影像處理、電腦視覺及深度學習概論
(Introduction to Image Processing, Computer Vision and Deep Learning)

Homework 1

TA:

少鈞: nckubot65904@gmail.com

Office Hour: 14:00~16:00, Mon.

10:00~12:00, Fri.

At CSIE 9F Robotics Lab.

Notice (1/2)

- Copying homework is strictly prohibited!! Penalty: Score will be zero for both persons!!
- Due date => 08:30:00, 2022/10/17 (Mon.)

  No delay. Penalties for late homework:
  - ➢ Up to 7 days late, loss of 50% of the score awarded
  - ➢ After 7 days, the score will be marked as 0.
- You must attend the demonstration, or your score will be 0. The demonstration schedule will be announced on NCKU moodle.
- You must make a GUI, or you will get some penalties.
- Upload to => 140.116.154.1 -> Upload/Homework/Hw1_1
  - ➢ User ID: opencvdl2022 Password: opencvdl2022
- Format
  - ➢ Filename: Hw1_1_StudentID_Name_Version.rar
    - Ex: Hw1_1_F71234567_林小明_V1.rar
    - If you want to update your file, you should update your version to be V2, ex: Hw1_1_F71234567_林小明_V2.rar
  - ➢ Content: project folder*(excluding the pictures)

    *note: remove your “Debug” folder to reduce file size

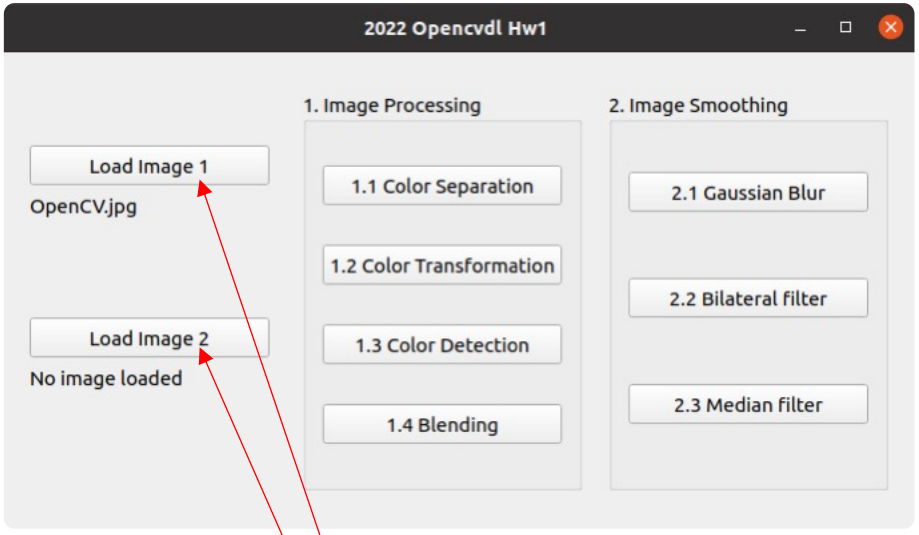
Notice (2/2)

- Python (recommended)
  - Python 3.7 (https://www.python.org/downloads/)
  - opencv-contrib-python (3.4.2.17)
  - Matplotlib 3.1.1
  - UI framework: pyqt5 (5.15.1)

- 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

Assignment scoring (Total: 100%)

1. (20%) Image Processing (出題：Sam)
   - 1.1 (5%) Color Separation
   - 1.2 (5%) Color Transformation
   - 1.3 (5%) Color Detection
   - 1.4 (5%) Blending
2. (20%) Image Smoothing (出題：Jack)
   - 2.1 (6%) Gaussian blur
   - 2.2 (7%) Bilateral filter
   - 2.3 (7%) Median filter
3. (20%) (出題：)
4. (20%) (出題：)
5. (20%) Training Cifar10 Classifier Using Resnet101 (出題：Wen)



Don’t fix your image path
(There is another dataset for demonstration)

1. Image Processing (20%)

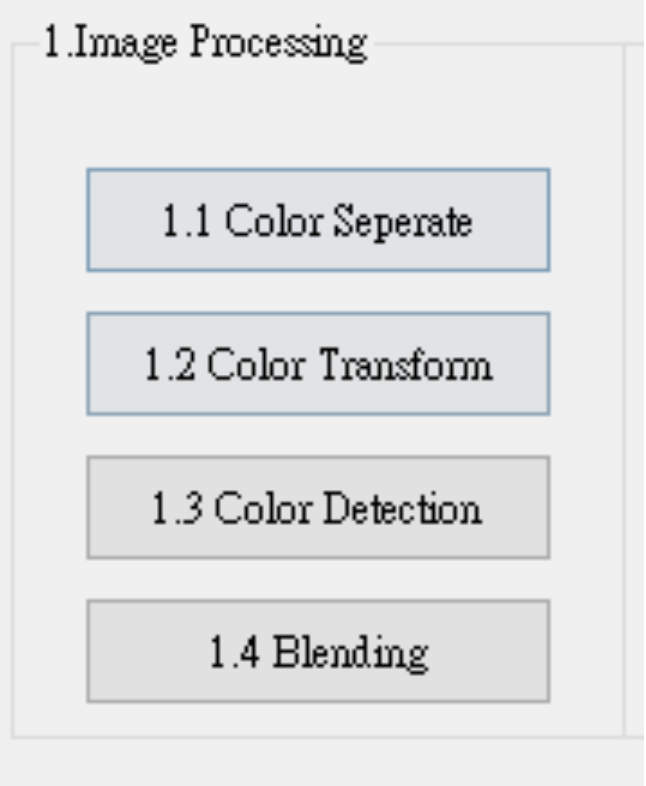
(出題：Sam)

1.1 (5%) Color Separation

1.2 (5%) Color Transformation

1.3 (5%) Color Detection

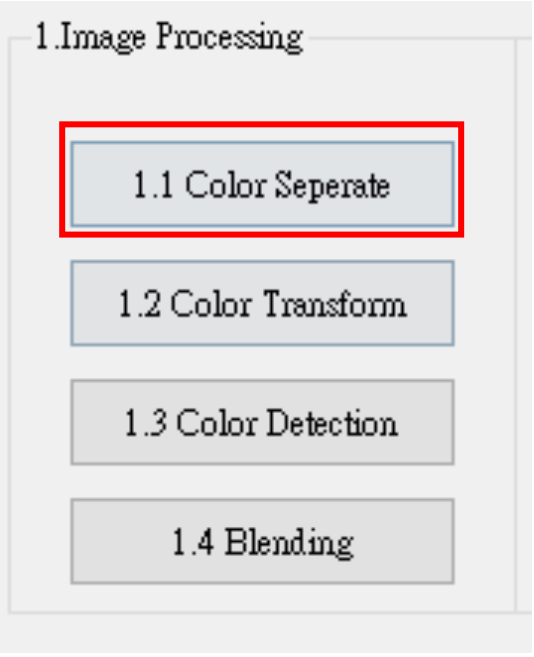
1.4 (5%) Blending



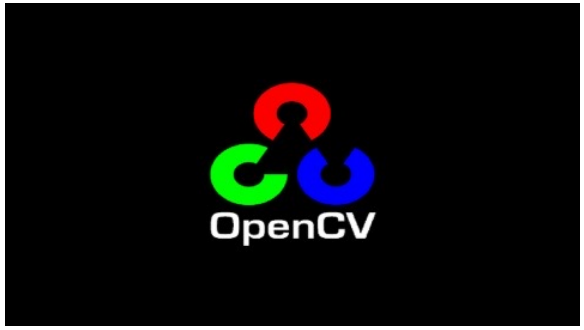
1.1 Color Separation (5%)

(出題：Sam)

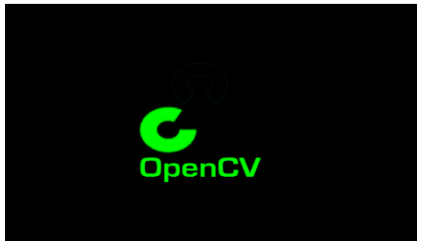
- Given: a color image, “OpenCV.jpg”
- Q: 1) Extract 3 channels of the image BGR to 3 separated channels and show the result images.
- Hint:
  - Textbook Chapter 3, p.31 ~ p.49
  - cv2.split(), cv2.merge()



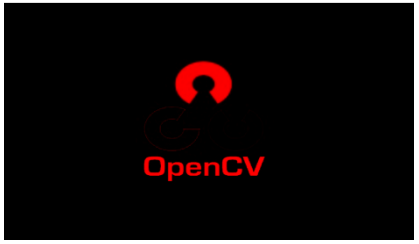
OpenCV.jpg



B channel



G channel

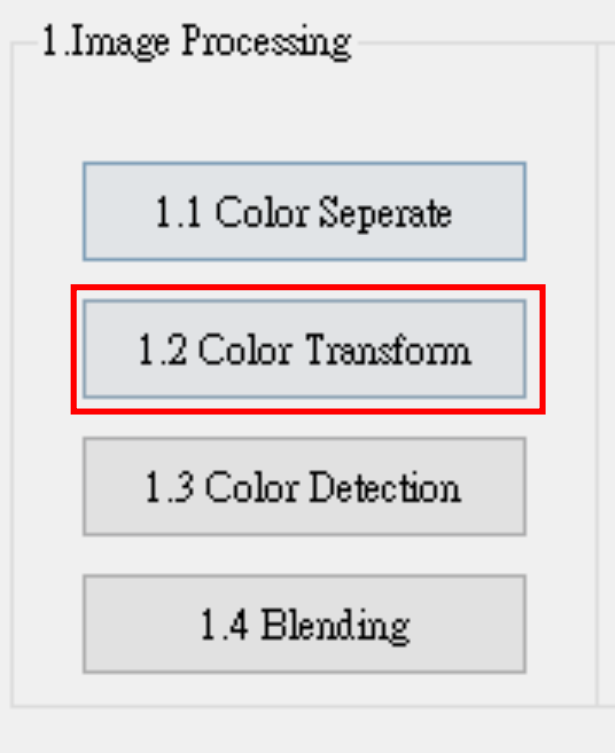


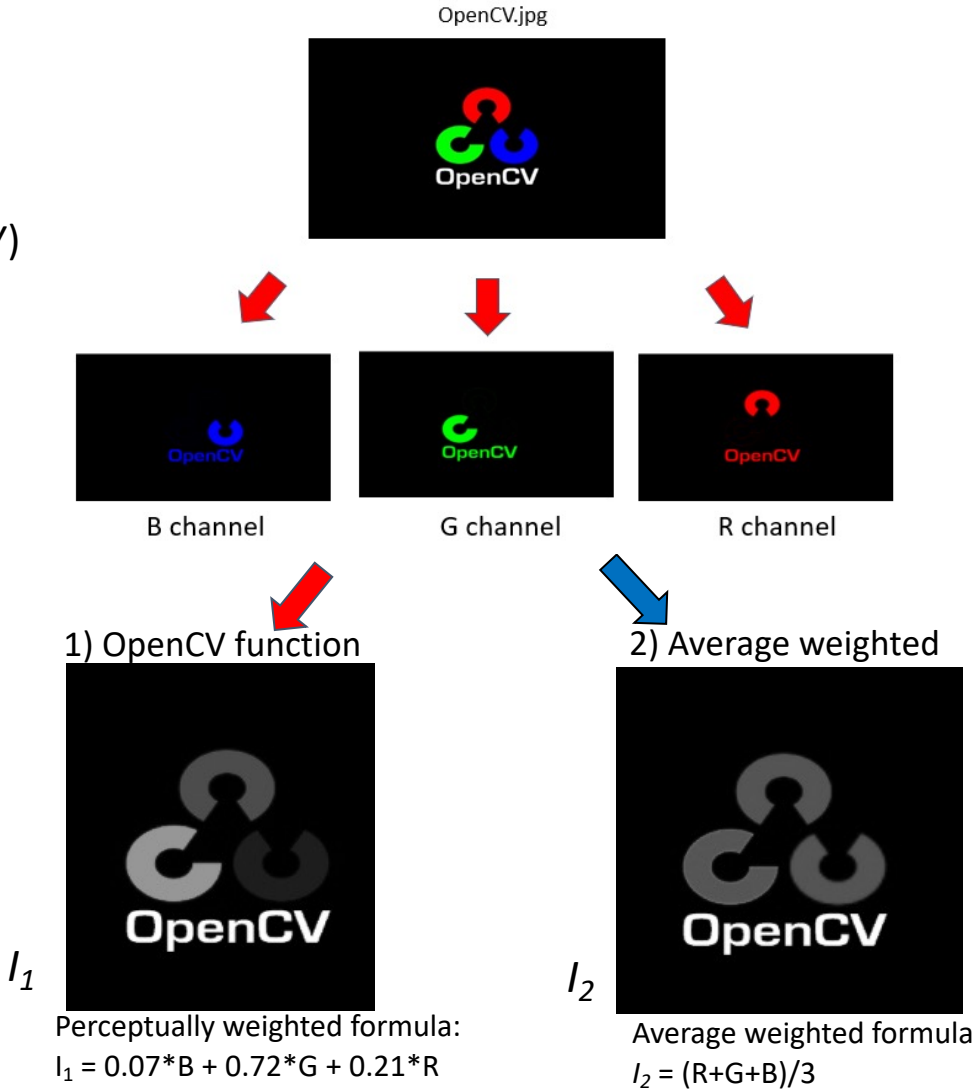
R channel

1.2 Color Transformation (5%)

(出題：Sam)

- Given: 1 color image: “OpenCV. jpg”
- Q: 1) Transform “OpenCV.jpg” into grayscale image I_1 by calling OpenCV function directly.
  2) Merge BGR separated channel images from problem 1.2 into grayscale image I_2 by $I_2 = (R+G+B)/3$.
  3) Show the above 2 results.
- Hint:
  - Textbook Chapter 3, p.56 ~ p.59
  - cv2.cvtColor(…, cv2.COLOR_BGR2GRAY)

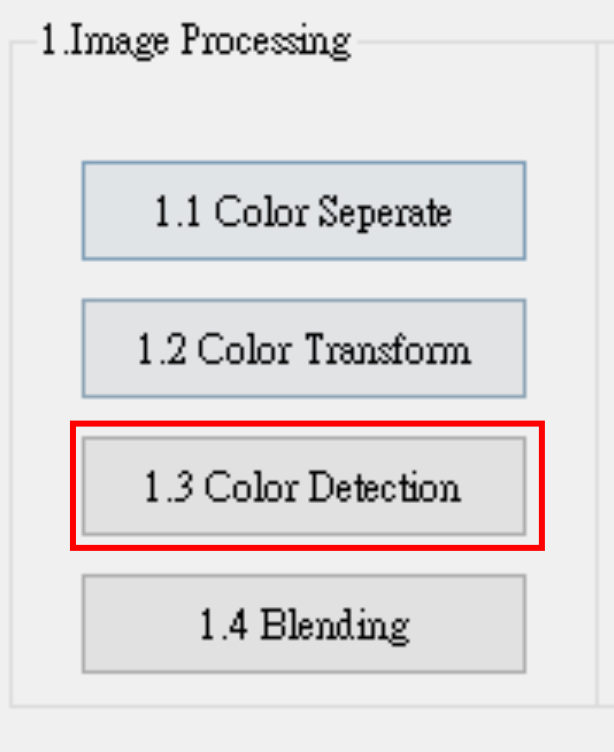


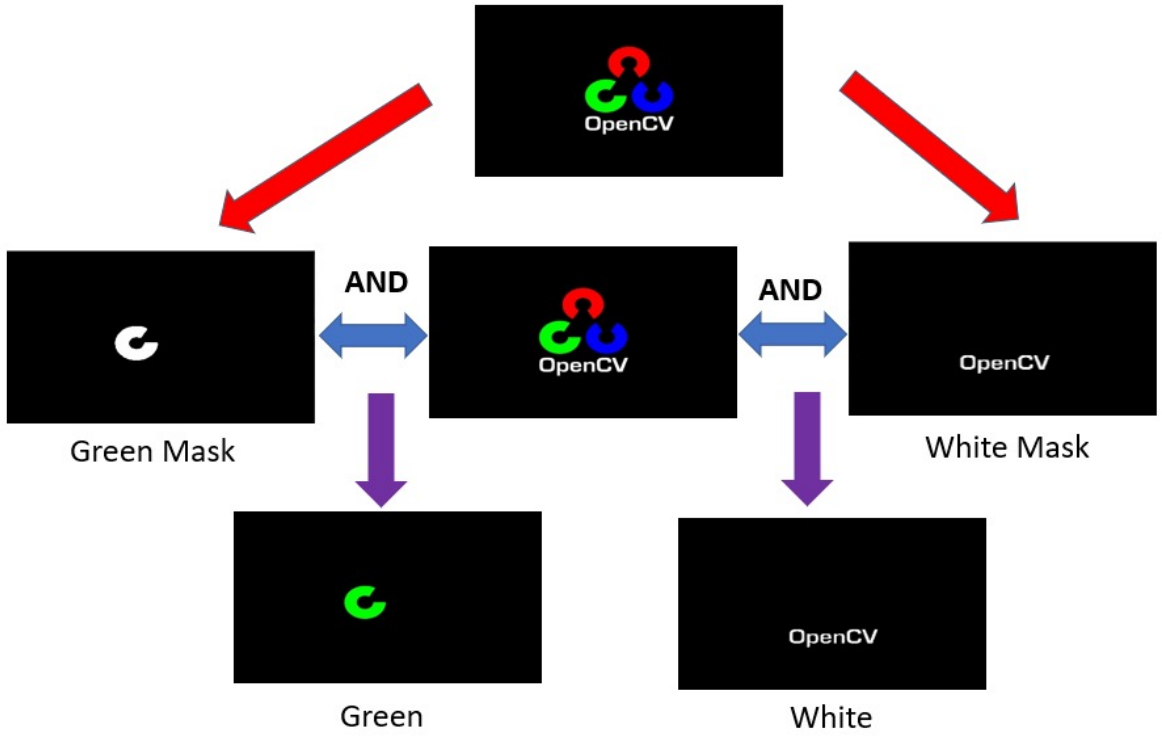


1.3 Color Detection (5%)

(出題：Sam)

- Given: 1 color image: “OpenCV. jpg”
- Q: 1) Transform “OpenCV.jpg” from BGR format to HSV format.
  2) Generate mask by calling :
  cv2.inRange(hsv_img , lower_bound , upper_bound)
  3) Detect **Green** and **White** color in the image by calling :
  cv2.bitwise_and(bgr_img , bgr_img , mask)
  4) Show the result

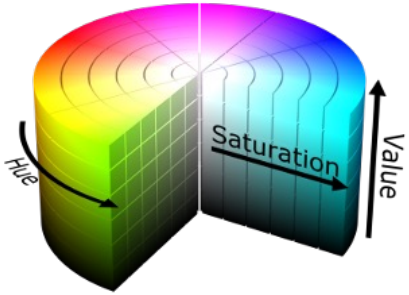


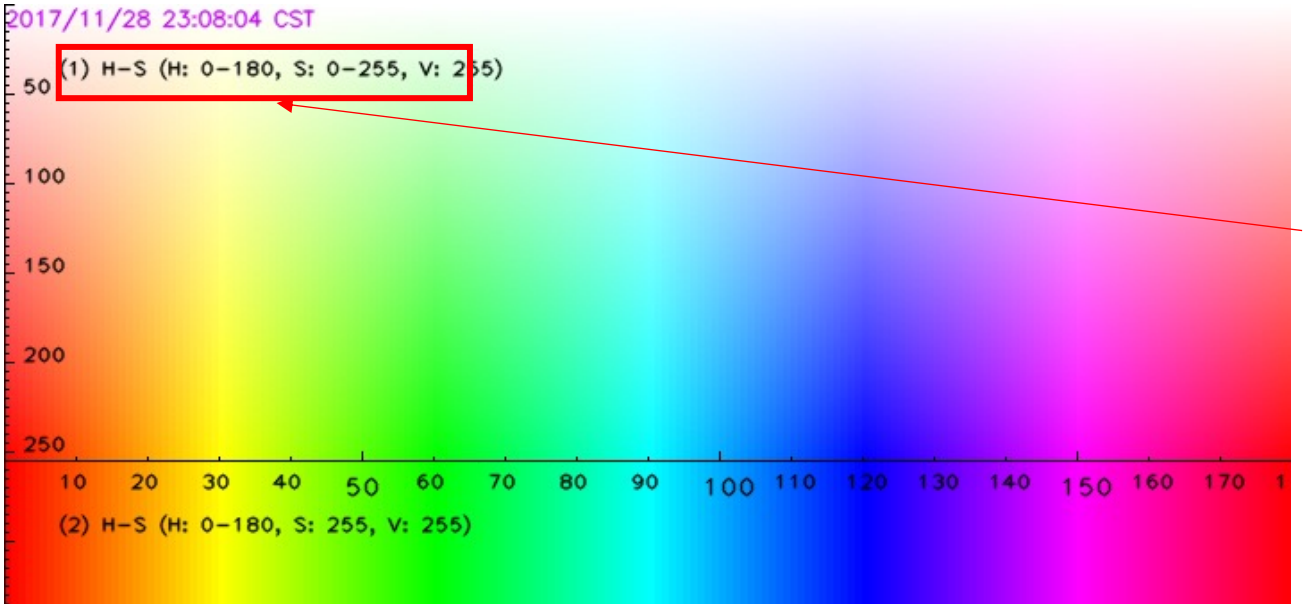


1.3 Color Detection (5%)

(出題：Sam)

- Hint:
  - cv2.cvtColor(…, cv2.COLOR_BGR2HSV)
  - cv2.inRange(hsv_img , lower_bound , upper_bound)
  - cv2.bitwise_and(bgr_img , bgr_img , mask)





HSV values ranges between (0–180, 0–255, 0–255)

H(Hue) : x axis
S(Saturation) : y axis
V(Value) : 255

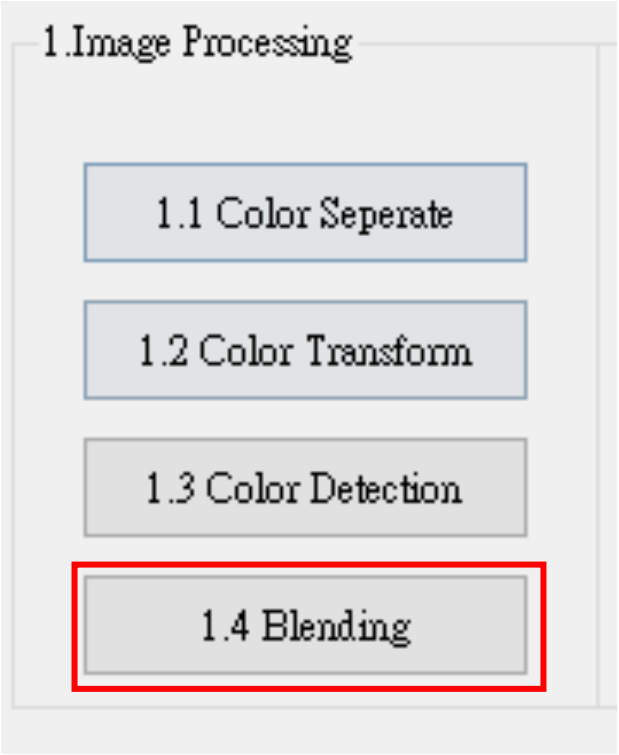
Using this range should be fine
Green Range : (40-80,50-255,20-255)
White Range : (0-180,0-20,200-255)

REF: https://medium.com/@gowtham180502/how-to-detect-colors-using-opencv-python-98aa0241e713

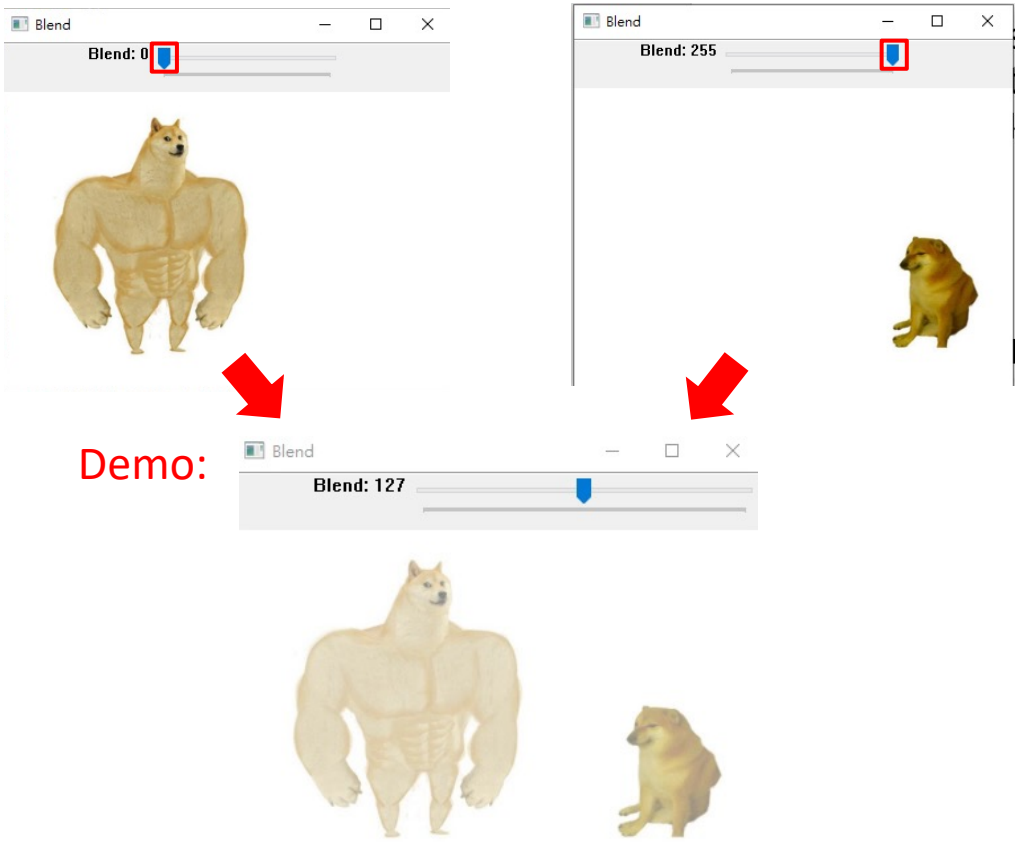
1.4 Blending (5%)

(出題：Sam)

- Given: 2 images, “Dog_Strong.jpg” and “Dog_Weak.jpg”
- Q: 1) Combine two images (Dog_Strong.jpg and Dog_Weak.jpg).
  2) Use Trackbar to change the weights and show the result in the new window.
- Hint:
  - Textbook Chapter 3, p. 50 ~ 52
  - cv2.addWeighted(), cv2.createTrackbar()



Demo:



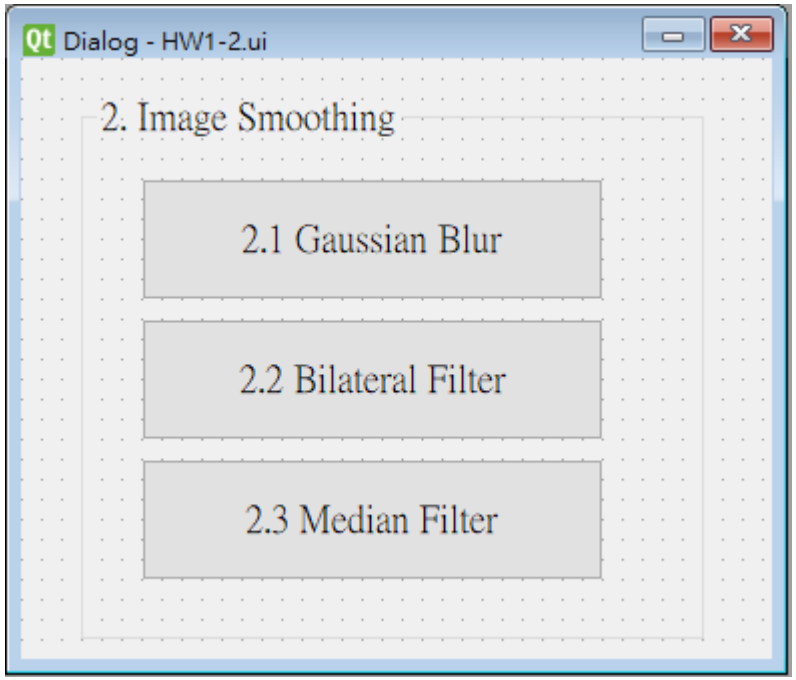
2. Image Smoothing (20%)

(出題：Jack)

2.1 (6%) Gaussian blur

2.2 (7%) Bilateral filter

2.3 (7%) Median filter



2.1 Gaussian Blur

(出題：Jack)

Given: “image1.jpg

Define: gaussian magnitude 0 ~ 10,

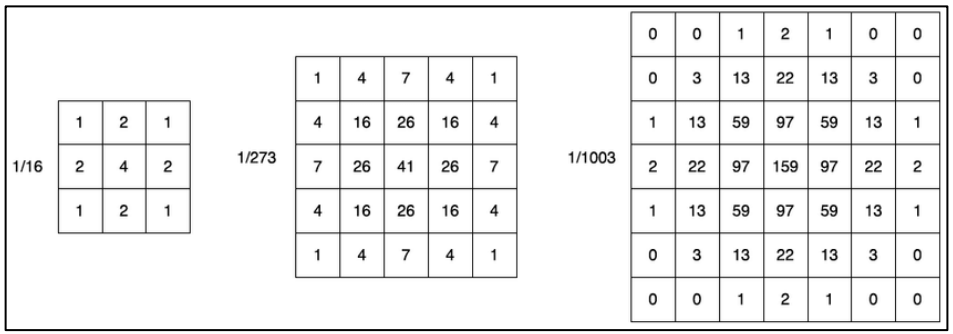
Condition1. magnitude = m > 0 then Apply gaussian filter k x k to “image1.jpg” (k=2m+1)

Condition2. magnitude = m = 0 then output “image1.jpg”

Q: Use Trackbar to change the magnitude and show the result in the popup window.

Hint:

- Textbook Chapter 3, p. 50 ~ 52, p.109~115
- cv2.GaussianBlur(), cv2.createTrackbar()



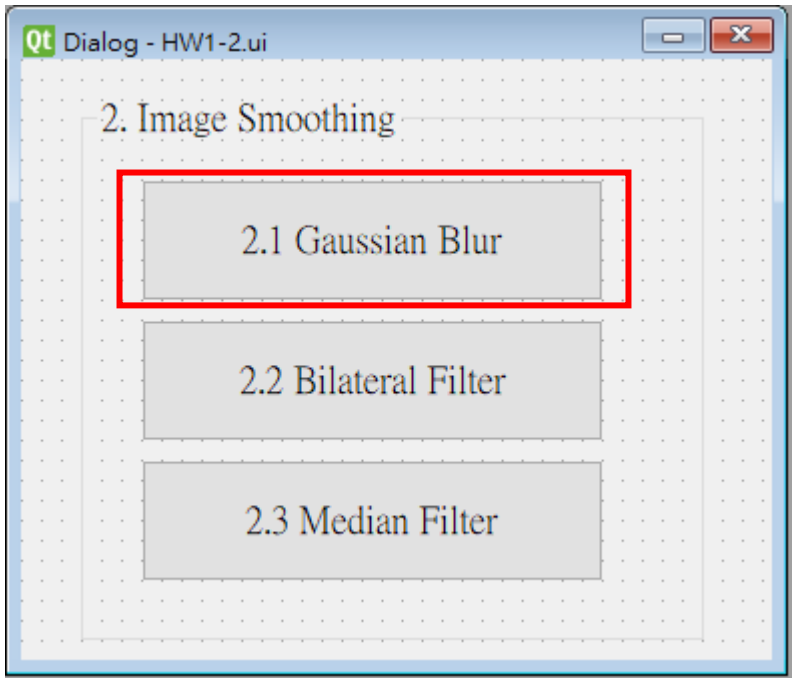
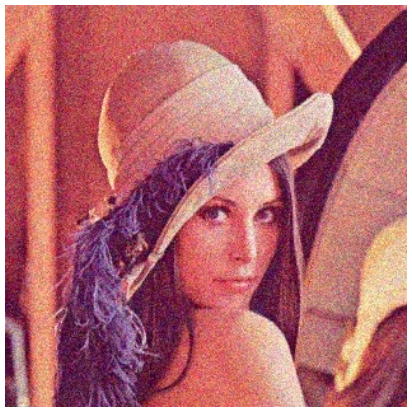
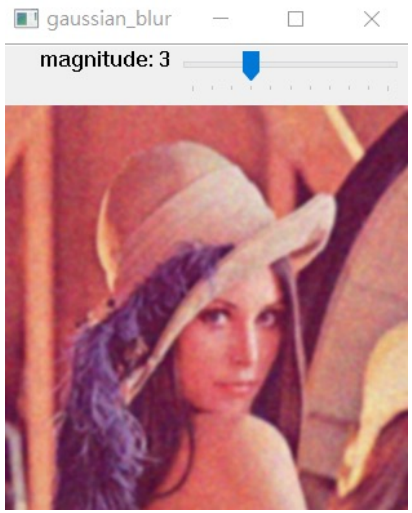


image1.jpg





2.2 Bilateral Filter

(出題：Jack)

Given: “image1.jpg

Define: Bilateral magnitude 0 ~ 10, sigmaColor = 90 and sigmaSpace = 90.

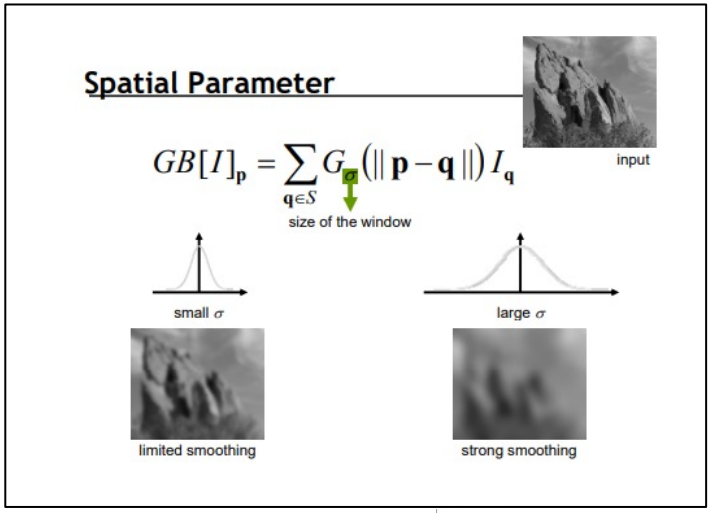
Condition1. magnitude = m > 0 then Apply bilateral filter k x k to “image1.jpg” (k=2m+1)

Condition2. magnitude = m = 0 then output “image1.jpg”

Q: Use Trackbar to change the magnitude and show the result in the popup window.

Hint:

- Textbook Chapter 3, p. 50 ~ 52, p.109~115
- cv2.bilateralFilter(), cv2.createTrackbar()



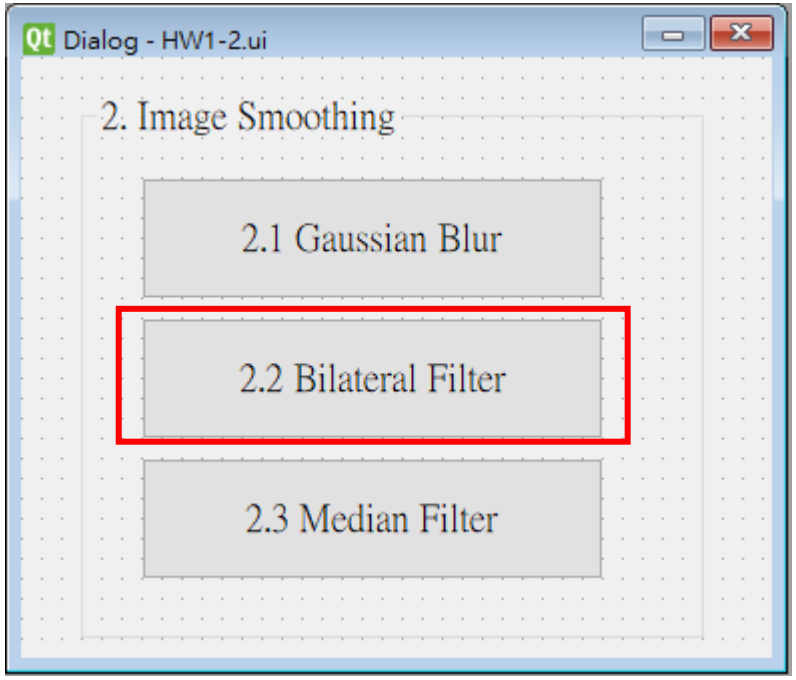
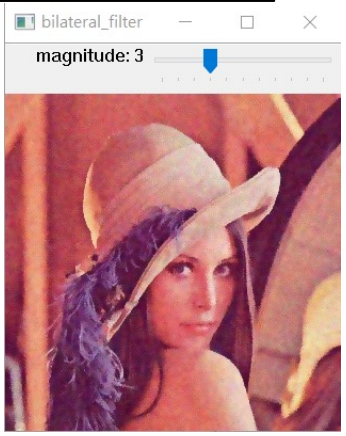


image1.jpg



2.3 Median Filter

(出題：Jack)

Given: “image2.jpg

Define: Median magnitude 0 ~ 10,

Condition1. magnitude = m > 0 then Apply median filter k x k to “image2.jpg” (k = 2m+1)

Condition2. magnitude = m = 0 then output “image2.jpg”

Q: Use Trackbar to change the magnitude and show the result in the popup window.

Hint:

- Textbook Chapter 3, p. 50 ~ 52, p.109~115
- cv2.medianBlur(), cv2.createTrackbar()

Median filter example