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An Adaptable Single and Multi-Face Recognition for Business Sectors

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***Abstract*— Password authentication is readily cracked, and hackers may simply predict the patterns. Faceprint plays a significant role , making it more difficult for hackers to match it up. A customizable app that takes the faceprint as an input, compares it to the current database, and analyses facial attributes to obtain a more exact face pattern to eliminate errors is created. The strategy comprises some modular and efficient algorithms like Siamese Neural Network (twin neural network) for accurate one-shot image recognition. Dlib is utilized for facial landmark detection. Then, using Retina Face for both one face and multiface detection in a crowd. And a pixel wise face localization method, Retina face to perform tasks such as face detection,2D face alignment and 3D face reconstruction simultaneously for accurate precision.The technology leverages a modular design to reduce the need for separate facial recognition systems. It is easily adaptable to all locations by just changing a few lines of code to meet the needs. With the advent of facial recognition technology, the technique will assist in quickly adapting to the changes required by diverse sectors.**

***Index Terms*— Siamese Neural Network, one shot image recognition, High Resolution Neural Network, multiface detection, Retina face**

I. INTRODUCTION

Crimes have become increasingly common in recent years all over the world. It can be avoided by using artificial intelligence. Technology has advanced significantly since the creation of mobile phones and artificial intelligence. Since face is an unique way to identify people, face recognition system has greater advantages compared to other biometric systems like fingerprint, palm print, iris, vocal etc,. Also, it doesn't require any human interaction and can be used without a person's knowledge, making it a very useful system to identify human activities in a variety of security applications, such as airport, criminal detection forensic, etc., Identity verification may be done quickly and effectively with face recognition. Facial recognition systems are capable of upto 99.97% accuracy, but the technology does have some drawbacks. To overcome this, different approach of face detection was studied using three algorithms. The first algorithm proposed is one shot learning algorithm that utilizes a kind of Artificial neural network (ANN) called Siamese network (Twin neural network). It is a class of neural network architectures that contain two or more identical subnetworks. It is used to find the similarity of the inputs by comparing its feature vectors, so these networks are used in many applications. With the aid of one-shot learning, given a few images per class is sufficient for Siamese networks to recognize those images in the future. Also, based on a single stage design, a novel pixel-wise face localization method named Retina face was proposed, which employs a multi-task learning strategy to simultaneously predict face score,facebox,five facial landmarks,3D prediction and

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correspondence of each facial pixel. Retina Face was used to predict both one face and multi-face identity in a crowd. In addition to these, Dlib was utilized to figure out the facial landmark points and to enhance the alignment of the face properly.

II. Ease Of Use

In the airline business, facial recognition is already employed to enable quick and precise identification at all points of the passenger journey, including check-in, luggage drop, security screening, retail transactions, and boarding lineups. Also, it makes immigration and baggage claims procedures more streamlined and unobtrusive at the airport.Facial recognition can offer a quick, precise, and most importantly frictionless solution for providing someone access to particular areas of a business or, from an IT perspective, access to particular files and databases. In order to combat time fraud and enhance employee security when entering and leaving the office, businesses are also employing facial recognition technology for time and attendance systems.Additionally, it is used to recognise customers in loyalty programmes, offer a tailored level of care, speed up in-store payment processes, and improve customer experience. One of the key benefits to any organization is the speed at which identity can be processed using facial recognition.As enterprises search for seamless COVID-related solutions, the low cost of integrating facial recognition into current security systems presents a win-win situation.

III. Proposed Solution

A. Face Recognition:

The camera identifies and locates a person's face image.

B. Face Analysis:

After that, the image of the face is gathered and examine. In comparison to 3D photographs, matching a 2D image with face recognition technology relies on 2D images. The idea is to identify the key landmarks that distinguish your face.

C. Image to Data Conversion:

The face capture technique turns analogue information (a face) into a collection of digital information based on the person's facial features (data). Your face analysis has been converted to a mathematical formula. The numerical code is known as a faceprint.

D. Finding a match:

Your faceprint is then compared to a database of recognized faces to find a match. Your faceprint's compatibility with a picture in a facial recognition database is determined

IV. System Architecture

The following architectural diagram describes about the overall concepts of the system.
Architectural diagram: The Architecture diagram in Fig.1. presents an overview of our system; especially the figure illustrates the overall concept of the system. The images obtained by the camera are used todetermine face landmarks. During the procedure, the facial features are retrieved and compared to the pre-stored face features in the known face database to identify a match. The security adviser receives an immediate alert if the individual recognized by the system turns out to be an unidentified person.

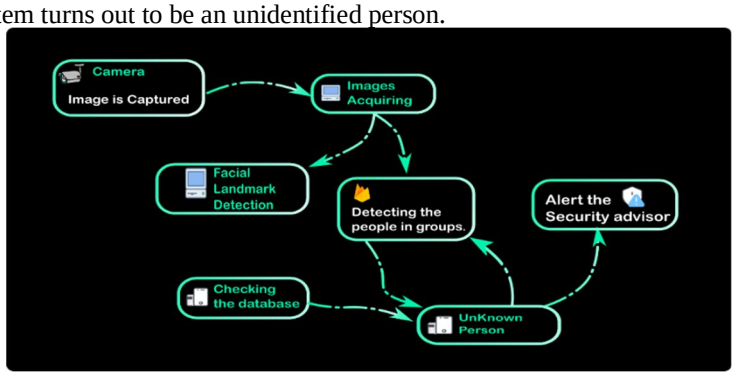

Figure1.Architecture Diagram

A. Siamese Neural Network

One-shot image recognition is accomplished using the Siamese Neural Network. These networks are fed a set of inputs. The characteristics of one input are computed by each network. Then, using their difference or the dot product, the similarity of the characteristics is calculated. Target output is 1 for input pairings of the same class, and 0 for input pairs of different classes. In Siamese, the parameters and weights are the same for both networks.

Workflow:

1. Anchor, positive, and negative image folders are the three types of folders.
2. The anchor folder, which contains a folder containing images captured from the webcam, and the positive folder, which also contains images captured from the webcam.
3. The webcam images are compared to the positive and negative images.
4. It is then sent to the Distance Layer using model encoding.
5. If the Distance Layer returns one, the image is verified; otherwise, it is unverified.

About Network: Rectified linear (ReLU) units is utilized in the first L 2 layer, and sigmoidal units in the subsequent layers. The model consists of many convolutional layers with a fixed stride of 1 and a single channel with varying size filters in each layer. The number of convolutional filters is specified as a multiple of 16 to increase efficiency. The network applies a ReLU activation function to the output feature maps before optionally maxpooling with a filter size and stride of 2.

First, the convolutional +ReLU, 64@ and a 105*105-pixel picture are sent. In this instance, the first item is sent through is the filter (64), and the form is 10*10 pixels. Do you know what stride is? In this situation, one is the actual distance that our pixels move across the picture. 96 * 96 pixels and 64 channels! 64-unit maximum pooling layer 2*2 is essentially condensing! In order to duplicate this, padding is really used. Since the first two will always reproduce, they are referred to as core blocks. a thick layer + flatten. (Final block of embedding) Imagine the data as two rivers, each of which is producing a 4096-unit feature vector for NN and then translating input images into an embedding feature.

Architecture:

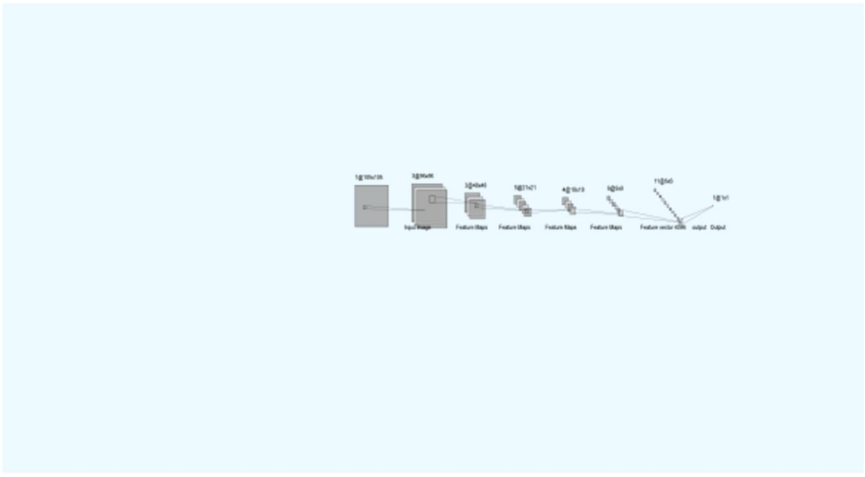

Figure 2. Architecture diagram of Siamese Neural Network

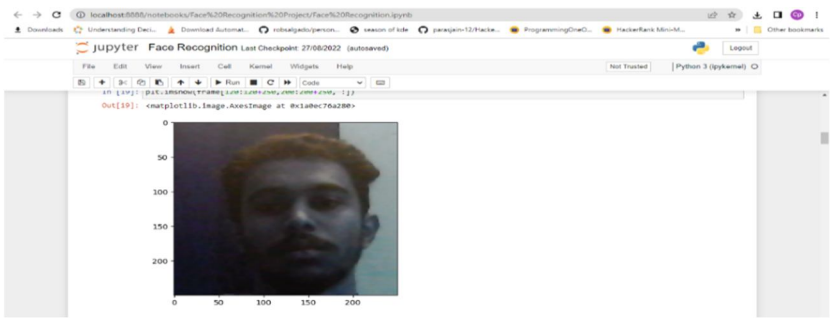

Figure 3. Displaying the captured anchored image in the screen(250 X 250 Pixels)

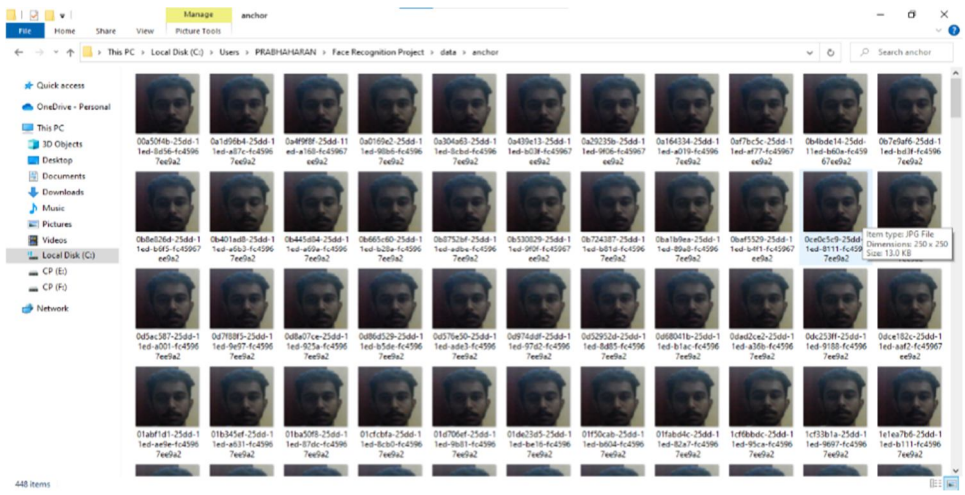

Figure 4. The Anchor folder containing the images captured from the camera

B.Retina Face

Retina Face is used to detect facial landmarks. Even in a crowd, its detecting performance is outstanding.The eye coordinates are among the facial landmarks that retina face may locate here.By using its function for extracting faces,it may then apply alignment to faces that have been recognized.Retina Face uses a single shot framework to simultaneously accomplish the three face localization tasks of face detection, 2D face alignment, and 3D face reconstruction. All three targets are solved with the single goal in mind that all regressed points for theaforementioned three tasks should be on the image plane Fig. 5..

Working : Pyramids of feature are the foundation of model design. The programme will then provide the face region coordinates, a confidence score, and coordinates for various features like the eyes, nose, and mouth and landmarks detected contain eye coordinates. The identified faces can then be aligned up until the eye coordinates become horizontal. The alignment improves facial recognition accuracy by roughly 1%. A unique extract faces function is provided by the Retina Face framework. It returns the actual face that was recognised. By default, alignment will be used, but you can disable it by setting the align option to False. ArcFace is insight face's face recognition module, while Retina Face is its face detection module.

Benefits: Accurate face alignment performs three different face localization tasks simultaneously, namely face detection, 2D facial alignment, and 3D face reconstruction.

C. Facial Landmark Detection Using Dlib

In this task of detecting facial landmarks, the face must first be detected in a given image, and then the face must be analyzed to obtain the face landmarks. Facial landmarks are useful for determining the alignment of the face and its features. Dlib is a cutting-edge C++ toolkit that includes tools for building complex software in C++ to solve real-world problems as well as machine learning algorithms. This library works only on the gray-scale image. All 68 landmark points are predicted using a model that has already undergone training. These landmarks allow us to pinpoint the precise location of the features. This library is extremely powerful and can be extended to a wide range of applications. Drowsiness detection, tracing the chin line, face mask detection, and many other features are available. Using the well-known Dlib library, the facial landmark coordinates, mark the facial landmark points with dots, such as the eyes, nose, mouth, ears, and jawline, and trace the dots along the jawline curve were displayed.

Workflow: Detecting facial landmarks is thus a two-step procedure:

Step 1: Determine the location of the face in the image.

Step 2: On the face ROI, identify the key facial structures.

Step 1 is accomplished by employing dib's frontal face detector.

Step 2 is accomplished by utilizing the facial landmark detector included in dlib.

Benefits:To identify and depict important areas of the face,facial Landmarks are used, such as eyebrows and eyes, mouth, jawline and nose. The 68(x,y) coordinates that correspond to facial structures on the face are estimated using the p retrained facial landmark detector found inside the dlib library. The architecture diagram and result are shown in Fig.6. and Fig.7.

Output:

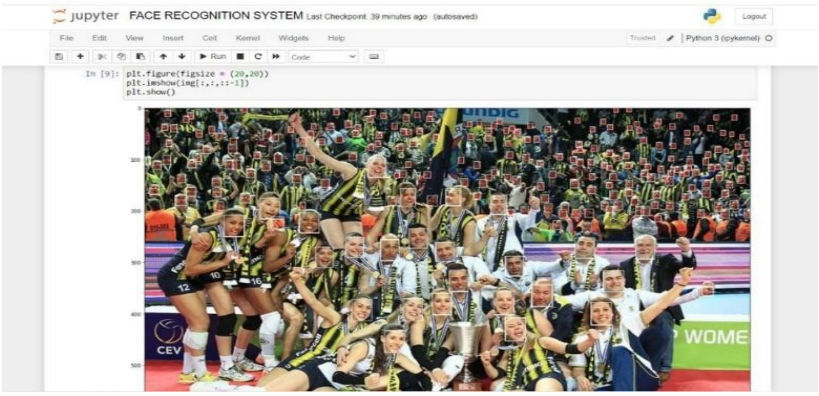

Figure 5. Output of Retina Face

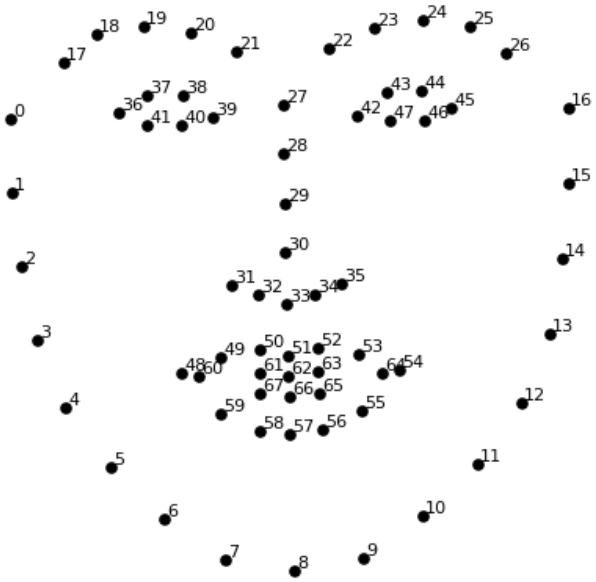

Figure 6. Facial LandmarkDetector

Figure 7. Processed Facial Landmark Image

V. CONCLUSION

In this research, deep facial landmark detection for facial recognition was investigated. It also emphasizes the application of the best algorithms for various circumstances. It functions properly in all properly in all

circumstances and is crucial for security reasons. This is highly helpful in locating the most wanted individuals at security borders and in places where most desired individuals can be located in groups using facial retina. It can be applied wherever in the future because our methodology is highly adaptable.

VI. Future Enhancements

A HR Nets Model will be developed in future to increase the precision of face landmark detection. Our strategy will incorporate technology that allows for payments to be made using face recognition, so customers may make purchases just by smiling, in order to improve bank transactions and reduce credit card fraud. Our strategy will also incorporate alerting techniques for driving while sleepy or dozing off.

References

[1] Hongwen Zhang, Qi Li ,Zhenan Sun and Yunfan Liu , "Combining Data-driven and Model-driven Methods for Robust Facial Landmark Detection" , IEEE published in 2019.

[2] MengyueZhang ,Weihan Liao , Jianlian Zhang , Huisheng Gao , Fanyi Wang and Bin Lin , "Embedded Face Recognition System Based on Multi-task Convolutional Neural Network and LBP Features" , IEEE published in 2019.

[3] Edy Winarno ,Prajanto Wahyu Adi , Imam Husni Al Amin , WiwienHadikurniawati , HernyFebruariyanti and Muchamad Taufiq Anwar , "Attendance System Based on Face Recognition System Using CNN-PCA Method and Real-time Camera" , IEEE published in 2019.

[4] Alice J. O'Toole, Yi Cheng, P. Jonathon Phillips , Brendan Ross and Heather A. Wild , "Face Recognition Algorithms as Models of Human Face Processing" , IEEE published in 2019.

[5] Jingdong Wang, Ke Sun, Tianheng Cheng, Borui Jiang, Chaorui Deng, Yang Zhao, Dong Liu, Yadong Mu, Mingkui Tan, Xinggang Wang, Wenyu Liu and Bin Xiao, "Deep High-Resolution Representation Learning for Visual Recognition", IEEE published in 2019.

[6] HaoranWu,ZhiyongXu,JianlinZhang,JianlinZhang,XiaoMa,"Face recognition based on convolution siamesenetworks",IEEE published in 2017.

[7] Di Wang,HongzhiYu,DingWang,GuanyuLi,"Face Recognition System Based on CNN",IEEE published in 2020.

[8] KezhuTao,YongluHe,CaihongChen,"Design of Face Recognition System Based on Convolutional Neural Network",IEEE published in 2019.

[9] MaheenZulfiqar,FatimaSyed,MuhammadJaleedKhan,KhurramKhurshid,"Deep Face Recognition for Biometric Authentication",IEEE published in 2019.

[10] JinKeong,XingboDong,ZheJin,KhawlaMallat,Jean-Luc Dugelay,"Multi-spectral Facial Landmark Detection",IEEE published in 2020.

[11] JiankangDeng,JiaGuo,EvangelosVerveras,IreneKotsia,StefanosZafeiriou,"RetinaFace: Single-Shot Multi-Level Face Localisation in the Wild",IEEE published in 2020.