Facial Recognition System

Submitted by:

Roaya Neffeti
Yessine Barkia

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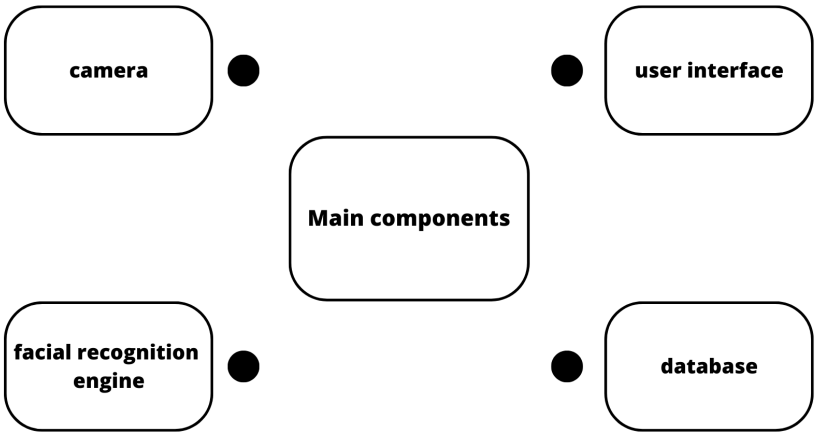
I- Introduction

Facial recognition technology has become increasingly prevalent in various applications, including security, law enforcement, and retail.
The ability of facial recognition systems to identify individuals based on their unique facial features has made it a popular choice for many organizations seeking to enhance security and streamline their operations.
In this report, we present the results of a facial recognition project that was designed to develop and implement a facial recognition system for use in a security application

II- Main concepts

1- Main components :

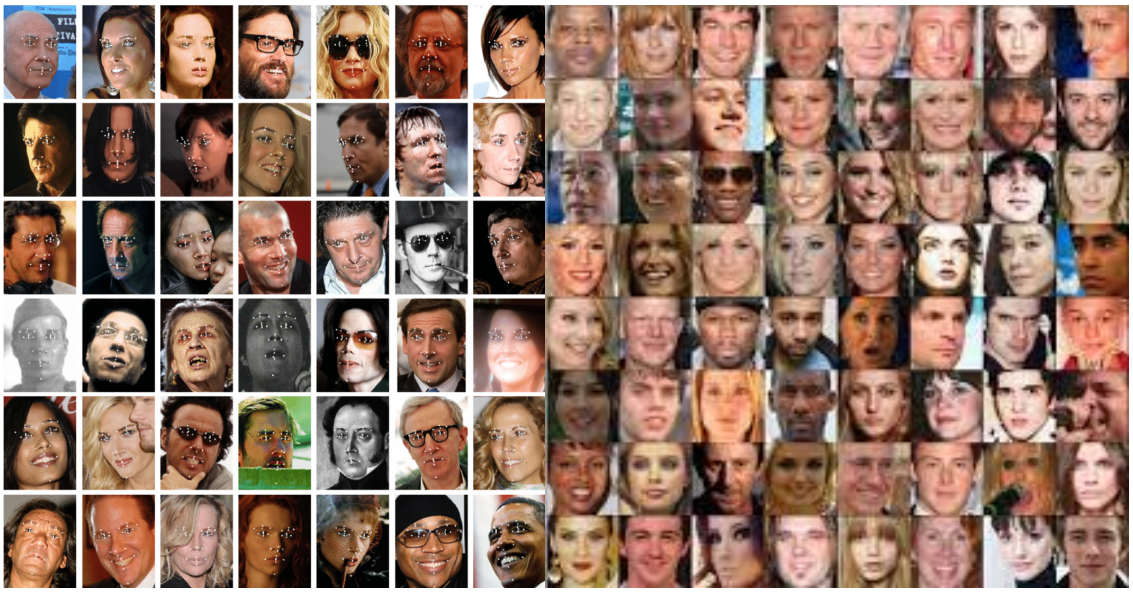


- **User interface:** This component allows users to interact with the system and provides the necessary instructions for capturing the facial image.

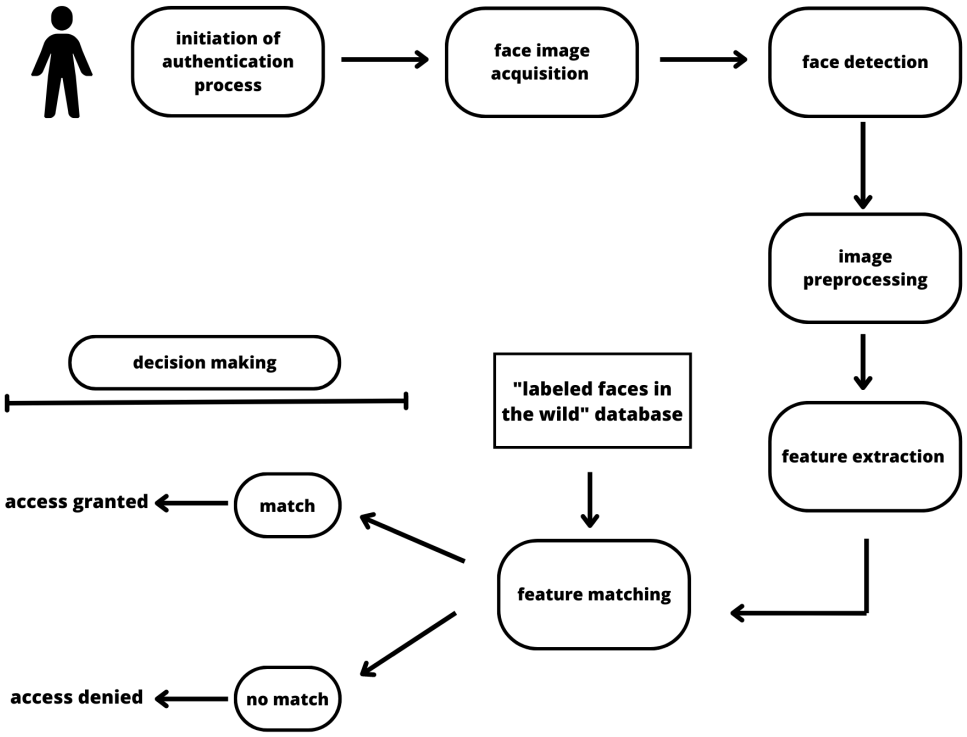
Example: The user interface could be a touch screen display at an entry point of a secure building, where an authorized user can present their face for recognition. The interface may display instructions on how to position their face within the camera's view and provide feedback on whether the face was recognized or not

- **Camera:** The camera captures the user's facial image, which is then processed by the system.
  Example: The camera could be a high-resolution camera with a wide-angle lens, installed at the entry point of a secure building, any type of camera could be used with this system

- **Facial recognition engine:** This component is responsible for analyzing the facial image and identifying the user.
  Example: OpenCV (Open Source Computer Vision)
- **Database:** The system stores the user's facial template in a secure database.
  The database that will be used : “labeled faces in the wild” ; a database of face photographs designed for studying the problem of unconstrained face recognition. The data set contains more than 13,000 images of faces collected from the web. Each face has been labeled with the name of the person pictured



2- Functional flow:



—-> The functional flow of a facial authentication system is as follows:

0. The user initiates the authentication process by accessing the system through a web interface.

1. A digital camera acquires an image of the face.

2. System locates the face in the image, this is also called face detection. Face detection is one of the more difficult steps in face recognition, especially when using surveillance cameras for scanning an entire crowd of people.

3. Pre-processing the collected facial data to improve the quality of the images or videos such as resizing, cropping, or normalization.

4. When a face has been selected in the image, the system analyzes the spatial geometry(distance between eyes, shape of the nose or lips, or facial landmarks).In general the system generates a template, this is a reduced set of data which uniquely identifies an individual based on the features of his face.

5. The generated template in the previous step is compared to the facial template stored in the database.

6. If the facial image matches the stored template, the system grants the user access to the application or service. If the facial image does not match the stored template, the system denies access to the application or service.

For example , we can apply this to one the applications of the facial recognition which is the **attendance management system** , this is how it goes :

The general face recognition model contains two basic parts ;Enrollment and Recognition.

Enrollment	**Recognition**
↓	↓
registration phase in which first the image is captured, then the face detection algorithm for capturing the image is called. The captured image is then stored in database	takes place when teacher captures the image of the class First image is captured then face detection of all students takes place,after detecting Pre-processing is done on that image Each student face features are extracted from the database, then the classification is done accordingly.

3-Benefits :

greater security

faster services

lower crime rates

integation with other technologies

- **Faster services :** Up-to-date recognition solutions allow businesses to offer their clients fast and impeccable services that require identity verification. The technology needs just two seconds to examine a face
- **greater security:** AI-based facial recognition systems employed at the state level can assist in detecting terrorists and criminals. Thus, technology may prevent crimes and save people's lives, especially in crowded places. On a personal level, facial identification is an effective security tool for online services like banking, healthcare, shopping, etc
- **Lower crime rates:** With face recognition algorithms, it has become much easier for the police to hunt down criminals. If a potential criminal realizes there is a face recognition system, he may abandon the idea of committing an offense
- **Integration with other technologies:** One more essential advantage of modern face verification solutions is that they are compatible with various security software.

4- What are the applications of facial recognition?

1. **Automobile Security**
2. **Access Control**
3. **Immigration**
4. **Education:** This is one of many new tech trends that are transforming education
5. **Retail**
6. **Healthcare**