



Operator Authentication Using Facial Recognition

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Abstract— Face recognition and facial comparison are examples of biometric identity verification technologies that are already widespread in our daily lives. We use fingerprint technology or facial recognition to unlock our phones on a daily basis, and we see it at airports all over the world etc. Finger print is widely used for verification purpose. But it has sensor dependency and also finger orientation and accuracy in detection process. In addition, in the current scenario, it is essential to have contactless authentication scheme. Face recognition is one such tool. Face covers a wide range of data points and hence it is more accurate technique and has many open source tools. The present project deals with the same. The image of a person is trained and stored in the database. When the person who is to authenticate the image of his face is captured in real time. The trained image and the real time image's data points are compared. Upon comparison, if both of the data points match, access is given and if the data points do not match access is denied.

Keywords—Facial recognition, Biometrics, Fingerprint technology.

I. INTRODUCTION

In the past few decades, facial recognition has been the most researched field among the biometric techniques. It is due to the fact that it has wide range of applications. The facial recognition process can be defined as follows: Given that the data base consists of many pictures of the persons, these pictures are compared against the live pictures to come to a conclusion about the person's identity. The previous methods of identifying people and granting them access to physical or virtual places were PINs, passwords, ID cards, keys etc... These techniques break down an individual's physiological as well as social ascribes with a particular ultimate objective to choose as well as determine his/her identity. In any case, the characteristic science of individuals can't be lost, neglected, taken, or reproduced. A few models incorporate physiological attributes of an individual, like facial pictures, fingerprints, retina and voice and social attributes, like walk, mark, and keystroke elements, which are utilized in biometric methodologies for individual confirmation or ID particularly for security frameworks. Security applications have seen an enormous advancement during the most recent years, which is a characteristic consequence of the innovative transformation in all fields.

Facial features in face recognition for person ID are viewed as a significant technique for the biometric region. At times an individual's face may not be noticeable. Consequently, face recognition frameworks give specialists the chance to concoct other techniques to address these downsides and upgrades the security and assists with finding latest improvement methods for facial recognition.

Applications:

These days, biometric-based security applications have been significantly expanded, particularly in the space of face acknowledgment. Subsequently, face acknowledgment applications are an amazing method to precisely furnish of individual security, for example, with a smart card, law authorization, surveillance, or for entertainment. Table 1 shows the applications of the face recognition.

Fields	Scenarios not applications (Examples)
Security system	boarding systems
Face ID	Driver licenses
Accessing	vehicle access, ATM,
Human-Computer Interaction	Interactive gaming and proactive computing.
Surveillance system	park surveillance

II. LITERATURE SURVEY

In the current period of globalization, an assortment of advancements have been made that make it simpler for people to take care of their responsibilities. Mechanical advancements have gotten incredible changes to portions of the world or on the other hand in each country, both developed and non-developed nations are in the dire need of technology as a cycle of giving and moving data as equipment or programming. One of the innovations created as of now is the biometric technique called as facial recognition. Recognition based on faces has been broadly implemented in our daily lives like security and in the medical applications. Facial recognition has provided solutions for difficult issues in the medical world, for example the facial recognition test to separate indistinguishable twin's faces.

Facial recognition is a computerized innovation, for example, cell phones have grown quickly in this recent time. Previously on a cell phone gadget facial recognition must be done in the condition where the user's face is not moving i.e the person's face must be static. However, presently there are certain smart phones that are capable to work in versatile conditions. Facial recognition in security area has developed astronomically in the recent times, like programmed automatic face recognition technique (AFR) which capacities to compare faces in the group and contrast them with watch list pictures, which are open to suspects, missing people and individuals looked for by the authorities. AFR innovation has been broadly introduced in open places like roads, malls, and arenas.

Neural Networks:-

Pattern recognition and classification are still used by the Neural Network. Kohonen was the first to demonstrate that aligned and normalised faces could be recognised using a neuron network. Using neural networks, there are methods for extracting features. There are a variety of algorithms for face recognition that can be used with tools like PCA or LCA to create a hybrid classifier.

Feed Forward Neural Networks with Additional Bias, Self-Organizing Maps with PCA, and Convolutional Neural Networks with Multi-Layer Perception are a few examples. These can help the models work more efficiently.

Hybrid Techniques:

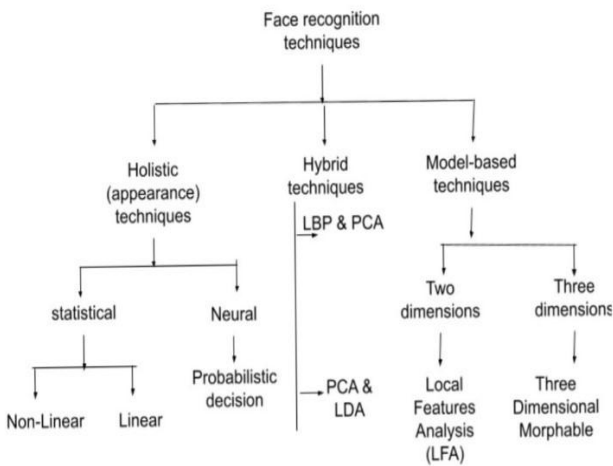
1) PCA & LBP:

PCA is a feature extraction approach that has been used in pattern recognition and computer vision for a long time. PCA has been utilised by a number of researchers for face recognition, with one of them using it for feature extraction and dimension reduction. Obtaining the training set photos and transforming them into eigenfaces with the highest eigenvalues and calculating the weight for each image in the training set is the first step in face recognition using Eigenfaces.

LBP stands for Local Binary Pattern. It is a texture feature extract as well as a grayscale image form. It refers to a binary code for an image pixel that describes the pixel's immediate surroundings.

Model Based techniques:

The model, the initialization procedure, the goal function, and the fitting algorithm are the four elements of model-based approaches. A parameter vector p represents the model's various configurations, such as position, orientation, scaling, and deformation. A set of feature points, a contour, a textured region, and other elements are used to map models onto an image's surface. Deformable models are ideal for evaluating human faces in all of their nuances. Translation, rotation, and vector of deformation parameters $b = (b_s, 1, \dots, b_s, m)^T$ are included in its parameters $p = (t_x, t_y, s, b)^T$. The face's configuration, such as the opening of the mouth, roundness of the eyes, and rising of the eye brows, is described by the latter component.



Facial recognition techniques:

Statistical Approach:-

Patterns are represented as features in the statistical approach. In a discriminant function, the recognition function is the first step. Each image depicted a different set of characteristics. As a result, the objective is to select and use the appropriate statistical instrument for data extraction and analysis.

For face identification, there are a variety of statistical methods available. These analytical tools are utilised in groups of two or more.

III. METHODOLOGY

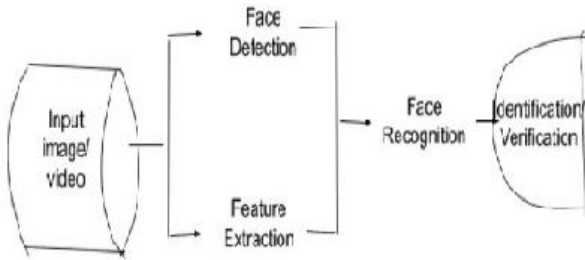


Fig: a

In figure 'a' the below discussed steps are portrayed.

Feature extraction:

The process of extracting face component parts such as the eyes, nose, and mouth from a human face photograph is known as facial feature extraction. Face feature extraction is critical for the setup of processing techniques including face tracking, facial expression detection, and face recognition.

Face detection:

Face detection is defined as computer technology that detects people's faces in digital photographs. Face detection software works by finding human faces within larger photos using machine learning and calculations known as algorithms. These wider images could include landscapes, skyscrapers, and other human body parts that aren't faces (e.g. legs, shoulders and arms).

Working and Implementation:

- The first step is to register. The picture is saved in the data base. A bar code is generated in relation to that picture. The library used to generate the bar code is pyzbar and zbar python modules.
- Pyzbar is a module used to read one dimensional bar codes and qr codes. Zbar is a module used to interface to the zbar coding in python. The next step is authentication. The first layer of authentication is to scan the bar code. If the bar codes are matched, the authentication process is continued.
- The basic reason to implement barcode is to ensure higher amount of security. The trained (registered) image's data points are noted. Now, in real time, when a person is present in front of the camera the image is captured.

- Now these images are compared. If those have the same data points, access is granted. If not, the access is denied.

Python:

Python is a high-level, general-purpose programming language that is interpreted. Python's design philosophy prioritizes code readability, as evidenced by its extensive use of indentation. Its language elements and object-oriented approach are aimed at assisting programmers in writing clear, logical code for both small and large-scale projects.

The code utilized for facial recognition is written in python language which has a wide variety of libraries which are helpful in implementing the steps for facial identification. Few such libraries used are PYZ bar and Z bar which are used in generating the bar code. The generated bar code is used as the first step in authentication process.

Google colabatory:

Google Colaboratory (abbreviated as "Colab") is a product. Colab is a web-based Python editor that allows anyone to write and run any Python code. It's particularly useful for machine learning, data analysis, and education. Colab is a hosted Jupyter notebook service that doesn't require any setup and gives you free access to computational resources, including GPUs.

IV. OUTPUTS



Fig 1: Registered Image

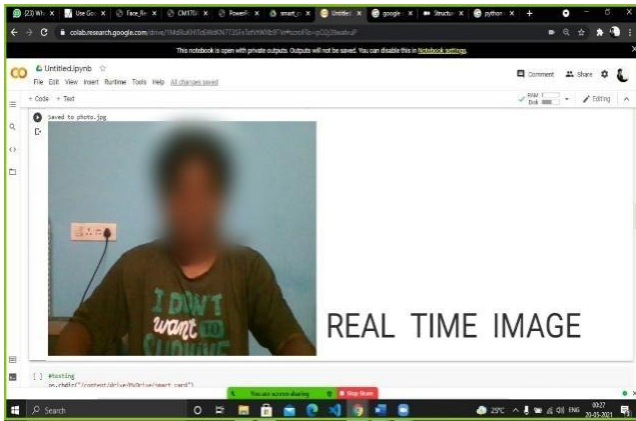


Fig 2: Real time image



Fig 3: Authentication

V. DISCUSSION

There are several reasons for recent increased interest in face recognition, including rising public concern for security, the need for identity verification in the digital world, face analysis and modelling techniques in multimedia data management and computer entertainment. we have discussed face recognition processing, including major components such as face detection, tracking, alignment and feature extraction, and it points out the technical challenges of building a face recognition system. We focus on the importance of the most successful solutions available so far. This paper describes chosen face recognition methods and applications and their potential use in areas not related to face recognition.

VI. CONCLUSION

Face recognition technologies aid law enforcement and justice by allowing them to stay one step ahead of the world's ever-evolving criminals. It's also important in homeland defense, which encompasses everything from blocking terrorists from boarding planes to protecting key infrastructure (dams, bridges, water reservoirs, energy plants, and so on) from attack or manipulation, as well as identifying known terrorists. It can also be used to improve security at airports and other transportation hubs.

Face recognition software can help immigration and customs officials work more efficiently. Security is crucial to the financial services business.

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