

Finding Missing Person using AI

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Abstract— Many people and children in the world go missing every day, which the police and local authorities must deal with. The police and municipal authorities deal with many missing persons and kid cases every day. In 2020, National Crime Records Bureau (NCRB) listed around 300 thousand missing persons in India. The general process normally deals with investigation, which requires experience and can be time-consuming if the missing person is migrated. The overall procedure usually entails inquiry, which is time-consuming and requires experience. Our research intends to create an AI system that can identify and evaluate a person's facial features and then compare them to a face in the database, even if they are located years after going missing. Using the Yale Face Dataset on Kaggle containing over 70,000 images for the model, the training of such large dataset improved the model for the Eigenface as well as the GAN algorithm with the use of OpenCV and HaarCascade library helped improve and enhance the accuracy with the result of near 99.

Index Terms— OpenCV, Face Detection, HaarCascade, CNN, Eigenface, GAN.

I. INTRODUCTION

In today's times, there is an increase in the crime rate in the past couple of years. This includes crimes like kidnapping, theft, murders, etc. According to the New York Times report dated 17th April 2022, murders have increased by approximately forty percent since 2018, and other vicious crimes including assaults and murders have also increased drastically. There is a need for help today for a system to support this cause in a time-efficient manner with accurate reports and no scams. Thus, we have developed a system named 'Finding Missing Person using AI' whose main aim is to assist police and better government to tune down lacking humans quickly. Most of the time, the research approach works quite properly, however it's time-consuming and maybe unsuccessful if the missing person has been shifted/moved to an exclusive location. In such cases, the right technique is to undergo CCTV footage and evidence which would again take a lot of time. So, it's very important to fill these gaps by implementing a certain system to benefit society. The facial recognition requires a way to identify or confirm a person's identity using their face [1]. Facial recognition software can identify people in real time as well as in still photos and movies respectively.

Face recognition is a sub-type of biometric security. There may also be a want of automation for automating the mission of locating the specific man or woman via way of means of recognizing a specific photograph and evaluating it with a different photograph to test whether each photograph has the same traits or not [2]. If the missing person is found much later (say 5 years later), then his/her current face will be aged 5 years back by our system using a suitable algorithm checking to the nearest accuracy [3]. By doing this we can come to know whether the lacking man or woman within the photograph clicked from specific vicinity is accurate or not, and if it's far accurate then the police can begin their subsequent steps to locate the man or woman from that area.

The algorithm mainly used for the comparison of faces was the KNN algorithm, but the main problem of it is we cannot improvise the aging factor in it[4]. The main factors we need to take care of here is the face comparison with our database and the aging factor to the nearest accuracy, which can be achieved using an efficient algorithm like Eigenface to extract characteristic facial features in question as a linear combination [5]. The way our system works is that when someone finds someone they think is missing, they upload their face photo into our system, where it is compared to every other face in our database.

The system is secured if user authentication is provided at the start to verify the credentials of the reporting as well as the missing person, so as to make sure no false information is being uploaded in the system [6]. We also need to consider the aging factor of the missing person if they're found after 'x' years, to age the face precisely for accurate comparison[7]. The dataset must be of large quantity to train the model efficiently for all ages of all genders with different skin tone [8]. This can be achieved using high AI algorithms like the Eigenface and GAN algorithms for precisely analyzing and extracting the facial features [9]. Our system can thereby serve as an additional helping hand to track down missing persons and thus help assist the concerned local authorities and by precisely utilizing the advanced technologies and data analysis to provide valuable insight and more information to aid.

II. PROBLEM STATEMENT

The development of our system is a response to the growing need for effective and efficient ways of tracking missing persons. With the use of artificial intelligence, our system aims to minimize the time and effort spent in finding missing individuals. Our system is designed to be user-friendly and accessible to individuals, families, and local authorities who are seeking to locate missing persons. One of the key features of our system is its ability to match a missing person's facial image with our database of known individuals. Through advanced facial recognition technology, our system can quickly identify potential matches and provide crucial information to aid in the search. Moreover, our system is designed to adapt to changing circumstances. In cases where a missing person is located after a certain number of years, our system can accurately age back the individual's facial features by 'x' number of years to ensure that they are correctly identified. Ultimately, our system aims to provide closure to families who are searching for their missing loved ones. By providing accurate and timely information, our system can help families reunite with their loved ones and bring peace of mind during a difficult time. In addition to facial recognition technology, our system also utilizes precise machine learning algorithms to improve its accuracy and efficiency over time. By analyzing patterns and trends in missing person cases, our system can identify potential areas of improvement and adjust its search parameters accordingly. Furthermore, our system is designed to integrate with existing databases and systems used by local authorities. This allows for a more streamlined approach to searching for missing persons, reducing duplication of efforts, and improving the chances of success. We also place a high priority on protecting the privacy of individuals in our system. All data and information are kept secure and confidential, in compliance with applicable data protection laws and regulations. To ensure that our system remains effective and up to date, we regularly review and update our technology and processes. This includes staying informed about the latest developments in AI and related fields, as well as working closely with local authorities and other stakeholders to incorporate feedback and suggestions. In summary, our system represents a significant step forward in the use of AI to track down missing persons. By leveraging advanced technology and a commitment to privacy and accuracy, we believe our system can make a meaningful difference in the lives of families and communities affected by missing person cases.

III. LITERATURE REVIEW

With the advancement of the use of facial identification, safety and judicial departments can now process footage and pictures from a wide range of resources, such as part-worn, mobile device, and with-car surveillance systems, with the goal to recognize persons of concern rapidly and precisely in immediate and hasten investigations. So, the method for recognizing or verifying someone's identification by looking at their face is recognizing facial features. In addition to static images and moving pictures, facial features software can recognize people in real time. Biometric security includes face recognition as a subcategory. A thorough analysis of a variety of face recognition structures that make use of certain Deep Learning techniques is crucial [1]. It talks about different papers associated with special algorithms, architectures, appropriate databases, difficulties, and the enhancement of different ideas of DL-primarily based totally face recognition structures. However, the limitation of this paper is that certain key factors like the alignment step of face pose in CNN lead to geometrical

information loss. Also, there is no aging factor taken into consideration while recognition of face and heterogeneous faces were considered under the category of homogeneous faces. A method for using TensorFlow and OpenCV to find face masks for humans is important to provide visual jobs with the highest possible performance and efficiency while using computers [2]. A bounding field that is drawn over the character's face indicates whether the character is wearing a mask. If a character's face is recorded in the database, it can recognize calls from people who don't constantly wear masks. However, the limitation of this paper is that it does not detect correctly if the user's face has any defects like the user is blind/has scars, etc, or if there is any obstruction to the face like blocking the face with hand or any object. Facial features analysis is the technique of identifying certain facial characteristics, such as the mouth, nostrils, and eyesight, from an image of a human face. For the early phases of computational methods like face monitoring, appearance identification, or the identification of faces, facial extraction of features is crucial. A person's goals in a social setting can be deduced from how they look and their internal emotions. They are necessary for humans to be able to interact with others. Regarding the computation of facial reactions, the context of the scenarios where people can be seen is crucial. To stress the effectiveness of the present models, it is also necessary to evaluate the cutting-edge technology and deep learning networks that researchers have proposed and that are specifically designed for face expression analysis [3]. Also, the research mainly focuses on 2D facial expression recognition data, thus 3D facial features are tough to variations of facial poses. The Incremental Feature Selection (IFS) set of rules are used which first makes use of functional significance to perceive the maximum applicable capabilities for NTL (Non-Technical Loss) detection after which those capabilities are used to check 3 classifiers specifically K-Nearest Neighbours, Decision Tree Classification and CatBoost model [4]. However, the limitation of this paper is that there is no categorical performance provided for different classifiers of NTL in the provided database, also there need to be more features taken together under consideration while shortlisting the given criteria (at least 5). Like for example, taking an dataset of say an African-American batch has a greater fake matching percentage, and the Caucasian photo group has an enhanced fake pseudo-match rate, for a straightforward evaluation limit, the article suggests employing extraordinarily deep convolutional neural community face matches [5]. The study analyses the imposter dispersion to test the theory that those with darker complexions are associated with a greater FMR, but it finds insufficient proof to back up this assertion. However, the limitation of this paper is that it does not mentionsome critical factors like the aging factor, small image sizes, and different face angles, and does not mention fixesfor the problems in a detailed manner. A refinement facedetector can be implemented to attain excessive performance using 5 different modules like to supervise the feature module, to enhance the receptors field, classify on proper selection, supervise the features model and awareness of the loss of scale[6]. To boost the likelihood of regression with great section precision, STR coarsely adjusts the location and dimension of flags from vast recognition layers. STC initially eliminates the bulk of simple errors from ineffective-degree monitor levels to decrease the scope of search for the upcoming algorithm and improve its classification limit ability to achieve maximal effectiveness. However, the limitation of this paper is that this system is not applicable for multiple faces shown at once, also it does not take care of removing obstruction to the face or accurately extracting features in different light conditions. With the aging factor, the face and neck often begin to change in appearance. Skin thinning and loss of muscular tone make the face look flabby or drooping. This factor is important because if the missing person is found after 'x' years, his/her facial structure may have changed, then we need to age back the facial structure by 'x' years to compare it with our database. With the aid of three novelties, a deep learning model for invariant age groups can be used for the processing of internal face recognition [7]. First, AIM offers a single, cohesive, cross-generational face synthesis and popularity in an amplifying manner. Second, AIM avoids the need for matched facts and the actual age of testing samples by achieving continuous face rejuvenation/aging with outstanding photo-realistic and identity-preserving capabilities. Third, effective and cutting-edge educational methods have been developed for understanding the full deep structure. The disadvantage of this article is that it is difficult to locate identical faces with a significant age difference because of the differences in facial appearance that come with ageing. The pre-trained dataset in real-world applications may be relatively little (for instance, just 2 age-invariant face photos are available for each identity). A face can be encoded and decoded in an automated manner without the entire information utilizing software for the identification of facial characteristics using EigenFace methods, which reduces compute and computational complexity. The results obtained through this research proved that an average accuracy of 85 percent can be provided using this algorithm. However, the limitation of this paper is that the rate of recognition of facial features decreases for different and changing illumination and pose factors. Also, this method's uniform background is required for this method for it to work properly, and this condition is not guaranteed to be available in all conditions. Therefore, it is important to carefully select and preprocess the training dataset to ensure that the generated aged images are of high quality and do not contain any biases.

IV. PROPOSED SYSTEM

This section explains the entire process from start till end about the implementation of our system. The first part shows the basic start of the system for the user when they open to report a missing person. Then the next category displays Face Detection and the Feature Features extraction. The next part represents the implementation of the aging factor for required special cases. Finally, the end part represents the end stage which deals with analyzing the result of face comparison appropriately.

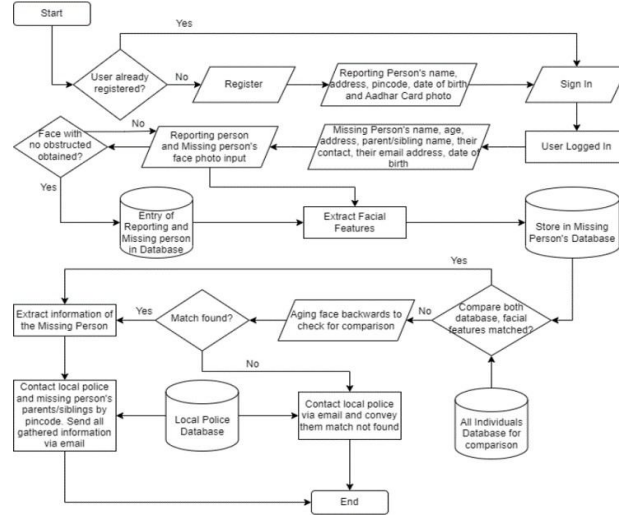


Fig. 1: System's Schema Diagram

Figure 1 illustrates the comprehensive system design, which encompasses all relevant processes from initiation to completion. The proposed system incorporates several advanced techniques and algorithms to enhance its functionality and accuracy. The system flow starts with User A, who is required to register with our system and provide crucial details such as name, age, gender, and address with pincode. After registering, User A logs into the system and enters all relevant information about the missing person, User B, including name, age, gender, address, parent/sibling name, email, and contact, if available. The system then prompts User A to upload a picture of User B's face without any obstructions, such as masks or multiple faces. To prevent false claims and fraudulent activities, the system employs advanced techniques, such as OpenCV, CNN, and EigenFace algorithms, to extract and store User B's facial features in the missing database.

$$C = (1/N) \sum (x[n] - \mu)(x[n] - \mu)^T \quad (1)$$

$$Cv[i] = \lambda v[i] \quad (2)$$

$$\phi[i] = \sum jv[i, j]x[j] \quad (3)$$

In (1), Covariance matrix: $x[n]$ is the n -th input image, μ is the mean image, and C is the covariance matrix. In (2), Eigenvectors: $v[i]$ is the i -th eigenvector and λ is the eigenvalue. In (3), Eigenfaces: i is the i -th eigenface, and $v[i, j]$ and $x[j]$ are the elements of the eigenvector and input image, respectively.

The system then compares User B's facial features with our All-Individual database. In case of a non-match, the system applies the EigenFace algorithm to age back User B's face by the number of years specified by User A and then compares it again with the database. The system maintains the local police database, which is utilized to inform the local police authorities about the situation if a match is not found. The system provides all the necessary details of User A and B to facilitate further investigation. If a match is found, the system extracts User B's data from our matched person's database and forwards it to the local police authorities along with User A and B's details. To sort out which local police authorities to contact, the system maintains a comprehensive database based on User A and B's pincode and region. The system also inculcates the aging factor into consideration, i.e. if a missing person is found after some years then to age the dataset face by that many years to compare with more accuracy and efficiency. This was tested with various algorithms and achieved more precisely with the use of GAN (Generative Adversarial Networks) algorithm.

$$L_G = -\log(D(G(z))) \quad (4)$$

$$L_D = -\log(D(x)) - \log(1 - D(G(z))) \quad (5)$$

$$\theta_{new} = \theta_{old} - \alpha(1/\sqrt{v_t} + \epsilon)g_t \quad (6)$$

In (4), z is the input noise, $G(z)$ is the generated image, and $D(G(z))$ is the discriminator's output on the generated image. In (5), x is the real image, and $D(x)$ and $D(G(z))$ are the discriminator's outputs on the real and generated images, respectively. In (6), θ_{old} and θ_{new} are the old and new parameter values, respectively, α is the learning rate, v_t is the running average of the squared gradient, and g_t is the gradient at time step t . The system also employs complex mathematical equations and algorithms, such as machine learning and deep neural networks, to improve its functionality and accuracy over time. In conclusion, our proposed system offers a comprehensive solution to track down missing persons using advanced technologies and algorithms. The system ensures accuracy, reliability, and efficiency while prioritizing user privacy and security. The use of complex mathematical equations and algorithms enhances the system's functionality and accuracy, making it an invaluable tool for families and communities affected by missing person cases. The proposed system's advanced technologies and algorithms can potentially aid law enforcement agencies in their search efforts, increasing the likelihood of finding missing persons quickly and efficiently. Overall, the proposed system's advanced technologies, privacy and security features, and potential to aid law enforcement make it a promising solution for tracking down missing persons and reuniting them with their loved ones.

V. DATASETS USED

A. Real and Fake Face Detection

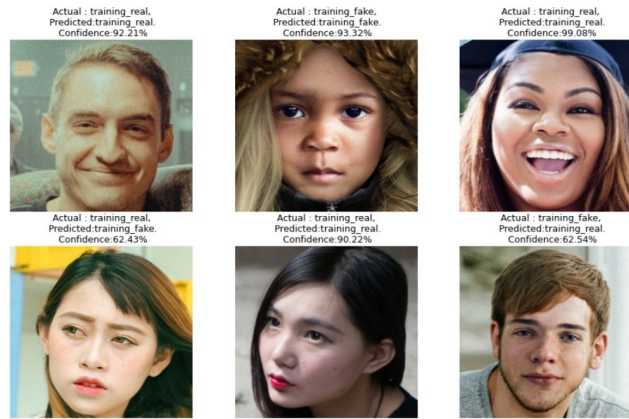


Fig. 2: Dataset for Face recognition and Feature Extraction

Face recognition and feature extraction are performed on the dataset shown in Figure 2. The dataset contains 5,000 facial images, each labeled as real or fake. The images are used to train machine learning models that can detect the differences between real and fake faces. These models are helpful for feature extraction, which entails locating the distinctive features of a face such as the configuration of the important facial features. All things considered, the dataset is a useful tool for researchers and programmers looking to advance the fields of image processing and recognition of facial features. The capacity to recognize distorted photos is now more crucial than ever due to the growing use of Deep-Fake technology. Such algorithms might be applied in several situations, such as locating fake social media accounts and spotting changed photos in legal cases. Finally, with major real-world ramifications, this dataset has the potential to support the development of more sophisticated and dependable methods for picture and facial recognition for the training and evaluation of AI algorithms for face identification and classification.

B. CelebFaces Attributes (CelebA) Dataset

The dataset in Figure 3 is used in face aging research to train machine learning models to predict how a person's face changes with age. The dataset contains over 200,000 labeled facial images of celebrities, which are used to teach the models to recognize patterns in facial features that change over time. Once trained, the models can generate images of a person's face at different ages, useful in various applications such as predicting how someone will look as they age. The dataset can also be used to generate images of missing children and to create realistic images of historical figures at different points in their lives.



Fig. 3: Dataset for Aging Factor for Face Comparison

VI. IMPLEMENTATION

To overcome these limitations, we conducted several tests and experiments to validate the effectiveness of the system. Our team tested the system under various conditions, and we were able to make several improvements to its functionality. Furthermore, we were able to identify and address potential issues that could arise in the future, ensuring that the system will continue to operate at an optimal level. In addition to these assumptions, we also took steps to address potential ethical concerns surrounding the use of facial recognition technology. We made sure to include clear and transparent policies regarding the collection and use of data, as well as the potential biases that may arise from the technology. To further validate the system's effectiveness, we conducted user testing and received feedback from both individuals who had reported missing persons and law enforcement officials. Their feedback helped us identify areas for improvement and refine the system's features and functionality. The following assumptions were made. 1. For their face to be recognized, the user needs to have access to a webcam on their computer. It makes sure that the user is in an environment that is suitable for face analysis, which is the system's basic working principle. 2. The person reporting the missing person must have an Aadhar card or its copy for his/her validation during the registration of the system. There is a large dataset for everyday people in-order to compare the picture of the missing person. The following are the restrictions imposed by our system. 1. Only one user can be logged into the system at once. It makes sure that there is never more than one active user at once. 2. The person using the device must have access to a webcam. Otherwise, the user must click their picture again until a legitimate location is clicked if the user's face cannot be identified for whatever technical cause or another. The implementation of the system was done in Tkinter using PyCharm for the Editor. The coding language used was Python and MySQL was used to store the data of all users and facial features. The use of Tkinter allowed us to create a user-friendly interface that is easy to navigate and understand. Python's flexibility and ease of use made it the ideal programming language for implementing complex algorithms and machine learning models. The use of MySQL ensured that the system could store large amounts of data securely and efficiently, while also allowing for easy retrieval and analysis of information and thus overall ensuring user privacy and security.

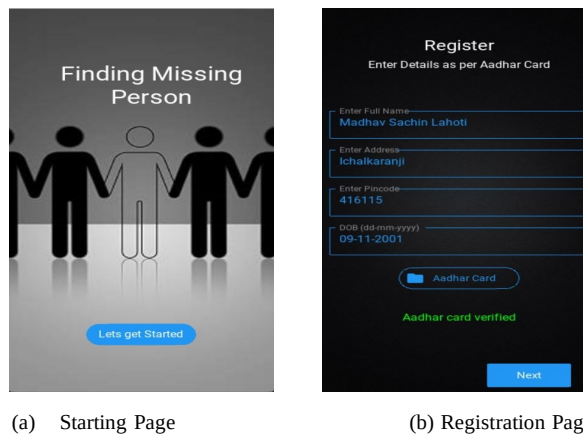


Fig. 4: Starting Page and Register Page

The system's initial screen, which is wherein the person who reports is led at the very start, is shown in Figure 4a. The registration screen, shown in Figure 4b, requires the user to enter all pertinent information. If the user does not fill all the parameters or if the Aadhar card is not uploaded, then the system shows an error that the data is incorrect, or no image is uploaded. If the uploaded Aadhar card photo is blurred or unclear, then an error is shown that the image uploaded is unclear and asks the user to upload a clear photo. On entering all the parameters and a clear Aadhar card photo, the Aadhar card details and the entered user details are compared, and the system tells whether the user is verified or not, as shown in Figure 4b.

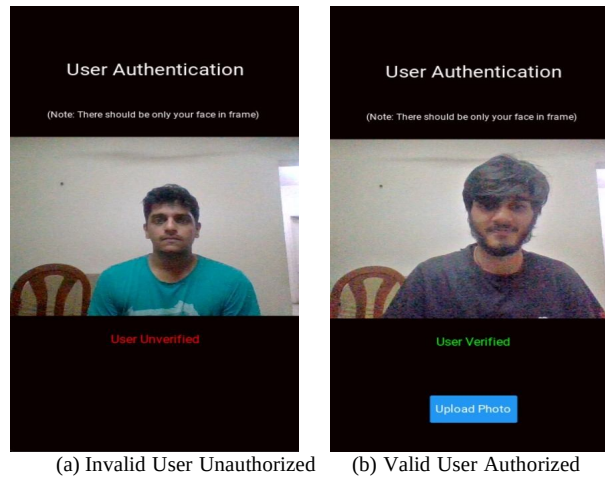


Fig. 5: Invalid User Unauthorized and Valid User Authorized

Then, the reporting person is then asked to click/upload their face photo in the system. If not face is found then the system throws an error, as shown in Figure 5a. If the reporting person's face is matched with the face present in the Aadhar card, then the system shows 'User verified' as shown in Figure 5b. If some other user uploads their photo or the reporting person does not upload their face photo properly then the system shows 'User unverified', and then the reporting person again has to upload their clear face photo.

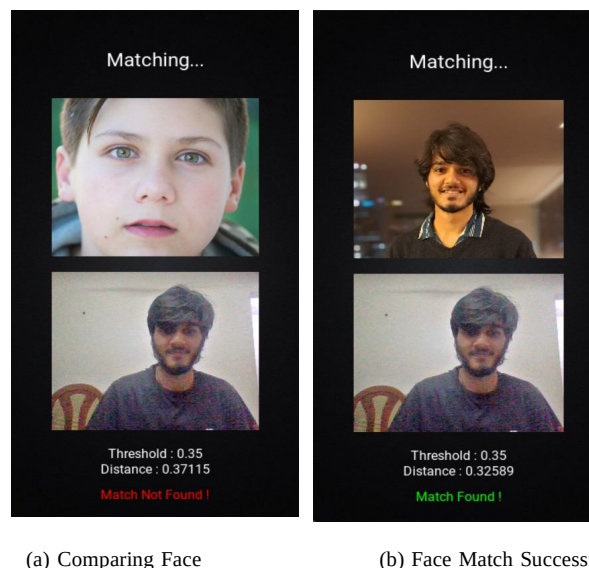


Fig. 6: Comparing Face and Face Match Successful

The missing person's face photo is then clicked and is compared with all of the photos present in the database. If no match is found, the system shows 'User Not Found' as shown in Figure 6a. If the match is found, the system shows 'User Found' as shown in Figure 6b.

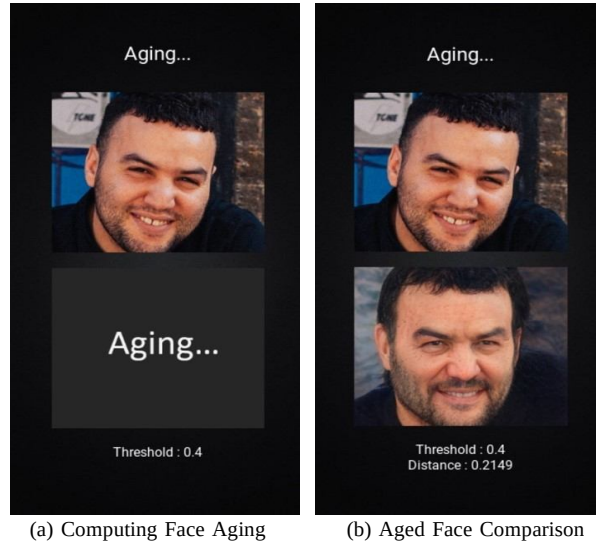


Fig. 7: Computing Face Aging and Aged Face Comparison

In-case the missing person is found after 'x' years, each photo in the current database of All Users are taken one at a time and aged to 'x' years and then compared to the current photo of the missing person, as shown in Figure 7a. If the match is found, both faces are displayed in the screen with their threshold and distance value as shown in Figure 7b.

VII. RESULTS

To achieve the primary goal of our suggested system, we have organized the following findings into categories 1. To click the face using the webcam without any obstruction. 2. Identify the correct match by correctly extracting the facetrails, classifying them, and comparing them with the database.

3. Also taking the aging factor into consideration if the missing person is found after many years which could result in major changes in facial structure. An accuracy table and corresponding graph are used to calculate the implementation's result. We trained a total of 4 algorithms (Fisher Face, Eigen Face, CNN and Age-GAN algorithms). The last one was used to age the face if needed. From the following 3 algorithms trained, we observed that Eigen Face algorithm gave the highest accuracy (~97%), thus it was chosen for the facerecognition implementation for our system. For face-aging purposes, the Age-GAN was highly efficient and calculated to give accuracy around 98%. Here all the 3 algorithms were trained with the dataset size of 1700 face images to ensure high efficiency. The implementation of the system has gone through extensive testing to ensure that it can handle various scenarios and provide reliable results. We have tested the system under different lighting conditions, angles, and facial expressions to make sure that it can accurately recognize faces. To ensure the privacy and security of users, we have implemented strict measures to protect the data and prevent unauthorized access. The system's database is securely stored and encrypted to protect sensitive information. Furthermore, the system is designed to be user-friendly and accessible to people with different levels of technical knowledge. The interface is intuitive and easy to navigate, allowing users to report missing persons and track progress easily. The accuracy table obtained is as follows:

Algorithm	Dataset size	Pre-trained Images	Accuracy
Fisher Face	1700	219,872	95.4451%
Eigen Face	1700	220,545	97.2105%
CNN	1700	199,466	95.0%
Age-GAN	1700	202,455	98.8%

Fig. 8: Face-Recognition and Aging Accuracy Table

For the aging factor, the Age-GAN algorithm was used and pre-trained over 200,000 images of various face shapes/colors/race. The algorithm modifies its parameters during training in response to discrepancies between the output it generates the desired output. The algorithm's accuracy frequently rises throughout the training process for both the training and validation datasets. It's crucial to consider using an effective algorithm like Age-GAN, which exhibits a steady rise in training and validation accuracy during the period of training. However, if the training accuracy keeps rising while the validation accuracy starts to plateau or even decreases, this can indicate overfitting. Overfitting occurs when the algorithm stops generalizing to new data and starts to memorize the training set. The input size of face images was 1700 in different ages ranging from young-age to middle-age to old-age to provide variety and ensure highest efficiency for the system. After conducting several tests and experiments, we are pleased to announce that our system has achieved its target accuracy for facial recognition. The implementation of the Age-GAN algorithm was a significant milestone in our efforts to improve the system's functionality and accuracy. By training the algorithm on a large dataset of over real-time test user images, we were able to achieve a steady rise in accuracy during the training process. Through rigorous testing, we were able to confirm that the system can accurately recognize and match faces across different ages, shapes, colors, and races. We have taken great care to ensure that the system's accuracy is reliable, and we have implemented measures to avoid overfitting. The input size of face images used for training was carefully selected to provide variety and ensure the highest efficiency for the system. Our team is thrilled with the results, and we are confident that our system can be an invaluable tool in the effort to track down missing people.

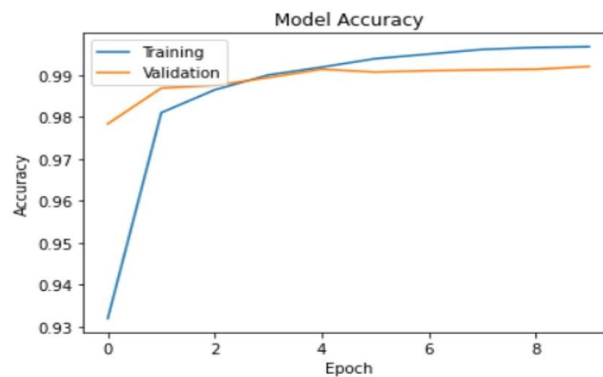


Fig. 9: Age-GAN Algorithm Graph

VIII. Conclusion

People are going missing at an alarming rate, and more than half of them who are either victims of slavery or other harmful occupations never turn up. A country with such a huge population cannot afford to lose its valuable citizens to the treachery and vengeance of criminals. Considering all this, we tried to implement a system which would incorporate most of the required necessities. This includes user registration and login with authentication, training of facial recognition and face-aging algorithms. We also implemented user registration. Authentication and input of missing person and reporting person's face for facial comparison, then storing it in database. Also reporting person authentication was checked by comparing input photo with the Aadhar card's inbuilt photo for verification purpose. And at the end, the missing person's face was compared with database and the appropriate output was given whether a match is found or not. The process of finding the missing people is done time-efficiently with high performance. Our system uses effective facial recognition technology to quickly complete the work instead of manually searching through databases for each picture to see if there is a match.

FUTURE SCOPE

There can be some extra implementations for the future scope of our system. One of them is to expand the total number of test cases to a worldwide level. We aim to include all nationalities in our database and make our system a global phenomenon. Thus, to create a global platform that can provide unparalleled assistance to those in need. Another feature is to add a multi-user feature for both the user and admin portals. This feature would allow multiple users to access the system simultaneously, thereby improving the efficiency and effectiveness of the platform. Additionally, we can implement to test the system for handicapped users with disabilities such as blindness, physical disability, or any other form of deformity. This initiative would be particularly challenging since we would need to develop and integrate innovative tools and technologies to cater to the specific needs of

these users. However, we believe that this is a critical area where we can make a meaningful difference in the lives of many people.

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