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Face Recognition Using the Eigen Face Algorithm to Support Smart Voting

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ABSTRACT

A new authentication technique in online voting system using facial recognition of the voter is used. In India, currently there are two types of voting system in practice. They are secret Ballet paper and Electronic Voting Machines (EVM), but both of the processes have some limitation or demerits. In India online voting has not been yet implemented. The current voting system is not safe and secure too. The voters need to go to distributed places like polling booths and stand in a long queue to cast their vote, because of these reasons most of the people misses their chance of voting. The voter who is not eligible can also cast its vote by fake means which may leads to many problems. That's why in this project we have to propose a system or way for voting which is very effective or useful in voting. In our approach we have three level of security in voting process. The first level is the verification of unique id number (UID), second level is the verification of election id number (EID) and third level is face recognition or face matching. The security level of our system is greatly improved by the new application method for each voter. The user authentication process of the system is improved by adding face recognition in an application which will identify whether the particular user is authenticated user or not.

Keywords: Face recognition, Eigen face, voting system, principle component Analysis (PCA).

1. INTRODUCTION

Now a day in India two types of method are used for voting. [1] The first method is secret ballot paper, in which lots of papers are used and [2] second method is EVM (electronic voting machine) which is used since 2003.we have to propose a method or way for online voting that is more secure than the existing system. In the proposed system the face detection and recognition concept is used to identify the exact person. There are three levels of verification were used for the voters in our proposed system. The first one is Unique id number verification, second level of verification is election commission id or voter card number, if your election commission id number is correct then you have to go for third level of security which is the main security level where the system recognize the face of the real voter from the current database of face images given by the election commission. If the captured image is matched with the respective image of the voter in the database, then a voter can cast their vote in the election as you have to know that in existing system is not much more secure because in existing system security level is only voter card so any one can give other person vote with voter card but here we proposed a way for voting which is more secure than existing system.

Even though our Country has taken steps towards Digitalization of India, considering the progress of Voting System it still has some flaws. Registration of Votes is being possible only if people go to polling booths for the current system. During the time of voting, voter's name is listed in the list of his/her respective area. They cannot vote outside the vicinity of the address mentioned in the voting card. So people who are migrated to other places cannot cast the vote physically. The recent pandemic situation of Corona Virus shows us the risk of this system. This can lead to failure of social distancing during voting process, as the voter needs to be physically present for casting the vote

It's an intriguing concept to allow smart voting with the facial recognition Eigenface algorithm. Combining face recognition with voting technologies could potentially increase security and efficiency in the political process. Face recognition has attracted substantial attention due to its applications in different sectors. However, there are a number of factors to take into account before putting such a system in place:

1. Data Collection and Voter Privacy: Voter privacy would be a problem if face data were collected. To maintain the security and privacy of people's biometric data, appropriate precautions must be adopted. Access controls, data storage, and encryption are important issues that must be handled.

2. Training Data: A database of facial photographs is used to train the Eigenface algorithm. To guarantee precise recognition across all demographics, lighting conditions, and expressions, a varied and representative dataset of voter faces would be required.

3. Principal component analysis (PCA): It is used by the Eigenface method to reduce the dimensionality of facial images. By doing so, the computational complexity may be managed and recognition accuracy can be increased.

4. Matching Threshold: It's important to choose the right matching threshold. A criterion that is too strict could result in erroneous rejections, while one that is too lax could create security flaws.

5. Real-time Recognition: To ensure a smooth and effective voting process, the system should be able to recognize voters in real-time. Here, the computational efficiency of the algorithm is important.

6. Hardware and Infrastructure: To allow the processing and storing of facial data, the implementation would need the proper hardware and infrastructure. This includes servers for processing and secure storage of biometric data, cameras for taking facial photos at voting places, and servers.

7. Accessibility and Inclusivity: To ensure that facial recognition technology doesn't exclude anyone, the system should be made to accommodate voters with different physical abilities.

8. Redundancy and Backup: In order to address technical faults or unforeseen challenges throughout the voting process, redundant systems and backups should be in place.

9. Ethical and Legal Considerations: The use of biometric data, informed consent, and the possibility of bias in recognition should all be taken into account.

10. Testing and Validation: To assure the system's accuracy, dependability, and security, it should go through rigorous testing and validation prior to deployment. A smart voting system that incorporates the Eigenfaces algorithm could improve the authentication and identification procedure, lowering the possibility of voter fraud and assuring a more effective voting process.

2. EXISTING SYSTEM

In the current voting system, [3] the ballet machines where used in which the symbols of various political parties are displayed. When we press the button with the respective party's (political party) symbol the voting is done. The chance of fake person casting their vote is more in the existing system. The voting person may use the fake voting card and cast his vote, this may cause problem. In the existing system, the person has to travel long places to his constituency to cast his vote. Therefore, we need an effective method to identify the fake voters during voting. So, facial authentication process is used for detecting the right person and also making the system to work in online, which will help the voters to cast their vote from their place itself. When a new face is encountered, calculate its weight.

- Determine if the image is face.

•If yes, classify the weight pattern as known or unknown. When a new face is encountered, calculate its weight.

Eigen face follows the Principal Component Analysis approach, in which face space forms a cluster in image space.

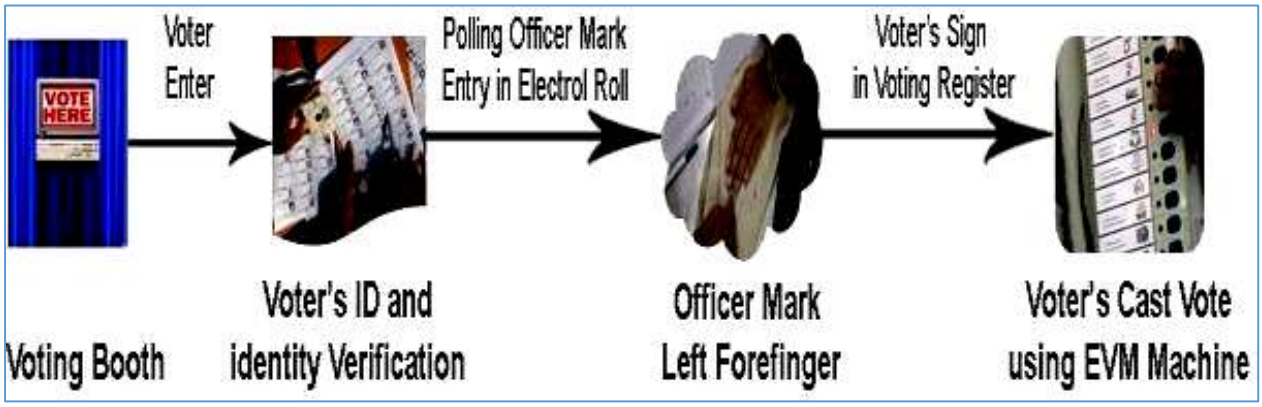

Fig1: Exiting voting process scenario

From the above figure 1, we can clearly see the existing voting process scenario and how that process is facing several challenges during voting.

3. DETERMINE THE FACE IMAGE

In this section we mainly try to discuss about the flow of how face image is identified and determined by the system. Once the face image is determined then we can able to apply that face image for online voting system.

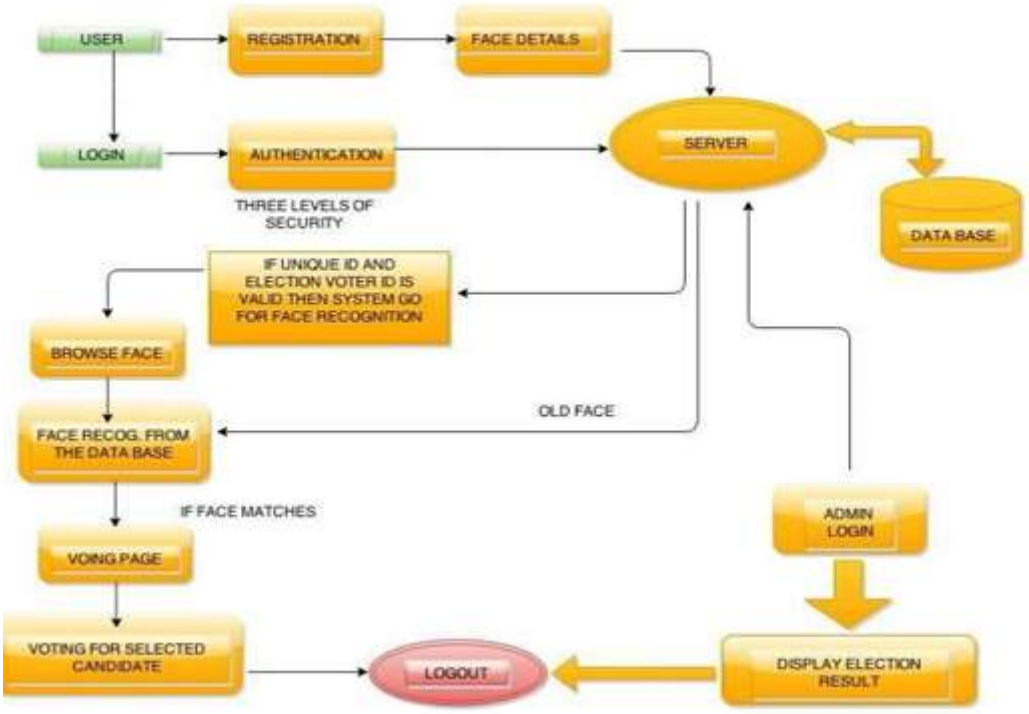

Fig.2: Represent the face image detection

We can clearly identify the user as the major role in the above image 2, and the user has two conditions: One is for registration, while the other is for logging in. The user is initially enrolled with correct information, and during his registration, he enters his facial details into the system. All of the basic registration information has now been entered into the database. The user is subsequently entered into the login phase with the use of his username and password; once authorized, the user is now able to participate in the online voting system. The user can browse faces as input and then try to match that input face with various face images in the database. If the face is detected, we can proceed to the voting page and vote for the proper candidate. Here is another module where he can login to his account and see who received the majority of votes from several faraway users.

4. PROPOSED SYSTEM

In the proposed system,we are working with three different-different security levels

Level1: -Unique id number (UID) [4].

At the time of voter registration system will request for the unique id from the voter. The entered unique id is verified from the database provide by the election commission.

Level2: Election commission id card number. [5]

In the second level of verification, the voter has to enter the election commission id or voter's id number. The entered id number is verified from the database provide by the election commission.

Level3: - Face recognition with respective election commission id number.

In this level, Eigen face algorithm is used to verify the facial image of the voters from the database provided by the election commission.

Also we try to apply Eigen Face Algorithm for identification of faces and its inner properties. Once this algorithm is applied on input image, we can able to identify valid voter and then can able to participate in online voting system.

Eigen Face Algorithm:

The main concept of Eigen Face algorithm is to follow the appearance –based approach to face recognition [6]. It is used to capture the variation in a collection of face images and this information is use to encode the particular images of individual faces. Then the encoded images of individual faces are compared with the collection of face images in a holistic manner. The Eigen faces itself form a basis set of all images used to construct the covariance matrix. The formed smaller set of basis images are used to represent the original training images which produces dimension reduction. By comparing how faces are represented by the basis set, the classification can be achieved.

- Face Images are projected into a feature space ("Face Space") that best encodes the variation among known face images
- The face space is defined by the "Eigenfaces", which are the eigenvectors of the set of faces.

WORKING OF EIGEN FACE ALGORITHM

Acquire the training set and calculate Eigen faces (using PCA projections) which define Eigen space.

PCA gives suitable representation

Calculation of Eigen faces

(1) Calculate average face: v.

(2) Collect difference between training images and average face in matrix A (M by N), where M is the number of pixels and N is the number of images.

(3) The eigenvectors of covariance matrix C (M by M) give the Eigen faces. M is usually big, so this process would be time consuming. $C = AA^T$

•Calculation of Eigenvectors of C

If the number of data points is smaller than the dimension (N<M), then there will be only N-1 meaningful eigenvectors. Instead of directly calculating the eigenvectors of C, we can calculate the eigenvalues and the corresponding eigenvectors of a much smaller matrix L (N by N).

$L = A^T A$

if λi are the eigenvectors of L then A λi are the eigenvectors for C. The eigenvectors are in the descent order of the corresponding eigen values.

Representation of Face Images using Eigen faces [8]: The training face images and new face images can be represented as linear combination of the Eigen faces. When we have a face image u: $u = \sum a_i \phi_i$ Since the eigenvectors are orthogonal: $a_i = u^T \phi_i$

First two Eigen faces.

Classification Using Nearest Neighbour

5. FLOW CHART OF FACE RECOGNITION

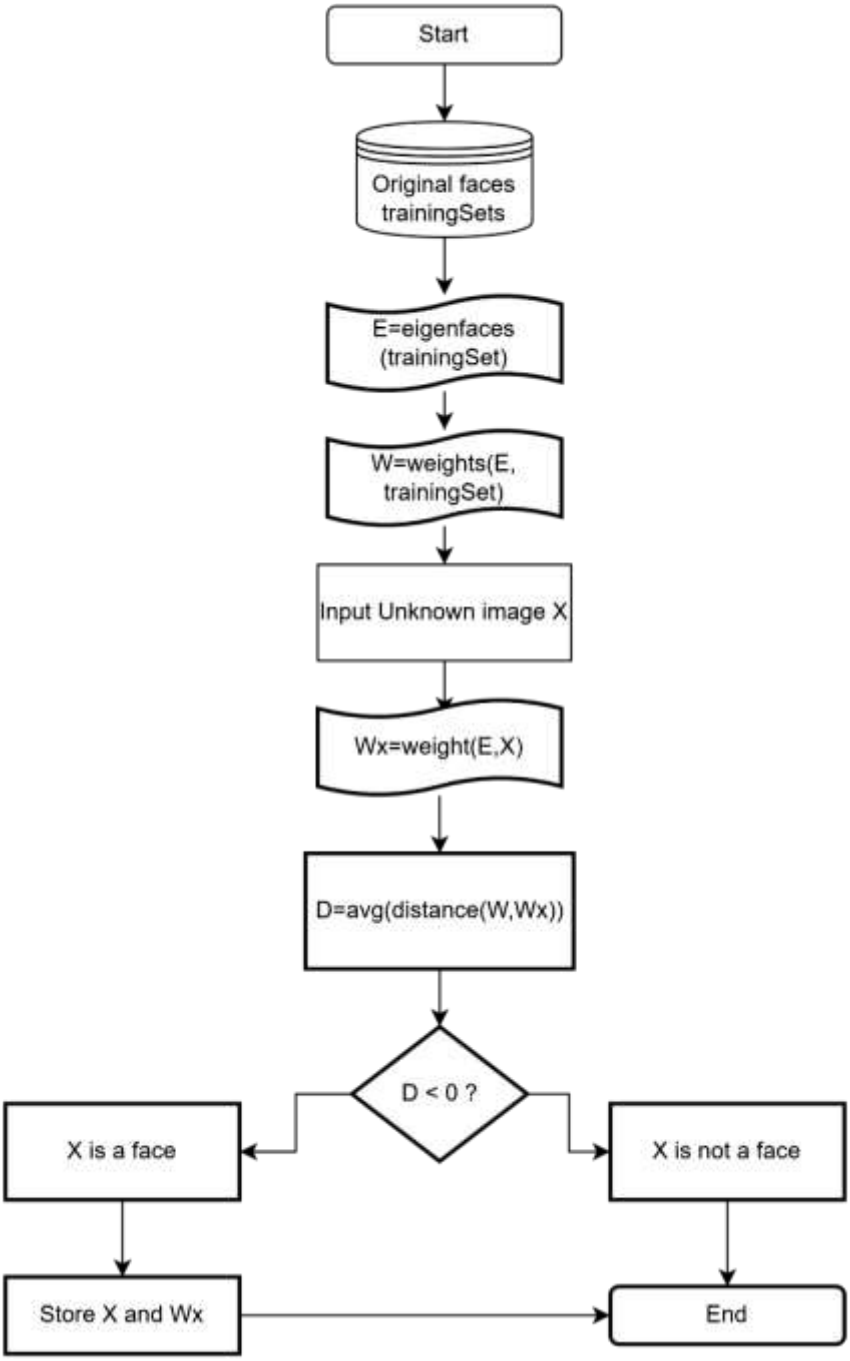

Fig 3: Represent the flow chart for the face recognition

1. Highly secured because we have to use face recognition [7]. And face comparison. Tech. so false user can't give votes.
2. We can access result (counting) faster than existing system because ballet system [8] takes much more time for counting process.
3. Online voting system increases voting percentage in India because lots of people don't give vote. They think that the voting process is too lengthy but in our approach any one can give vote from home easily.

6. RESULTS AND DISCUSSIONS

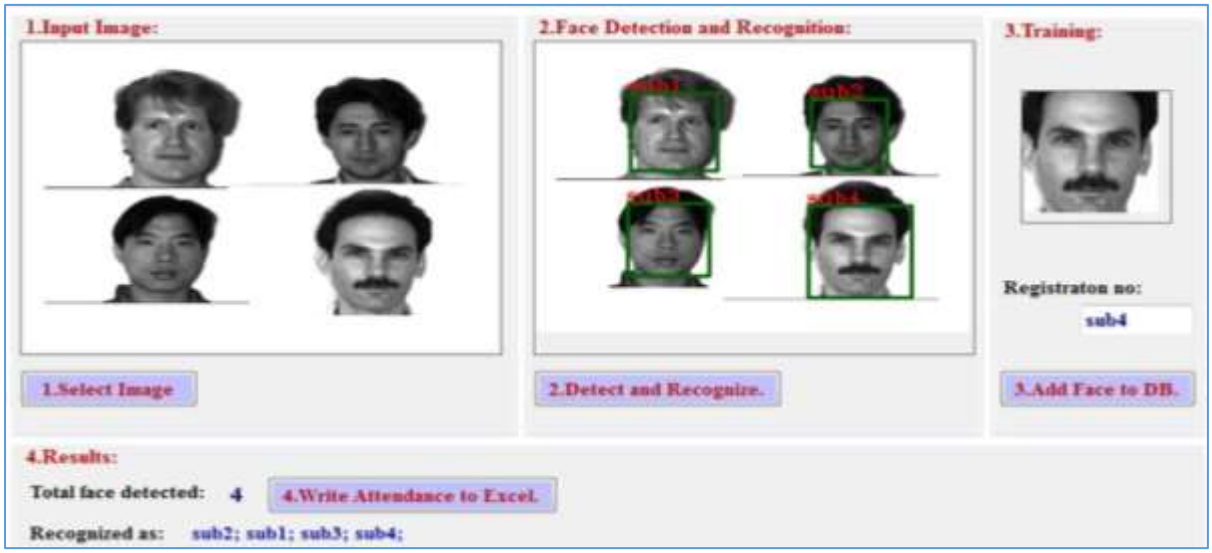

Fig 4. Represents the User Window

Explanation: From the above figure 4,we can represent about the user is going to load input images from the database and once images are uploaded, now we can able to detect the faces as sub1,sub2 and so on. Once all the images are categorized into subject categories, now we can able to train images and finally the result is displayed to the end user and recognized as either any of the subjects which are matched with input image.

7. CONCLUSION

As we see that existing voting system has many defects such as lengthy process, time taking, not secure, bogus voting, no security level but now we can say that our approach is more useful and secure from the existing system. Since, we are using three level of security in this proposed system the false voters can be easily identified. The facial authentication technique is very much useful in identifying the fraud voters, so we can avoid the bogus votes during election commission. Most of the methodologies mentioned above provide the safety, security and transparent to the voting process. But we are proposing system that gives the provision to vote from anywhere in India so the voter no needs to come to his constituency if he is in any other place on the day of voting. We are using a Aadhar database where the person's information like name, age, address, biometric identity, iris information, phone numbers are stored. For the security purpose the voters can cast their voting from anywhere by login to our proposed smart voting system through internet. As every operation is performed through internet connectivity so, it is onetime investment for government. Voters' location is not important but their voting is important. As data is stored in centralized repository so, data is accessible at any time as well as backup of the data is possible. Smart voting system provides updated result at each and every minute.Also requires less man power and resources. The database needs to be updated every year or before election so that new eligible citizens may be enrolled and those who are dead are removed from the voter list.

CONFLICT OF INTEREST

The author declares there is no conflict of interest.

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