

Assignment 1

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Introduction

In this exercise, we are required to detect faces in the image and apply spatial operations on each face.

Detecting faces

First, we take the image to its gray since it makes it computationally efficient. Surely, we can detect faces with the normal image, but as mentioned it requires much more resources.

Then, we should detect faces. We use "haarcascade_frontalface_default.xml" from opencv to detect faces. The following code is used to do so:

```
gray_image = cv.cvtColor(image, cv.COLOR_BGR2GRAY)
face_classifier = cv2.CascadeClassifier(cv2.data.haarcascades + "haarcascade_frontalface_default.xml")
face = face_classifier.detectMultiScale(gray_image, scaleFactor=1.1, minNeighbors=5, minSize=(40, 40))
```

This is a pre-trained model for detecting faces.

There are also other models that we can use to achieve a similar result. For instance we load the above xml file that detects faces.

Applying Spatial Operations

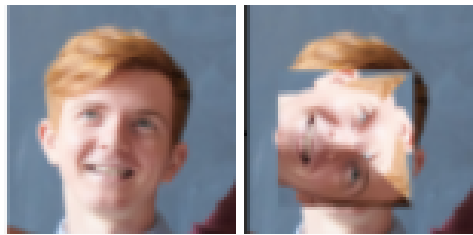
Reversing each face

In this part, we reverse each face. It is similar to taking each point to its mirror point. Here is an example below:



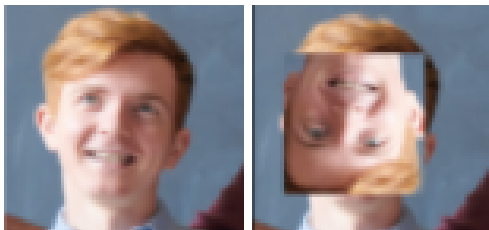
Rotating each face by 90 degrees

Now, we write a function that takes a matrix A and rotates it by 90 degrees clockwise. This results the following output:



Rotating each face by 180 degrees

In order to rotate faces by 180 degrees, we write the rotate_180 function that takes a matrix and rotates it by 180 degrees. This is the final result:

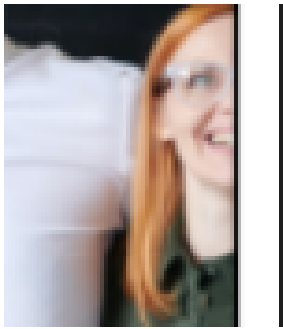


How it detects the faces

OpenCV uses machine learning algorithms to search for faces in a photo. Because faces are complicated, there isn't one simple test that achieves this task. Instead, there are thousands of small patterns and features that must be matched.

Since face detection is such a common case, OpenCV comes with a number of built-in cascades for detecting everything from faces to eyes to hands to legs.

However, it may fail sometimes. For example in this photo, this classifier could not detect the half face that was in the right of the photo:



So, even using these pre-trained tools may not be completely effective.