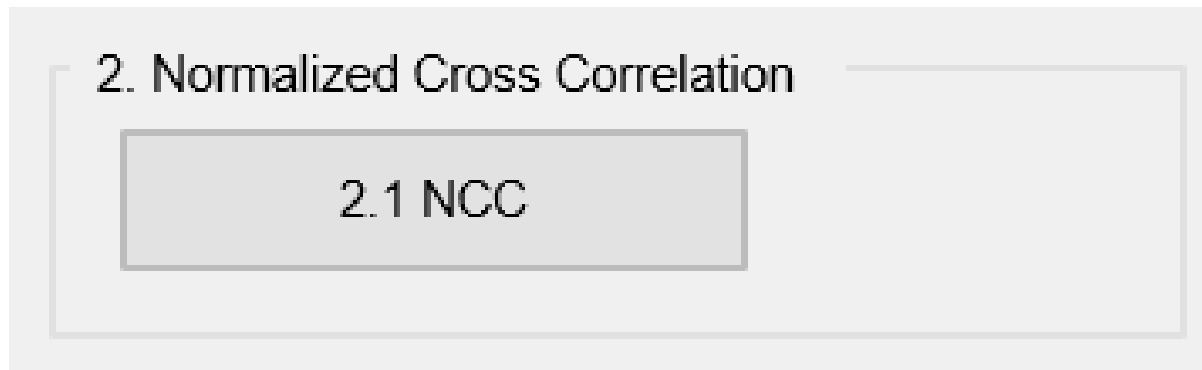
❑ Hint: OpenCV Textbook Chapter 12 (P.451)
`StereoBM::create(64, 9);`



Result

2. (30%) Normalized Cross Correlation (出題 : Jang)

❑ User interface for the second question:

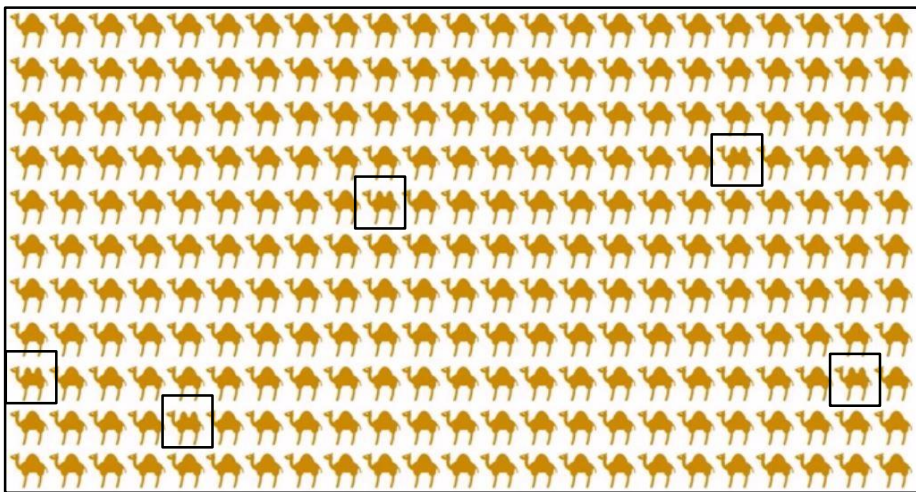


2. (30%) Normalized Cross Correlation (出題 : Jang)

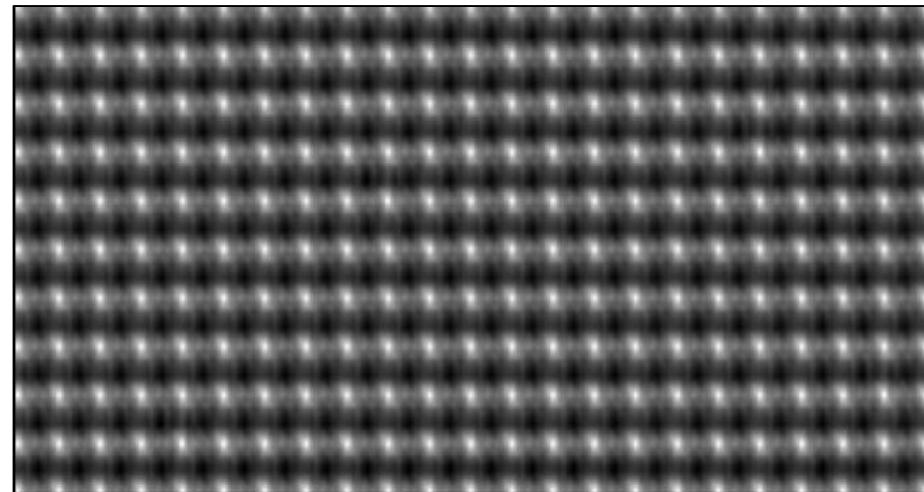
- ❑ Given two images: ncc_img.jpg, ncc_template.jpg
- ❑ Q: Click the button “NCC” to show:
 - One shows **result of template matching feature**.
 - The other shows **5 detected template images** on the original image(ncc_img.jpg).(You **MUST** use the Normalized Cross Correlation method.)



ncc_template.jpg



ncc_img.jpg



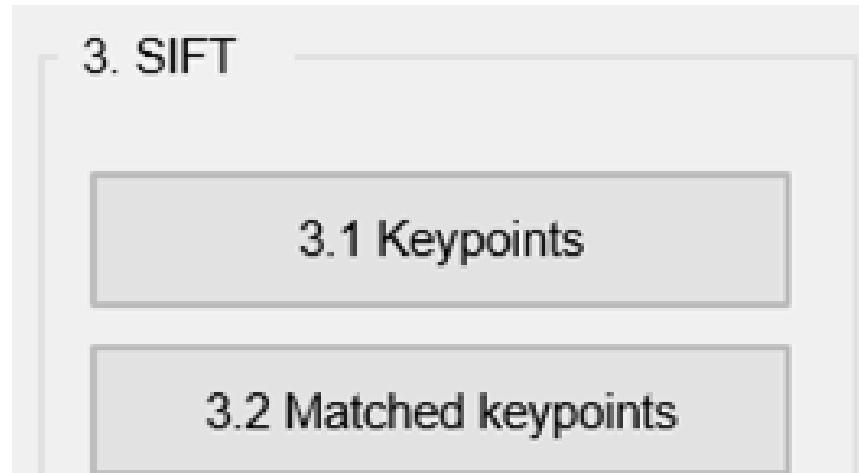
Template matching feature
(NCC value 0.0~1.0 □ gray value 0~255)

- ❑ Hint : ref. p338 ~ p339 (opencv2refman_2.4.7.pdf)

3. (40%) SIFT

(出題 : Michael)

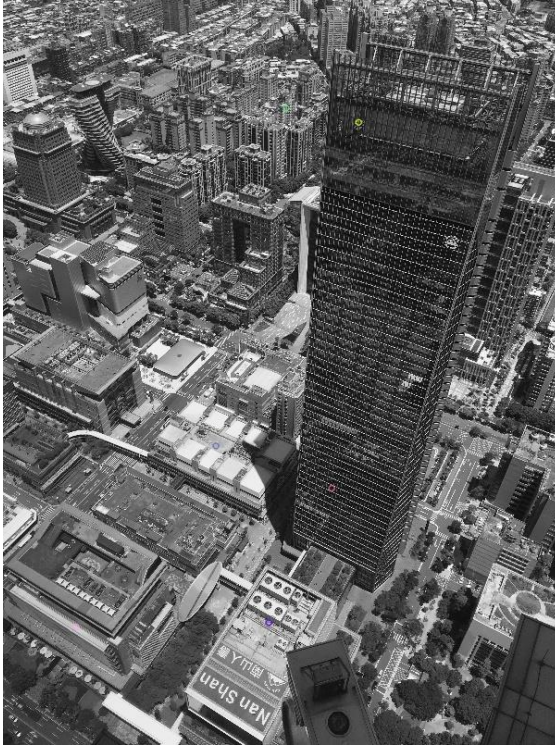
❑ User interface for the third question:



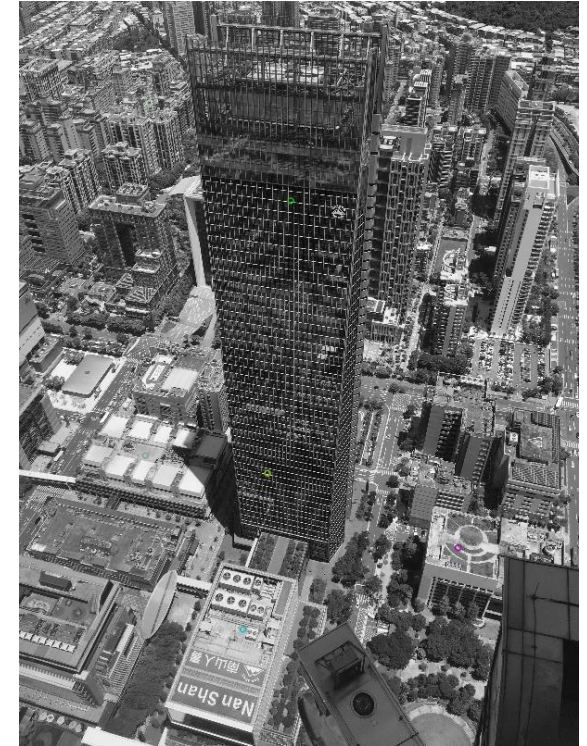
3. (40%) SIFT

(出題 : Michael)

- ❑ Q: 3.1) (20%) Click button “3.1 Keypoints” to **show**:
 - **6 feature points on each** Aerial1.jpg and Aerial2.jpg
 - then **save results** as FeatureAerial1.jpg and FeatureAerial2.jpg as figure 1:



FeatureAerial1.jpg



FeatureAerial2.jpg

Figure 1. Feature points on two images.

- ❑ Hint : (ref. : opencv2refman_2.4.7.pdf) ref. p663 ~ p670

3. (40%) SIFT

(出題 : Michael)

- ❑ Q: 3.2) (20%) Click button “3.2 Matched Keypoints”,
- draw the matched feature points between two images from 6 keypoints pairs obtained in Q: 3.1) and show the results as Figure 2:

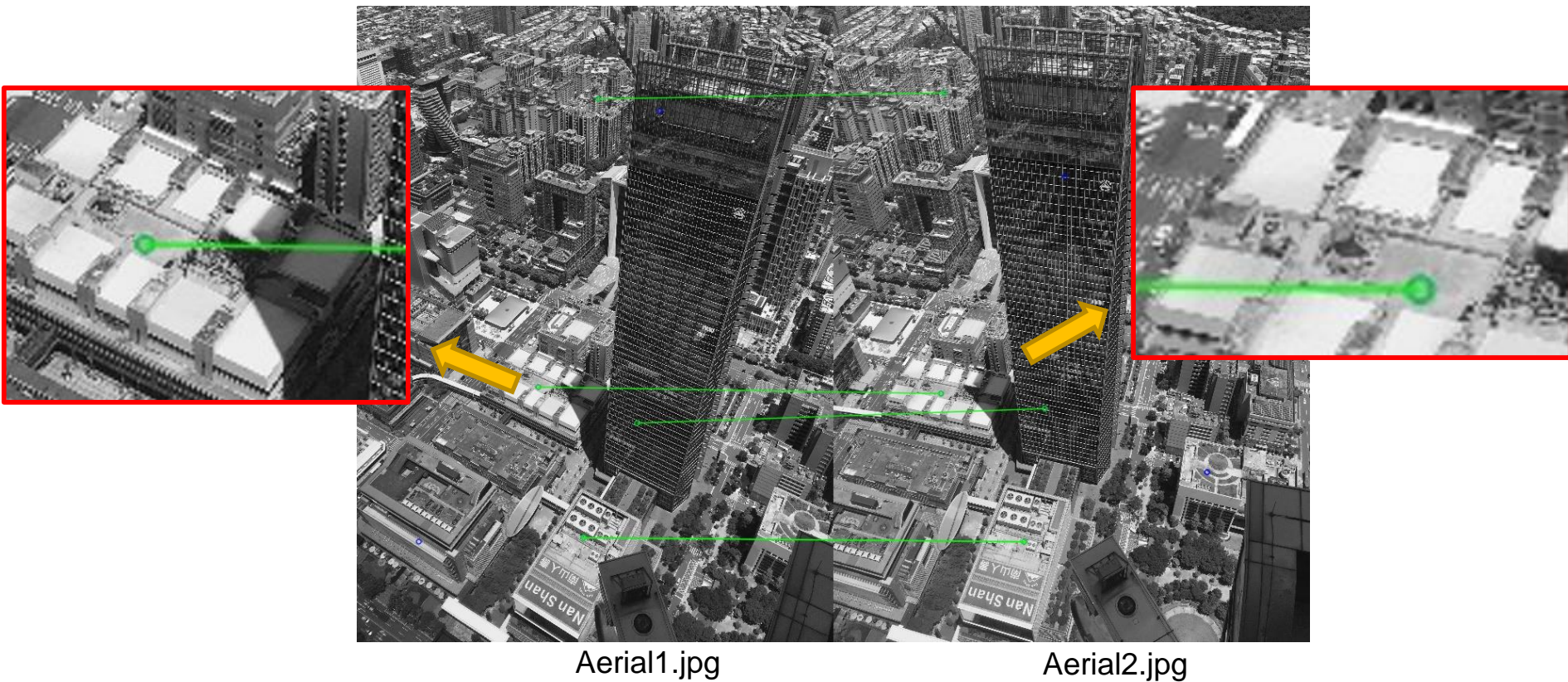


Figure 2. Feature points and their corresponding points.

- ❑ Hint : (ref. : opencv2refman_2.4.7.pdf) ref. p663 ~ p670