電腦視覺原理及應用簡介

Lab4

Skin Color Detection

介紹

- 在圖片中尋找人臉、四肢的應用中，skin color detection可用來做預處理，找出可能含有人的圖片

  (In the application of finding faces and limbs in pictures, skin color detection can be used for pre-processing to find pictures that may contain people.)

- 過程中會將圖片pixel轉換到合適的color space

  (The process will convert the image pixel to the appropriate color space)

  - e.g. RGB、**HSV**、**YCrCb**…

- 在進行skin color detection之前，對影像作模糊化減少影像的雜訊和細微變化。讓整體的顏色更均勻，提高後續續做skin color detection準確性。

  (In order to minimize noise and subtle image changes, blur the image before performing the skin color detection.)

- 在color space中找到合適的範圍，以此過濾出圖片中含有skin color的pixel

  (Find the appropriate range in the color space and filter out the pixels containing skin color in the image.)

- 過濾完圖片後，通常會使用morphology來減少雜訊

  (After filtering the image, morphology is usually used to reduce noise.)

  - e.g. erotion、dilation

Color Space (Cont.)

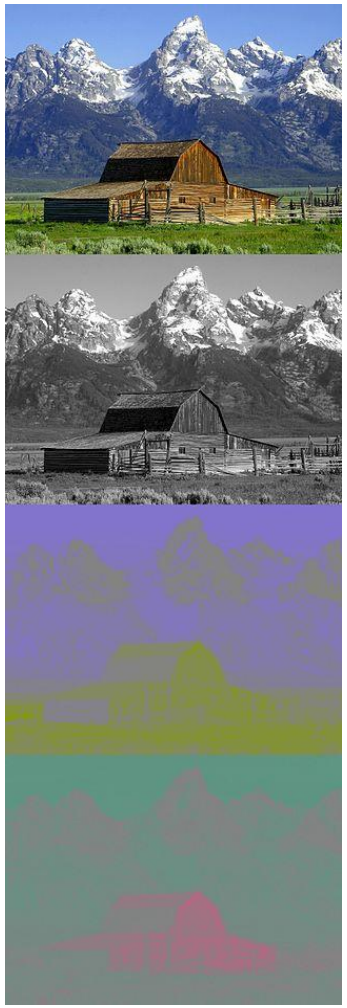
- Standard HSV
  - H(色相)、Saturation(飽和度)、Value/Brightness(亮度)
  - 閾值參考範圍：
    (0° <= H <= 25°) or (335° <= H <= 360°)
    (0.2 <= S <= 0.6) and (0.4 <= V)

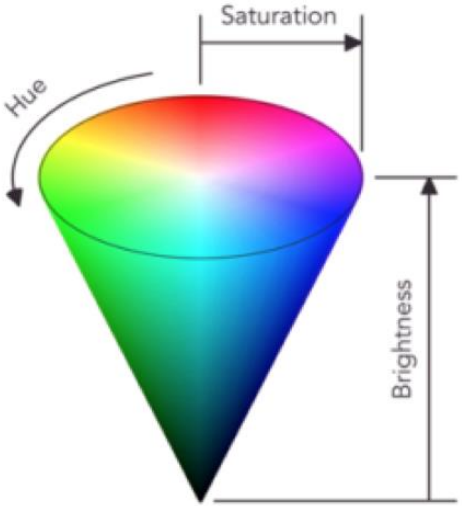
※ 在OpenCV中的H、S、V值的範圍與標準HSV有差異

✓ Range in Standard HSV
H ：0°~360° 、 S：0~1 、 V：0~255

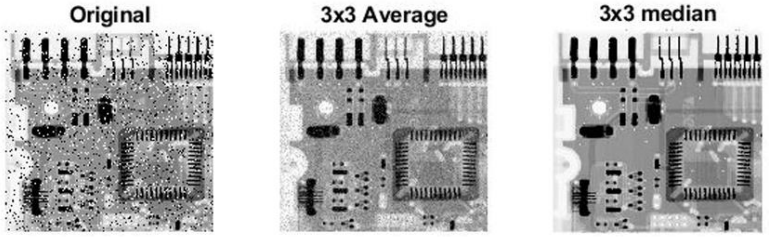
✓ Range in OpenCV
H ：0°~180° 、 S：0~255 、 V：0~255

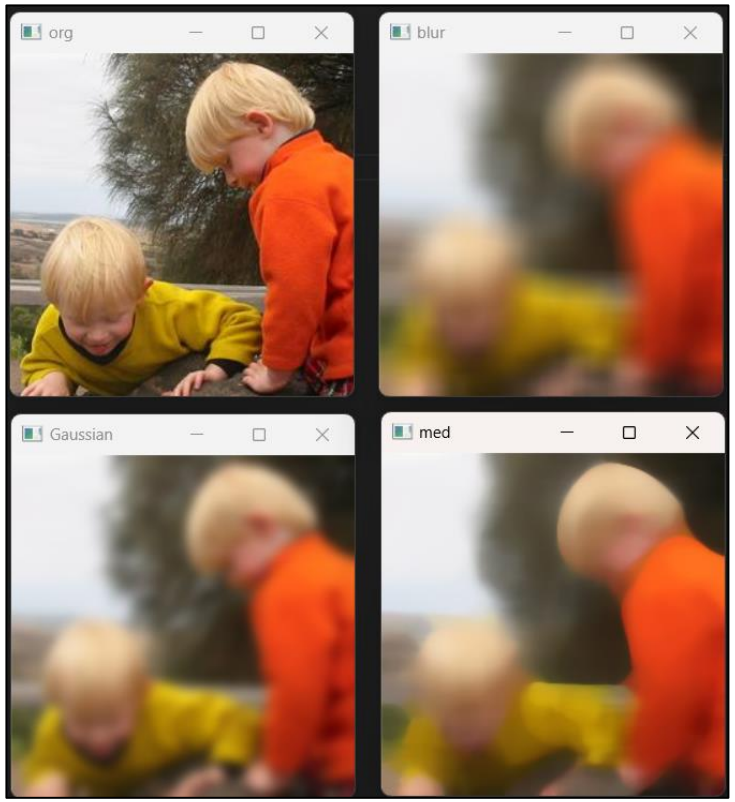
- YCrCb
  - Y(亮度)、Cr(紅色差)、Cb(藍色差)
  - 閾值參考範圍：
    255>=Y>=80，177>=Cr>=133，127>=Cb>=77





模糊化 (Blur)





- 均值模糊 (blur)
  - ➢ cv2.blur(img, (kernel_size, kernel_size))
    - img (來源影像)，ksize(指定區域範圍大小, e.g. (5,5))
    - 指定區域單位設定的範圍越大，則模糊的效果越明顯

    (邊緣模糊不自然、模糊過渡，適合處理輕度的模糊需求)
- 中值模糊 (medianBlur)
  - ➢ cv2.medianBlur(img, ksize)
    - img (來源影像)，ksize(模糊的程度，必須是大於1的奇數)
    - 模糊程度設定的範圍越大，則模糊的效果越明顯

    (保持邊緣清晰，但模糊效果相較均質模糊較輕。適合處理有極端噪聲(salt-and-pepper noise))
- 高斯模糊 (GaussianBlur)
  - ➢ cv2.GaussianBlur(img, (kernek_size,kernel_size), sigma)
    - img (來源影像)，ksize(指定區域範圍，必須是大於1的奇數, e.g. (3,3)，(5,5))，sigma為標準差
    - 模糊程度設定的範圍越大，則模糊的效果越明顯;
      標準差越大，生成的高斯分布越寬，模糊效果越強

    (邊緣模糊自然，平滑過渡)

流程

- 讀取影片(read video)
  - **cv2.VideoCapture("Video Name")**

- 使用高斯模糊(using gaussian blur)
  - **cv2.GaussianBlur(img, (ksize,ksize), sigma)，sigma可以設成2**

- 將color space從BGR轉換至HSV、YCrCb (transfer from BGR to HSV or YCrCb)
  - **cv2.cvtColor(img, cv2.COLOR_BGR2HSV)**
  - **cv2.cvtColor(img, cv2.COLOR_BGR2YCR_CB)**

- 依據不同的color space對應的閾值範圍產生出對應的mask

  (Generate the corresponding mask according to the Cr and Cb of the picture)
  - **cv2.inRange(img, lowerb, upperb)**
  - **閾值參考範圍: 255>=Y>=80，177 >= Cr >= 133， 127 >= Cb >= 77**
  - **閾值參考範圍: (0° <= H <= 25°) or (335° <= H <= 360°) 且 (0.2 <= S <= 0.6) and (0.4 <= V)**

  （多個條件要用bitwise_and(&) 或是 bitwise_or(|)）

流程 (Cont.)

- 對mask使用opening(erosion->dilation)去除部分雜訊
  (Use opening(erosion->dilation) to remove some noise)
  - **cv2.enrode(src, kernel)**
  - **cv2.dilate(src, kernel)**
  - **Or you can try …. cv2.morphologyEx(src, op, kernel) , op: cv2.MORPH_OPEN，cv2.MORPH_CLOSE**

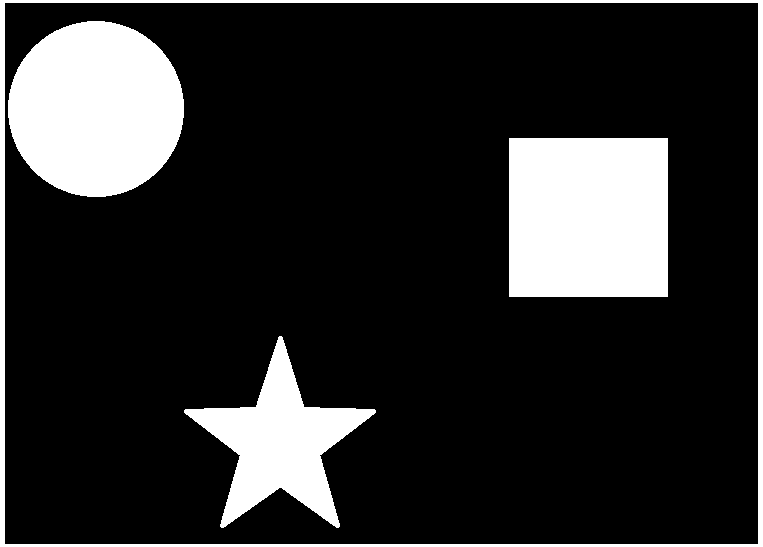
  ※ kernel size範例: np.ones((5,5), np.uint8)
- 在mask中取得skin color pixels的輪廓/ Get the profile of skin color pixels in mask
  - `cv2.findContours(src, mode , method)` --> contours, hierarchy
    ※ 注意src的型態需為unsigned int，而mask為bool，要做型態轉換 -> mask.astype(np.uint8)
    ※ mode可使用 cv2.RETR_EXTERNAL
    ※ method可使用 cv2.CHAIN_APPROX_SIMPLE
- 畫出輪廓/ Draw the contours
  - `cv2.drawContours(image, contours, contoursIndex, color, thickness)`

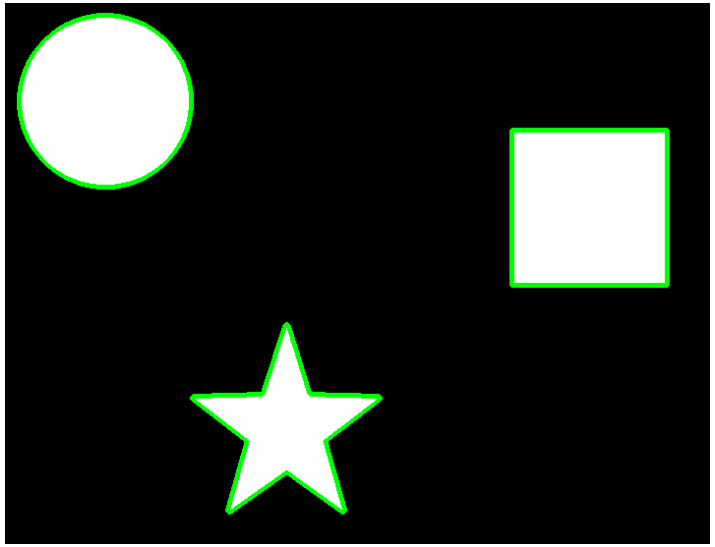
    ※contourIndex可設成-1, 代表畫出所有輪廓; color可設成(0, 255, 0); thickness可設成2
- 顯示結果/ Show results

Contour範例

```python
import numpy as np
import cv2

image = cv2.imread("example_contour.PNG")
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
contours, hierarchy = cv2.findContours(gray.astype(np.uint8), cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPLE)
cv2.drawContours(image, contours, -1, (0,255,0), 10)
cv2.imshow("gray", gray)
cv2.imshow("result", image)
cv2.waitKey(0)
cv2.destroyAllWindows()
```





Demo要求

- 讀取給定的影片(Lab4.mp4)/ Read the given video

- 將原影片的color space轉成YCrCb和HSV後在原frame上以及mask後的frame上畫出skin color region的輪廓

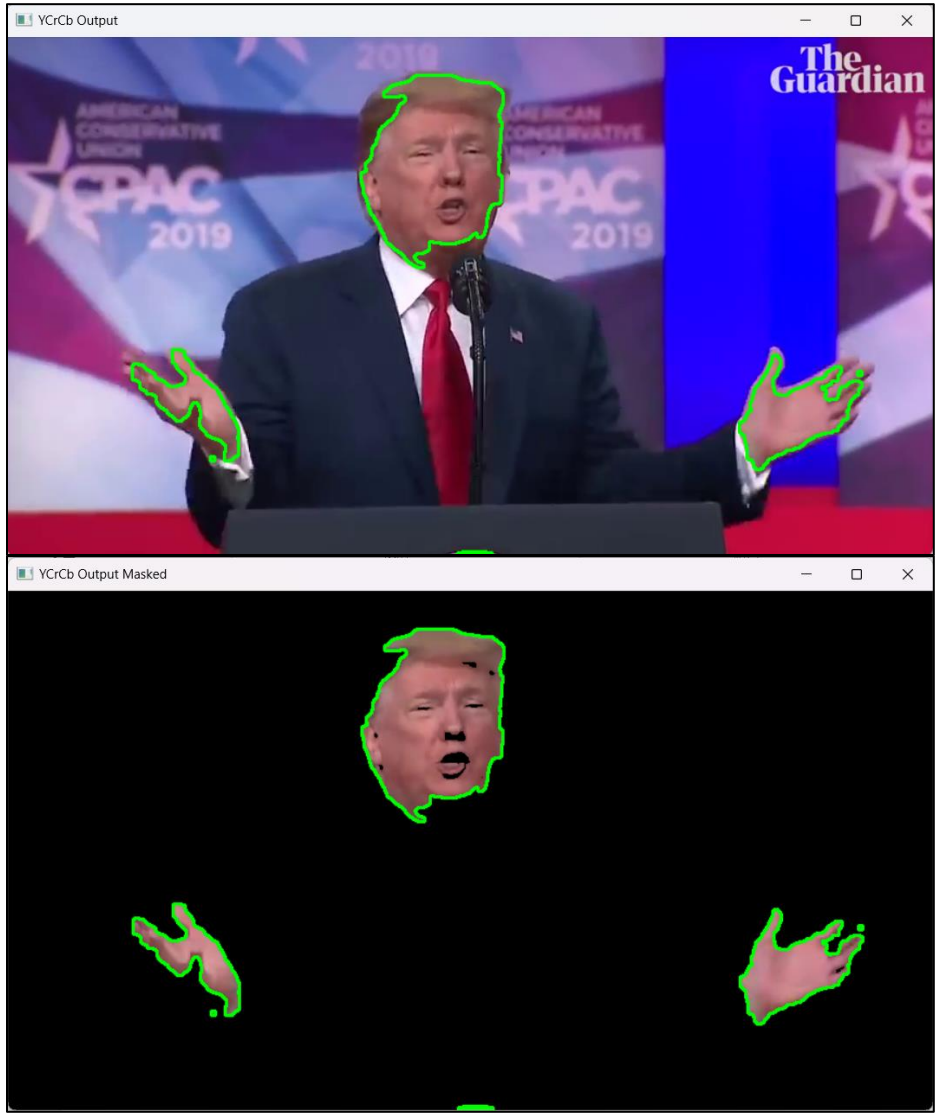
  Draw the contour of the skin color region

- 持續按任意鍵(除了q and Q)播放影片

  Keep pressing any key (except q and Q) to play the video

- 按q or Q結束影片/Press q or Q to end the video

Demo


YCrCb Output
The Guardian
AMERICAN CONSERVATIVE UNION
CPAC 2019
YCrCb Output Masked


HSV Output
The Guardian
AMERICAN CONSERVATIVE UNION
CPAC 2019
HSV Output Masked

參考資料

- GaussianBlur: https://docs.opencv.org/2.4/modules/imgproc/doc/filtering.html?highlight=cv2.gaussianblur#cv2.GaussianBlur

- erode: https://docs.opencv.org/2.4/modules/imgproc/doc/filtering.html?highlight=erode#cv2.erode

- findContours & drawContours: https://docs.opencv.org/2.4/modules/imgproc/doc/structural_analysis_and_shape_descriptors.html?highlight=cv2.findcontours#cv2.findContours