The
BRITISH
UNIVERSITY
IN EGYPT

Mohamed Khairi | 224483 | A3

Visual Computing and Image Processing

23CSAI02I

Dr. Ahmed Fahmi

Project Title:

- Attendance System with Facial Recognition

Introduction:

- Facial recognition is a computer vision technology that identifies a person from a face by analyzing and comparing patterns in his facial features which aims to simplify the process of recording attendance, offering a more reliable and efficient alternative to traditional methods like paper. This face is then compared to other faces to find the matching face. After it is known who this person is, this person's data, such as his name, time, and date, will be entered into an Excel file. An attendance system with facial recognition is a great way to ensure the accuracy of attendance records for students or employees, because through these records we will be able to track attendance, send warnings to students' families, and provide accurate payrolls. The challenge in this project is that I extract patterns or analyze the facial features of each person. A person and it is confirmed or accurate with a percentage of more than 50% or 55% that this identified person is the person we have in the data to be registered in attendance. Because it is possible that facial features or patterns from one person to another are close or similar, and this could cause us errors in recognizing a face and incorrect data being recorded, so we will want to make sure we recognize this face with a percentage of no less than 50%. Or a fairly large percentage in order for it to be accurate and work professionally.
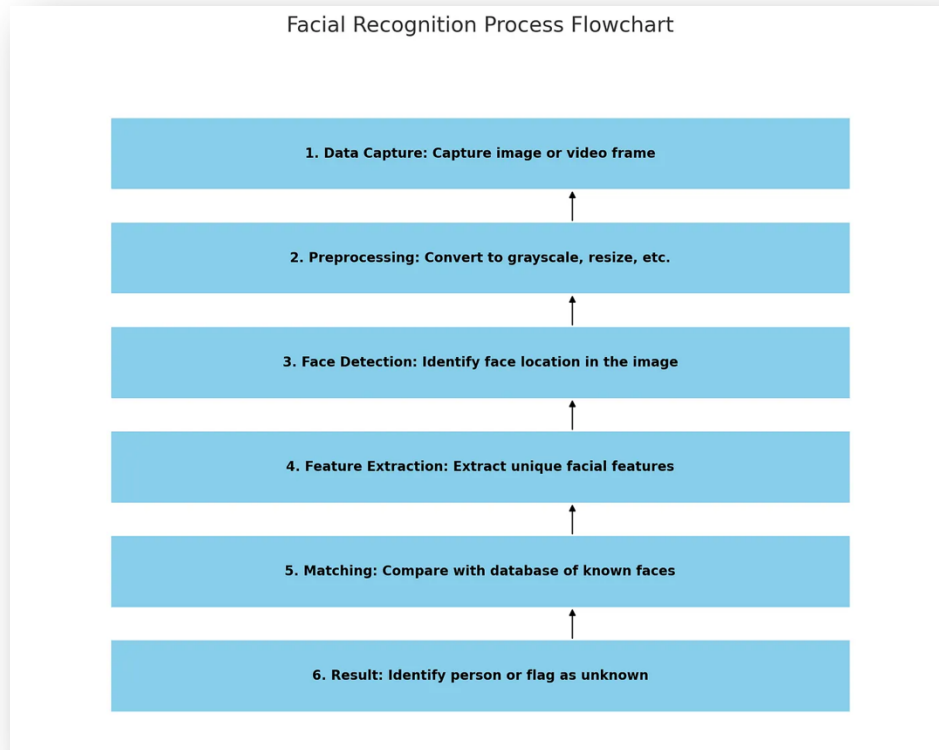
Methodology and Approach:

This system has a two-step approach:
- **Firstly**, it is to enter or enroll images of people, employees, or students (depending on the organization that will use this system) into a file. After that, preprocessing techniques are applied to improve the quality of the image so that it can be better recognized, such as blurring and sharpening. Facial encoding is also done to save the details of the person's face to let the system know the known faces.

- **Secondly**, is recording attendance. The system constantly captures video frames from the webcam and recognizes the person's face if he has it in the file whose photo we entered in the previous stage. If he is recognized and the system is 50% sure that this person is known, his attendance will be recorded at Attendance file by name, date and time.

Techniques and the Science Behind Them:

- **Facial recognition**: One of the most difficult pattern recognition problems in computers is facial recognition. Using a two-dimensional image, facial recognition systems try to recognize a human face, which is three-dimensional and varies in appearance depending on lighting and facial expression. Face recognition algorithms take four steps to complete this computational task. To separate the face from the background of the picture, face detection is first applied. The segmented face image is then aligned in a second step that takes into consideration the size of the image, the attitude of the face, and photography characteristics like grayscale and illumination. The goal of the alignment procedure is to make it possible for the facial feature extraction, or third step, to precisely locate face characteristics. The graphic represents the face by measuring and pointing out features like the mouth, nose, and eyes. In the fourth stage, the so-established face feature vector is compared to a database of faces or a file like the one in my system.

o   This **figure** shows the workflow of the facial recognition technology:

Facial Recognition Process Flowchart

| 1. Data Capture: Capture image or video frame |
| 2. Preprocessing: Convert to grayscale, resize, etc. |
| 3. Face Detection: Identify face location in the image |
| 4. Feature Extraction: Extract unique facial features |
| 5. Matching: Compare with database of known faces |
| 6. Result: Identify person or flag as unknown |

o   **Image Preprocessing:** To increase the level of facial recognition (accuracy), a set of image pre-processing methods is used, including Gaussian blur and sharpening:

Gaussian Blurring: is typically to reduce image noise and reduce detail. That determines the transformation to be applied to each pixel in the image using a Gaussian function, which is exactly how the normal distribution is expressed in statistics. A Gaussian function in one dimension has the formula:

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}$$

Sharpening: Using this technique, the edge (outline) and details such as (mouth, eyes and nose) are made clearer and easily distinguishable.

Tools/Libraries:

- The libraries using in the project are *OpenCV (cv2), NumPy (numpy), Operating System (os), datetime and face_recognition* for core facial recognition functionalities. The tools using in the project are *Jupyter Notebook* and *VS Code*.
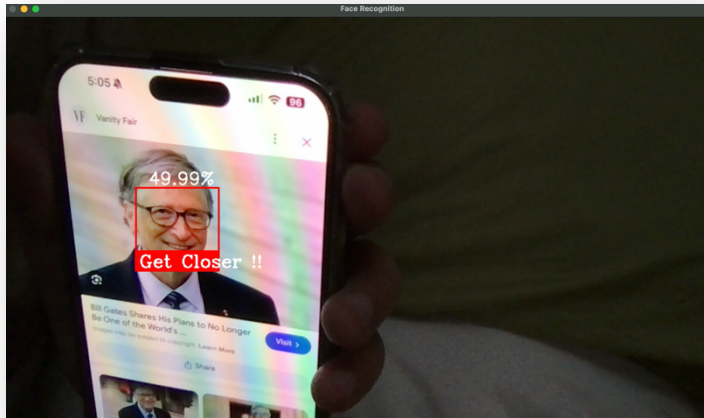
Screenshots:

- **Input:**

Original Image

After Preprocessing Image
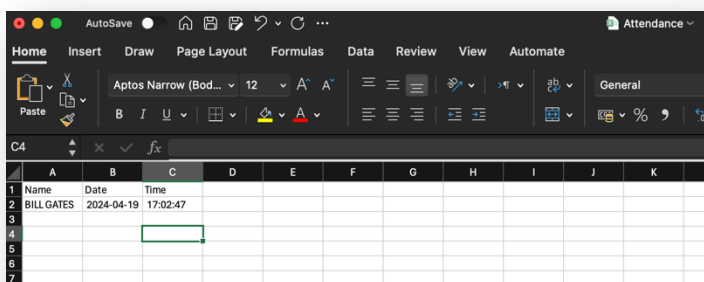
(Gaussian Blurring and Sharpening)

Output:

He must get closer to be recognized. It will not be recorded until 50% is reached.

The percentage rose to 56%. He was recognized as Bill Gates and will be recorded in attendance sheet/file.

Attendance Sheet, it has been recorded.

References:

- https://medium.com/fortis-novum-mundum/the-science-behind-facial-recognition-technology-1fe92c658eba

- https://en.wikipedia.org/wiki/Facial_recognition_system

- https://en.wikipedia.org/wiki/Gaussian_blur