HW7

November 16, 2019

1 Digital Image Processing - HW7 - 98722278 - Mohammad Doosti Lakhani

This notebook consists of: 1. First section contains following tasks: 1. Study AAM paper and summarize it 2. Study CLM paper and summarize it 3. Compare them with each other and also ASM (Active Shape Model) 2. `dlib` is a powerful library in image processing. For detecting face landmarks there are built-in methods in `cv2` and `dlib` 1. Study the codes in linked here and write a program to calculate face landmarks via offline approach and demonstrates them (link1, link2, link3) 1. OpenCV 2. dlib 2. Compare them based on speed and accuracy (use subjective measurement for accuracy)

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1.2 2 `dlib` is a powerful library in image processing. For detecting face landmarks there are built-in methods in `cv2` and `dlib`

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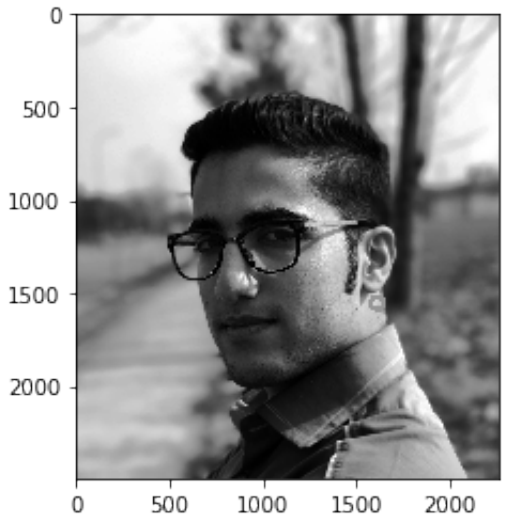
    1. OpenCV
    2. dlib
2. Compare them based on speed and accuracy (use subjective measurement for accuracy)

1.2.1 2.A Calculate Face Landmarks

1. OpenCV
2. dlib

Note: I had a few problems with installing `dlib` so this code has been copied from results I have achieved in Google Colab.

```
In [3]: import numpy as np
        import cv2
        import dlib
```



cv result

```
import imutils
import matplotlib.pyplot as plt
import time
%matplotlib inline
```

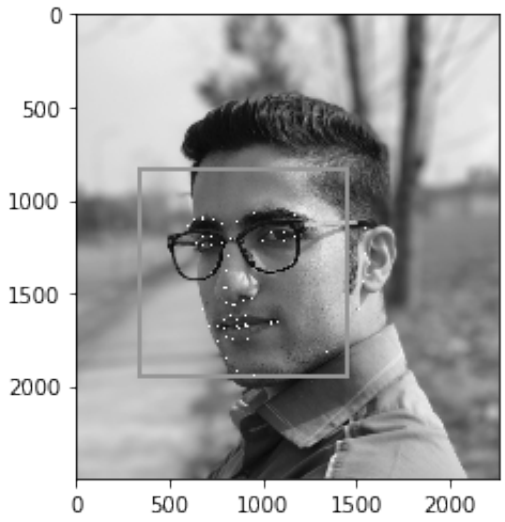
2.A.a OpenCV

```
In [ ]: face_cascade = cv2.CascadeClassifier(cv2.data.haarcascades+'haarcascade_frontalface_al
        image = cv2.imread('IMG.JPG', 0)
        image = cv2.equalizeHist(image)
        faces = face_cascade.detectMultiScale(image)
        for (x,y,w,h) in faces:
                center = (x + w//2, y + h//2)
                image = cv2.ellipse(image, center, (w//2, h//2), 0, 0, 360, (255, 0, 0), 4)
        plt.imshow(image, cmap='gray')
```

2.A.B dlib

```
In [ ]: # download data
        !wget http://dlib.net/files/shape_predictor_68_face_landmarks.dat.bz2
        !bzip2 -dk shape_predictor_68_face_landmarks.dat.bz2

        detector = dlib.get_frontal_face_detector()
        predictor = dlib.shape_predictor("shape_predictor_68_face_landmarks.dat")
        image = cv2.imread('IMG.JPG', 0)
        faces = detector(image)
        for face in faces:
            x1 = face.left()
            y1 = face.top()
```



dlib result

```
    x2 = face.right()
    y2 = face.bottom()
    cv2.rectangle(image, (x1, y1), (x2, y2), (0, 255, 0), 3)

    landmarks = predictor(image, face)

    for n in range(0, 68):
        x = landmarks.part(n).x
        y = landmarks.part(n).y
        cv2.circle(image, (x, y), 4, (255, 0, 0), 4)
plt.imshow(image, cmap='gray')
plt.show()
```

2.B Compare dlib and cv2 Time: 1. Considering loading model 1. dlib: 2.208890199661255 2. HaarCascade (cv2): 2.6401994228363037 2. Without model load time 1. dlib: 0.7304553985595703 2. HaarCascade: 2.6089558601379395

So based on the values we can say that dlib is pure success as only cv2 trained model could not find the face and just marked a small area beneath the ear. Acutally, `dlib` almost found perfect rectangle for face and landmarks are fiton eyes, nose, lip, etc which is enough reason to say that `dlib` is better. About time, even though the result of `dlib` is much better, it achieved it approximately 3.57X faster.