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FACE RECOGNITION

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ABSTRACT- *Face recognition technology is a biometric technology that uses a person's face traits to identify them. Face photos are collected by people, and the recognition technology processes them automatically. The study introduces related face recognition research from severalangles. The paper discusses the stages of facial recognition development and related technologies. We discuss face recognition research in real- world scenarios, as well as general evaluation standards and face recognition databases.We take a look at facial recognition from the future. Face recognition has emergedas a promising future development direction with numerous possible applications.*
Nowadays, face recognition is one of the most advanced computer vision technologies. In computer vision, illumination, and other fields, face recognition is always a difficult issue. facial expression, posture Face recognition keeps track of the objects that are being tracked.in video photos captured with a video camera in real time Simply said, To put it another way, it's a system application for automatically recognising people. a person captured in a photograph or video frame In this paper, we will discuss to propose a facial recognition system that is automated. This Face detection, feature extraction, and facial recognition are all used in this application. algorithmic recognition, which automatically detects when the individual in front of the camera has a human face knowing who he is

KEYWORD-Face Recognition, Principal component analysis (PCA), Biometrics, eigenfaces.

1.INTRODUCTION-

Facial recognition is a method of recognizing or verifying a person's identification by looking at their face .It is possible to use facial recognition to recognize persons in photographs, videos, or other media instantaneously Facial recognition is a useful tool biometric security category. A facial recognition system is a device that recognizes people by their faces, technology capable of matching human face from a photograph or video frame against a face database. It works by determining and measuring face traits from a photograph and is frequently used to validate people via means of ID verification service. It's a method of biometric identification bodily measurements are used in this scenario to

validate a person's face and head by analysing their biometric face data and pattern to locate, confirm, and/or verify a person's identity, the technology captures a collection of unique biometric data related with their face and facial expression. Smartphones and other forms of technology, such as robotics, have seen increased use of facial recognition technologies in recent years. Facial recognition systems are classified as biometrics since they involve the measurement of a person's physiological features.

Despite the fact that facial recognition systems are less accurate than iris and fingerprint recognition as biometric technologies, they are extensively used due to their contactless nature. Advanced human-computer interface, video surveillance, and picture indexing have all used facial recognition technologies. This paper will discuss the stages of face recognition . Development and related technologies, such as early algorithms, artificial features and classifiers, deep learning, and other stages. Following that, we will discuss face recognition research in real- world scenarios. Finally, we go over the general evaluation standards and facial recognition databases.

2.LITERATURE REVIEW

[1].Eigenfaces Eigenface is one of the most thoroughly investigated approaches to face recognition. It is also known as Karhunen Loève expansion, eigen picture, eigenvector,and principal component. References used principal component analysis to efficiently represent pictures of faces.

The yargued that any face images could be approximately reconstructed by a small collection of weights for each face and a standard face picture (eigenpicture). The weights describing each face are obtained by projecting the face image onto the eigenpicture. Reference used eigenfaces, which was motivated by the technique of Kirby and Sirovich, for face detection and identification. In mathematical terms, eigenfaces are the principal components of the distribution offaces, or the eigenvectors of the covariance matrix of the set of face images. The eigenvectors are ordered to represent different amounts of the variation, respectively, among the faces. Each face can be represented exactly by linear combination of the eigenfaces. It can also be approximate using only the "best"eigenvectors with the largest eigenvalues.

The best M eigenfaces construct an M dimensional space, i.e., the "face space". The authors reported 96 percent, 85 percent,and 64 percent correct classifications averaged over lighting, orientation, and size variations, respectively. Their database contained 2,500 images of 16 individuals. Anthony Giordano & Michael Uhrig. The method is incredibly effective and just requires a small quantity of data input. Although it is critical that all of the faces be orientated in the same direction, the approach works well once this is accomplished. Despite shrinking the size of the photos in the second database by almost 23% and cutting the processing time in half, we were still able to achieve a success rate comparable to the first database. More study might be done in this area to evaluate a larger number of variables in the images. Further research into the best effective approach for preparing photos before they are stored in the database is another important factor.

[2].Neural Networks The attractiveness of using neural networks could be due to its non linearity in the network. Hence, thefeature extraction step may be more efficient than the linear Karhunen-Loève methods. One of the first artificial neural networks (ANN) techniques used for face recognition is a single layer adaptive network called WISARD which contains a separate network for each stored individual . The way in constructing a neural network structure is crucial for successful recognition. It is very much dependent on the intended application.

For face detection,multilayer perceptron and convolutional neural network have been applied. For face verification, is a multi-resolution pyramid structure. Reference [proposed a hybrid neural network (SOM) neural network, and a convolutional neural network. The SOM provides a quantizationof the image samples into a topological. space where inputs that are nearby in the original space are also nearby in the output space, thereby providing dimension reduction and invariance to minor changes in the image sample. The convolutional network extracts successively larger features in a hierarchical set of layers and provides partial invariance to translation,rotation, scale, and deformation. The authors reported 96.2% correct recognition on ORL ;database of 400 images of 40 individuals.

[3].K. Lander, V. Bruce, and M. Bindemann, ‘‘Use-inspired basic research”

Unlike much of the research on individual differences in face matching and identification, which is driven by practical issues faced by security personnel such as passport officials and police, this study has obvious theoretical consequences.

Individual differences are typically not taken into account in cognitive models of face recognition (e.g., Bruce & Young, 1986; Burton, Bruce, & Johnston, 1990; Burton, Jenkins, Hancock, & White, 2005) or face detection (Lewis & Edmonds, 2005), with the exception of specific neuropsychological cases that reveal something about the general organisation of these systems, such as dissociations in the analysis of facial expressions from the process of face recognition. Similarly, these models only capture a small portion of individual variation. Some theories, for example, claim that residual activity in the usual face processing system explains neuropsychological disorders characterised by deficits in areas of face processing (see Schweinberger & Burton, 2003).

None of these ideas, on the other hand, account for the individual variances seen among neurologically normal observers, which are the subject of this special issue. Individual differences appear to be one of the most well-documented potential sources of mistake in face matching and identification, if not the most well-documented. Furthermore, any cognitive face processing system's 'hardware' is ultimately provided by the individual. Individual differences in face matching and recognition with a primarily applied focus give a strong reminder that it would be negligent not to add individual differences into theoretical models in this regard. Individual differences across various populations and face-processing tasks are very easy to track, as the examples covered here illustrate, but our theoretical comprehension of these differences has not progressed at the same rate. As a result, we still don't have persuasive explanations for why some people perform worse than others in seemingly basic tasks like paired face matching, nor do we have solid theoretical frameworks to guide training programmes aimed at improving performance.

[4] Y. Hu, H. An, Y. Guo, C. Zhang, T. Zhang, and L. Ye, ‘‘The development status and prospects on the face recognition,’’ This comprehensive analysis presents the most recent state-of-the-art in facial recognition research. Recent advancements in this discipline are clearly outlined, and future prospects are suggested. The findings of this review reveal that there has been a significant increase in research in this field in the previous five years, especially with the introduction of deep learning approaches that have outperformed the most popular computer vision methods. Furthermore, a number of public and private facial databases are available for research and commercial reasons, and their basic characteristics and evaluation processes are discussed. To allow researchers to compare their results to the labelled faces in the wild (LFW) database in terms of approach, architecture, metrics, precision, and protocols, an emphasis on the LFW database was required. The most important takeaway from this research is that 2D facial recognition is still open to future technology and material advances for image capture. Researchers, on the other hand, are becoming increasingly interested in 3D facial recognition. The recent development of 3D sensors reveals a new direction for facial recognition that could overcome the main limitations of 2D technologies, such as changes in physical appearance, ageing, pose, changes in light intensity, and, more broadly, facial expressions, missing data, cosmetics, and occlusions. In the case of unfavourable acquisition conditions, the geometric information offered by 3D facial data could greatly increase the accuracy of facial recognition.

[5] R. Gottumukkal and V. K. Asari, ‘‘An improved face recognition technique based on modular PCA approach,’’ The results show that for N = 4, 16, and 64, the modular PCA approach completely beats the PCA method in all aspects. The best results, however, were found for N at 16. The first image is the reconstructed image obtained using the PCA method, the second image is the original image, and the third image is the concatenation of the reconstructed images obtained using the modular PCA method for N 14 16. The first image is the reconstructed image obtained using the PCA method, the second image is the original image, and the third image is the concatenation of the reconstructed

images obtained using the modular PCA method for N 14 16. Under the conditions of varying illumination, the PCA-based technique was ineffective, because it takes each face image's global information and represents it with a set of weights The weight vectors of the test image will differ significantly from the weight vectors of the training images with normal lighting under this circumstance, making it impossible to correctly identify them. The face images were divided into smaller parts and weight vectors were computed for each of these sections, resulting in weight vectors that are more representational of the local information of the face in the case of modular PCA. As a result, for differences in lighting, the weights of the facial regions that aren't influenced by changing lighting are very similar to the weights of the identical individuals' face regions under normal settings. As seen in the experimental findings, this leads to higher recognition results when employing modular PCA. A modular PCA approach has been presented as an extension of the PCA method for face recognition.
When there are considerable fluctuations in expression and lighting, the modular PCA technique outperforms the PCA method. There is no notable improvement in the performance of modular PCA for huge variations in stance. The modular PCA approach can be used instead of the PCA method for face recognition. The modular PCA method will be particularly effective for identification systems that are subjected to considerable fluctuations in lighting and face expression.

[6] D. C. Hoyle and M. Rattray, ‘‘PCA learning for sparse high-dimensional

The effectiveness of principal component analysis is investigated (PCA). We focus on the question of how many training pattern vectors are required to accurately capture the data's low-dimensional structure. This issue is more pressing given that PCA is routinely used to analyse extremely high-dimensional (N 5000–30000) real data sets resulting from molecular biology research. The number of patterns p in these applications is frequently orders of magnitude fewer than the data dimension (p N). We continue prior research by analysing p random patterns that are isotropically distributed with the exception of a single symmetry-breaking direction. The thermodynamic limit N is taken into account in the classic mean-field theory for PCA performance, with p/N fixed.

[7] Suguna G C, Kavitha H S, Sunita Shirahatti, Sowmya R Bangari,

Face recognition requires great accuracy and a short detection time in today's real-time applications. Accurate identification and recognition of a face from blurred video frames or skewed photographs or pictures is critical in most applications, ensuring the highest level of security. For real-time applications, the suggested face recognition system offers a high recognition rate and a short training period. The system uses MTCCN to identify 5-point landmarks in order to detect faces, and linearSVM to classify and recognise the face. To test forface recognition during a live feed, the model was trained on new data. The suggested system's real-time recognition accuracy is 99.85% for straight, small deviation to the left or right, and with the head lifted up in front of the camera.

3.OBJECTIVE

- To enhance the Frame/sec for Face Recognition System, such that Recognition is done in Real Time. Presently, work on 30frames/sec , Our motto is to achieve higher frames/sec or high-Resolution frames/sec.
- To discover a series of data of the same face in a database from an incoming image.
- To ensuring that this process happens in real time, which is something that not all biometric face recognition software suppliers offer
- To identify individuals, whether individually or collectively. The number of false positives can vary, depending on the technology used for facial recognition.

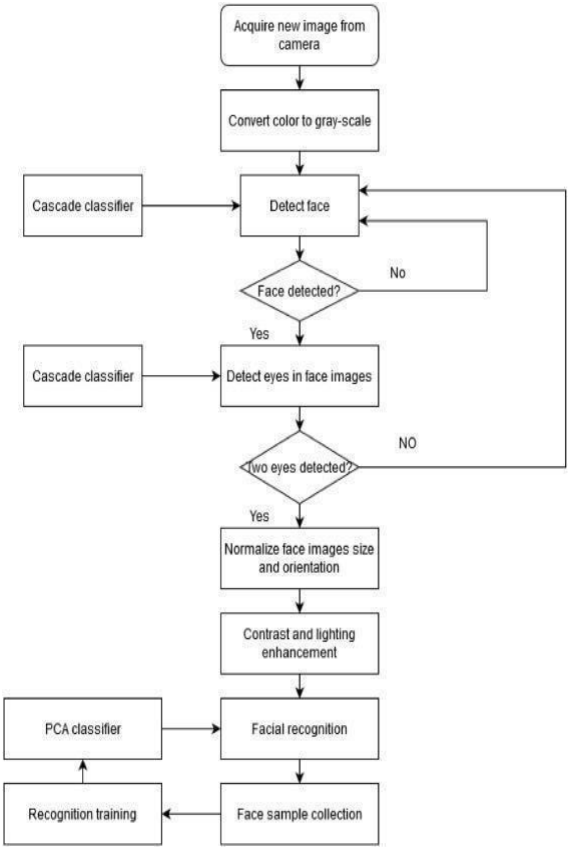
4.)PROBLEM STATEMENT

Biometrics are extremely significant in today's environment. As the population grows, so does the challenge of preserving a unique ID, especially since biometrics are unique to each individual. This is why,

because one cannot change one's face, facial recognition is the most reliable technique. Face detection, face pre-processing, and face recognition operations are all part of a full face recognition system. As a result, the face region must be extracted from the face detection process and separated from the background pattern, laying the groundwork for the following extraction of the face difference characteristics. Based on the risen in depth 8 of learning detection approaches, the face has recently popularity, When compared to the traditional method, it not only saves time but also improves accuracy. The technique of feature extraction and contrast identification of normalised face photographs to acquire the identity of human faces in the images is known as face recognition of separated faces.

5.METHODOLOGY

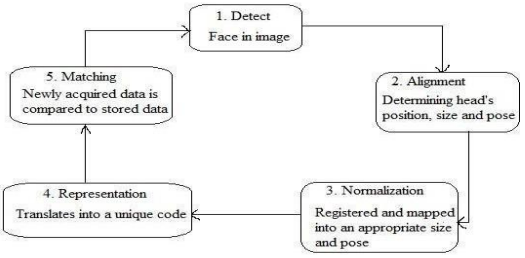
Face recognition software employs a mix of holistic and feature extraction techniques. In most methodologies, 3D images are employed. The system can note the curves of the eye sockets, for example, or the forms of the chin or forehead because the image of a person's face is captured in 3D. Because the technique uses depth and an axis of measurement, even a profile face wouldsuffice because it has enough information to assemble a full face.
Detection, Position, Measurement, Representation, and Matching are the typical steps of a 3D system. Detectionis the process of capturing a person's face by scanning an image or shooting their face in real time. Position - Measurement, Representation, and Matching are the typical steps of a 3D system.
Detectionis the process of capturing a person's face by scanning an image or shooting their face in real time. Position - determining the head's placement, size,and angle. If the 3D image is to be compared to another 3D image, it must not have been altered.
Photos that are displayed in 2D, on the other hand, usually require a few adjustments to the 3D image. This is a difficult task, and it is now one of the most difficult task.



(figure 1 flow chart)

The process of defining architecture, components, modules, interfaces, and data requirements is known as systems design. [2] Figure System design can be thought of as a product development application of system theory. Face detection is a technique for detecting human faces in digital photos and video frames. Detecting occurrences of objects in digital images and movies using object detection technologies. There are five primary modules in the proposed automated recognition system:

1.Image Capture: To capture an image of the person's front, a camera is set away from the entrance. A separate technique is used to detect faces.



(figure 2 Block diagram)

(Figure 3 image capture)

2. Face Detection and Facial Features: Facial recognition is continually improving thanks to an adequate and effective facial detection algorithm. Face-to-face geometry, building methods, Face geometry-based methods, and feature invariant methods are some of the facial algorithms. Methods based on machine learning. Viola and Jones provided a framework that has a high detection rate and is also fast, out of all of these methods. The Viola-Jones detection algorithm is both quick and reliable. As a result, we picked Viola-Jones face detection, which employs Integral Image and AdaBoost learning algorithms as classifiers. In a range of lighting circumstances, we've found that our approach produces better results.

3. Database Development-Every individual is required because we have chosen a biometric-based method. This step of database creation entails capturing each individual's image and extracting the biometric feature, which is subsequently enhanced using preprocessing techniques and saved in the database.

4.Pre-prosesing-Pre-processing is the process of extracting the facial features. The retrieved facial picture and transforms to 100x100 are specified in this pre-processing stage. The most widely used Biometric Normalization approach is Histogram Equalization. This boosts the image's contrast by extending beyond the image's intensity, making it even more clear and striking.

5. Post-Processing-After detecting a person's face, the names are displayed in a video output in the suggested system. The result is created by the database system's exporting mechanism. In real time video, these created records can be observed. This ensures that anyone whose faces the system does not recognize must check the database. As a result, they will be able to fix the system and improve its stability and accuracy.

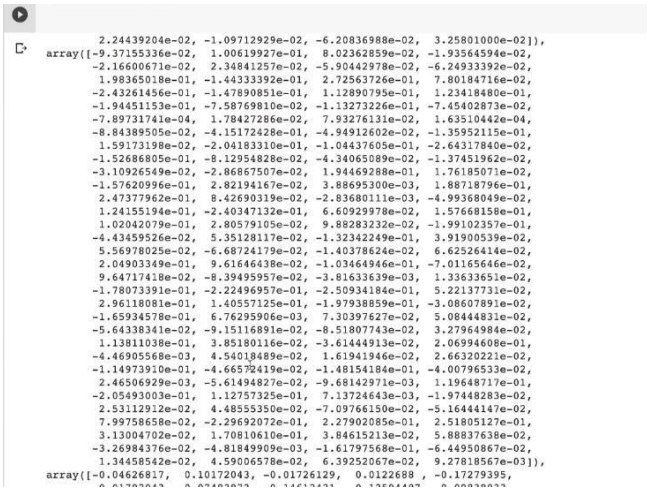
Principal component analysis (PCA)- Face Detector , for which there are numerous non-derived learning algorithms. The OpenCV-based face detectors Jones did extensive work, which was later based on Gradient's histogram. Face images are described using PCA in terms of a set of basis functions, or eigenfaces. Early identification problems described Eigenface. Because PCA is a methodology, it does not rely on class definition.
Euclidean distance is used in our eigenvalue implementation. Analysis of several linear principal components. A face image and video, on the other hand, are multilinear arrays, and this vector defines a 1D vector from the face image with liner projection. I believe that classifying the facial pixels will aid in optimization.

6.OUTPUT USING PYTHON

First it will find the known encoding with the help of dlib library, it will generate 124 numeral known encoding to find the correct face as given in figure no 5.

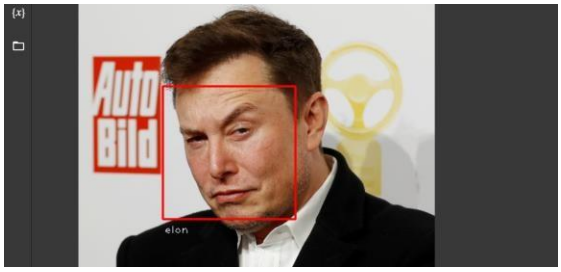
```
known_encodings = []
known_names = []
known_dir = 'known'

for file in os.listdir(known_dir):
    img = read_img(known_dir + '/' + file)
    img_enc = face_recognition.face_encodings(img)[0]
    known_encodings.append(img_enc)
    known_names.append(file.split('.')[0])

known_encodings
```

(Figure-5 known encoding generating)



(figure-5 no of encodings)

Then it will detect the face by feeded data by the algorithm given .



(figure-6 final result)

Steps involved in a face recognition model:

- Face Detection: Locate faces and draw bounding boxes around faces and keep thecoordinates of bounding boxes.
- Face Alignments: Normalize thefaces to be consistent with the training database
- Feature Extraction: Extract features of faces that will be used for training andrecognition tasks.
- Face Recognition: Matching of the faces in a prepared database

7.CONCLUSION

Because of its simplicity, face recognition technology is frequently employed in the security and finance areas. Face applications will become more developed as science and technology advance, and application scenarios will become more diverse. Face recognition, on the other hand, is prone to causing technological, legal, and ethical issues. Due to the automated elements of facial recognition technology, comparable linked information may be processed or decided through automation, which is opaque and difficult to monitor, and may result in errors or discrimination. It's difficult to go back in time. Face recognition data, for example, is utilised for non-recognition purposes such as evaluating a person's sexual orientation, race, or religion.

8.FUTURE DEVELOPMENT

Face recognition technology has advanced significantly with the advancement of science and technology, but there is still potential for improvement in terms of practical use. There may be a specific camera for face identification in the future, which can increase image quality and handle problems like image filtering, image reconstruction, denoising , and so on. We may also complement 2D photos with 3D technologies to overcome challenges like rotation and occlusion.

9.REFERNCES

[1] Karhunen Loève expansion, eigen picture, eigenvector,and principal component anlysis

A Kirby and Sirovich

B. Anthony Giordano & Michael Uhrig.

December 2010

[2] Karhunen-Loève methods

The attractiveness of using neural networks could be due to its non linearity in the network.

[3] K. Lander, V. Bruce, and M. Bindemann, ‘‘Use-inspired basic research

on individual differences in face identification: Implications for criminal

investigation and security,’’ Cognit. Res., Princ. Implications, vol. 3, no. 1,

pp. 1–13, Dec. 2018.

[4] Y. Hu, H. An, Y. Guo, C. Zhang, T. Zhang, and L. Ye, ‘‘The development

status and prospects on the face recognition,'' in Proc. 4th Int. Conf.

Bioinf. Biomed. Eng., Jun. 2010, pp. 1–4.

[5] R. Gottumukkal and V. K. Asari, ''An improved face recognition technique based on modular PCA approach,'' Pattern Recognit. Lett., vol. 25,

no. 4, pp. 429–436, Mar. 2004.

[6] D. C. Hoyle and M. Rattray, ''PCA learning for sparse high-dimensional

data,'' Europhys. Lett. (EPL), vol. 62, no. 1, pp. 117–123, Apr. 2003.

[7] Suguna G C, Kavitha H S, Sunita Shirahatti, Sowmya R Bangari, ''FACE RECOGNITION SYSTEM FOR REALTIME APPLICATIONS USING SVM COMBINEDWITH FACENET AND MTCNN,''

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