Experiment no 6:

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Aim: To study Detecting and Recognizing Faces

Objective: To Conceptualizing Haar Cascades Getting Haar cascade data Using Open CV to Perform face detections performing face detection on still images

Theory:

Conceptualizing Haar Cascades- Haar cascades are a method in computer vision for object detection. They use simple Haar-like features to distinguish objects from the background. To create a cascade, a dataset of positive and negative images is needed for training. Integral images speed up feature calculations. Adaboost trains a strong classifier from weak ones based on Haar features. The cascade consists of stages that filter out non-object regions, improving detection speed. Sliding window detection applies the cascade to different positions and scales in an image. Thresholding determines if a region passes each stage. Haar cascades are effective for object detection, often used for tasks like face or pedestrian detection.

Obtaining Haar Cascade data for object detection involves either using pre-trained classifiers or creating custom ones:

- Pre-trained Classifiers: Download pre-trained Haar Cascade classifiers from sources like OpenCV, GitHub repositories, or online platforms for objects like faces. These are readily available and suitable for common objects.
- Custom Classifiers: For unique objects or high precision, create custom Haar Cascade classifiers. Collect positive and negative images, annotate positive images with object bounding boxes, and use tools like OpenCV's opencv traincascade to train the classifier. This process requires careful parameter tuning and substantial computational resources.

Using Open CV to perform Face Detection:

To perform face detection using OpenCV:

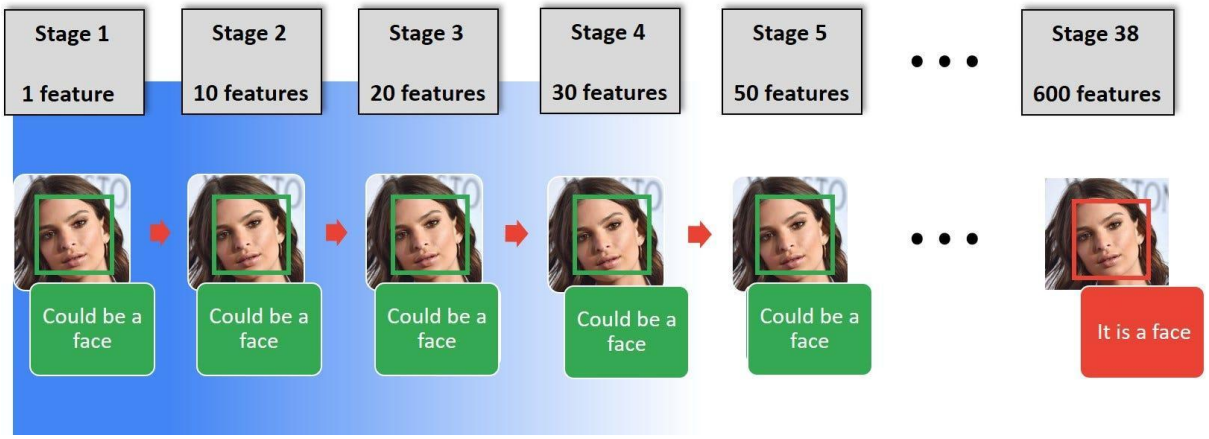
- Install OpenCV with pip install opencv-python.
- Import OpenCV with import cv2
- Load the Haar Cascade classifier for faces.
- Read an image or capture video from a webcam.
- Convert the image to grayscale.
- Use detectMultiScale to detect faces, specifying parameters like scaleFactor, minNeighbors, and minsize.
- Draw rectangles around detected faces.
- Display or save the result.
- Release resources if using webcam capture.
- This process enables you to detect and visually highlight faces in images or video streams using OpenCV's pre-trained classifier.

Performing Face detection on a still image:

- Install OpenCV with pip install opencv-python.
- Import OpenCV using import cv2.
- Load the pre-trained Haar Cascade classifier for faces.
- Read the image you want to analyze.
- Convert the image to grayscale for better detection.

Introduction

Discover object detection with the Haar Cascade algorithm using OpenCV. Learn how to employ this classic method for detecting objects in images and videos. Explore the underlying principles, step-by-step implementation, and real-world applications. From facial recognition to vehicle detection, grasp the essence of Haar Cascade and OpenCV's role in revolutionizing computer vision. Whether you're a novice or an expert, this article will equip you with the skills to harness the potential of object detection in your projects.



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Why Use Haar Cascade Algorithm for Object Detection?

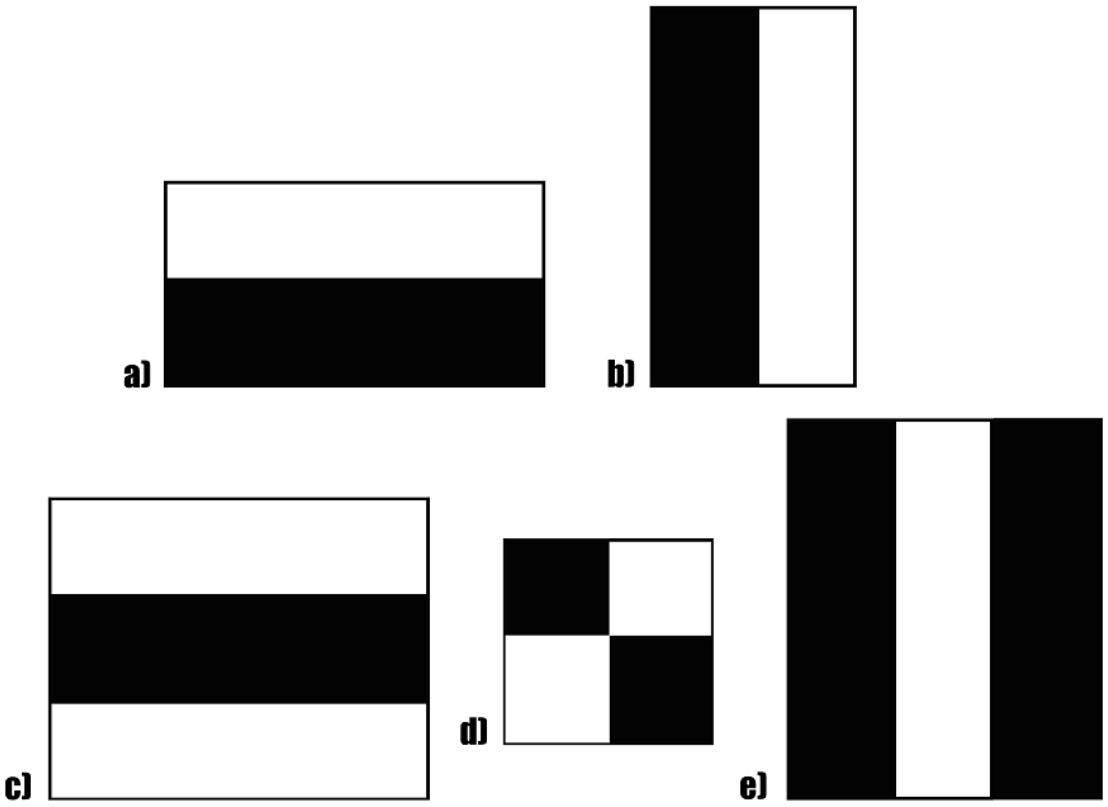
Identifying a custom object in an image is known as object detection. This task can be done using several techniques, but we will use the haar cascade, the simplest method to perform object detection in this article.

What is Haar Cascade Algorithm?

Haar cascade is an algorithm that can detect objects in images, irrespective of their scale in image and location.

This algorithm is not so complex and can run in real-time. We can train a haar-cascade detector to detect various objects like cars, bikes, buildings, fruits, etc.

Haar cascade uses the cascading window, and it tries to compute features in every window and classify whether it could be an object.



Haar cascade works as a classifier. It classifies positive data points → that are part of our detected object and negative data points → that don't contain our object.

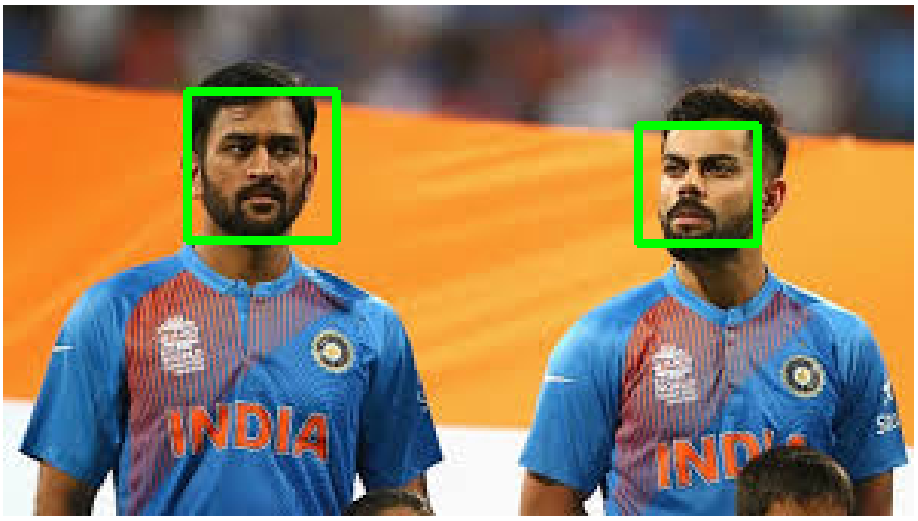
- Haar cascades are fast and can work well in real-time.
- Haar cascade is not as accurate as modern object detection techniques are.
- Haar cascade has a downside. It predicts many false positives.
- Simple to implement, less computing power required.

Code:

```
import cv2
import sys
from google.colab.patches import cv2_imshow

cascPath = "/content/haarcascade_frontalface_default.xml"

faceCascade = cv2.CascadeClassifier(cascPath)

image = cv2.imread("/content/images (1).jpg")
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)



faces = faceCascade.detectMultiScale(
    gray,
    scaleFactor=1.1,
    minNeighbors=5,
    minSize=(1,1),
    flags = cv2.CASCADE_SCALE_IMAGE
)
```

```
print("Detected {0} faces!".format(len(faces)))



for (x, y, w, h) in faces:

    cv2.rectangle(image, (x, y), (x+w, y+h), (0, 255, 0), 2)


cv2_imshow(image)

cv2.waitKey(0)
```

Output:



Conclusion :

- The journey of conceptualizing Haar Cascades, acquiring Haar cascade data through OpenCV, and employing it for face detection in static images is a valuable exploration in computer vision.
- Haar Cascades provide an effective means to detect objects, particularly faces, through a cascade of classifiers. Leveraging the power of OpenCV simplifies the implementation, making it accessible to a wider audience. This process plays a pivotal role in applications like facial recognition, surveillance, and image analysis.
- By mastering these techniques, we empower ourselves to harness the potential of machine vision in diverse fields, offering enhanced security, automation, and insights into our visual data landscape.