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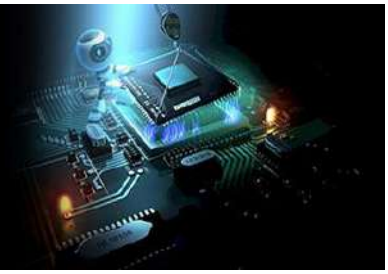

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Intelligent voting via face recognition and detection

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Abstract
A tool for facial recognition is a technology that can recognise or verify a person from a digital image or from a source of video. There are many ways facial recognition systems work, but usually they work by matching selected facial features within a database from a given image with faces. It is also known as a Biometric Artificial Intelligence-based application that can uniquely identify a person by analysing patterns based on the individual's facial textures and shape. In this method, we use three authentication steps for the electors will be used. The first step is the verification of the UID, the second step is the number of the voter card and the third step is the verification, which includes different algorithms for facial recognition. We will offer a comparative analysis between these algorithms in this paper, namely: FisherFace, SURF & Eigenface.

Keywords: E-Voting, Facial Recognition, EigenFace, FisherFace, SURF

Introduction
Today in India, at present, we are voting by two kinds of voting mechanisms first the secret Ballet paper and the second one is Electronic Voting Machines (EVM), but the way of voting makes it imperfect, which lead to demerits and makes it difficult drawbacks, which further makes the present ongoing system unsafe and insecure. So, in our study we chose to three levels of verification. In our chosen study of the system, we are proposing three levels of verification that is competent in present voting plot and very powerful in abbreviating the improper voting scenarios. The very first is the unique id which is UID, which will be generate at the time of registration and provided to the voter. After which, in the second step of security when given id to the Election Commission Officer, there the officer review it and after this crosschecked the third steps, which is tier of verification which strengthen the security because through which the voter needs to go. Here , the roll of facial recognition arrives where the current feature of the voter is matched with that of the database which was stored previously at the time of registration, from this the system get safe and secure voting. In this paper, we are studying different types of facial recognition method and making comparative study of different algorithm used for facial recognition. We have also measured the accuracy of these algorithms by practically implementing it and evaluating it on the test set.
There are four section in this paper. In section I there is brief introduction to the different types of voting structure. Whereas, section II contains the Literature Survey which is to show the recent work done in this field. The next is the Data Analysis section, which is the Section III for our proposed method. This section consists of a comparative study of different types of algorithms used for facial recognition. And the last is section IV contains the main conclusion part of our complete research.

Literature Survey
There are many work done in past to evaluate in this field which involves the present algorithm and comparison constructs on distinct properties and situation that is what kind of database is used and the system used for recognition of facial features, the type of neural-based image processing system. To get an understandable, clean and transparent image the number of distortion and depletion plays a vital role for the confined space of the image because it is very important condition whether it matches with the image in database, while capturing the image processing of it and to accurately match in the database match it with one that is present in the database [1].

Data analysis

A. Eigenfaces

The Eigenfaces techniques is commonly used for the face recognition from the images. It makes use of Eigen vectors to execute facial recognition so the name Eigenfaces. Here, a new face is recognized by the creation of Eigenfaces basis for recognition that is involved by the base segments. This technique classifies faces based on general facial figures which in turn these figures involves various features of face [shown in figure 1.] based on testing dataset images. Eigenface method requires training on a dataset of familiar faces where all images are of the same size and pixels, along with other properties like grayscale, with values ranging from 0 to 255 [2].

Steps to the algorithm are as follows:- [3]

- The training data set is developed for each new person by collecting images from the different viewing angles to fully recognize each facial feature.
- After which the images in the training set are recompiled and restored using open CV to have the same dimensions and scale in pixels
- To enhance the features, we increase the image contrast, which is a further step of enhancing the feature.
- These are then used jointly to form an Eigenvector

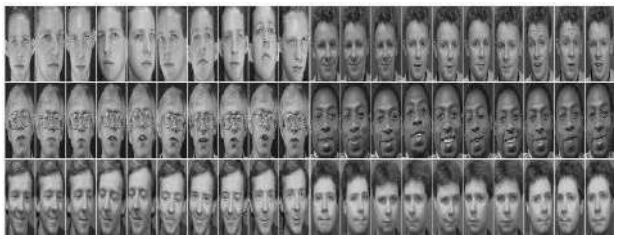

Fig 1: Sample Database for faces

The technique used by Eigenfaces uses Principal Component Analysis (PCA) to identify Eigen values [4]. Principal Component Analysis is a tool for reducing dimensionality and generates Eigene space from the data by extracting and combining its specific attributes. This Eigene space then consists of the Eigenvectors which help to represent the various patterns in mathematics. These patterns arise from the matrix of features that was created from the images in the training dataset. The Principal Component Analysis therefore shapes the Eigen space, which consists of Eigen values, which helps to optimize the variance. Eigenface device output is the first point-derived result from the face of the person which can be used to match the identity of the voter. Voters will be asked to enter their ID number to retrieve their picture from the database [5].

Eigenface has some of the demerits defined as follows:

- Scale-sensitive means some pre-processing of an image is needed prior to identification.
- Its performance decreases under varying conditions of pose and lighting.
- It cannot be used for serious pose variations as well as for gestures.
- The ratio of class scatter and in-class scatter cannot be maximised.

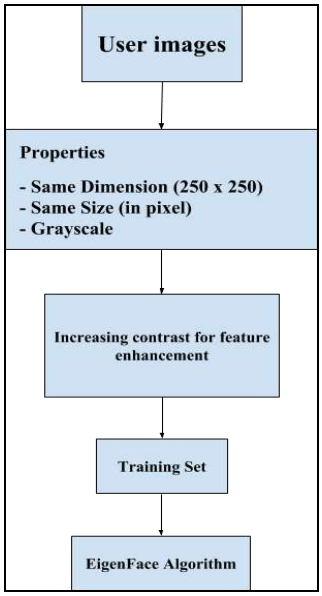

Fig 2: Reveals the algorithm's \method for complete demonstration.

B. Fisherfaces

The Fisherface technique is an expansion of Eigenface technique. The major difference between Fisherface and Eigenface technique is that in Fisherface, it has combination of both Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) for dimensionality reduction.[6] The Fisherface [Figure 3] is mostly used when there is large variations in lighting and facial expression of images. Using LDA for dimensionality reduction maximizes the ratio of between class-scatter to within class scatter and for this reason it works better than PCA [7].

Algorithm steps are as follows:

- Creation of the training dataset. Here, the training dataset is generated in a similar way as generated in Eigenface technique.
- The Fisherface technique then follows its feature extraction process using PCA and LDA.
- PCA extracts Eigenvector from the training image data.
- LDA helps in finding the directions that are used for classification.

Fig 3: Fisherface feature sets

By using the combination of PCA and LDA [Figure 4], helps in reducing time complexity. Which leads to process of image processing fast, and this results in increases in the speed of facial recognition in images with more efficiency and better results. To reduce dimensionality Fisherfaces technique uses Fisher Linear Discriminant (FLD) [8] to FLD

maximizes between class scatter and minimizes within class scatter. So, FLD is a good way to reduce dimensionality keeping classes separate from each other [9].

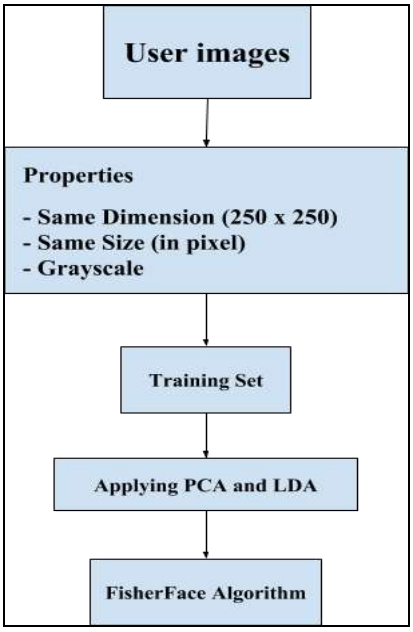

Fig 4: The training process for Fisher face technique

C. Surf

SURF is Speeded Up Robust Features is an algorithm that helps images to fast analyzation and representing corresponding invariant. SURF also helps in detecting objects based on its scale and angle properties and for this reason, it is a scale and in-place rotation invariant detector. SURF method follows mainly three stages: feature detection, orientation and feature description; these are shown in figure 5:

- Feature Detection- At this stage, the SURF feature detector applies a Gaussian mask to an image at different scale and rotation invariant if possible.
- Orientation finding- here a check for image alignment based on the rotation of the image, which helps in finding the right orientation in regard to that single key point so that if the image is rotated then the image becomes aligned.
- Feature Descriptor- In this step, the SURF feature descriptor checks the information of the neighbourhood of the key points.
- When the step 3 completed, Euclidean distance is then computed on the descriptors. Step 2 and 3 are the main steps involved with SURF. To enhance speed and to make it evaluated only once SURF uses fundamental images.

There are many advantages of SURF Techniques, some are:

- it uses box filters for interest point detection and then computes gradient statistics to encode local information.
- Since the complexity of computational time is smaller in feature, detection makes it faster to run.
- it uses fundamental images because of which makes the calculation for box filters easy.
- SURF is a robust algorithm is quite useful in when the detection of objects in images build on the feature descriptors. It is also used for tasks such as image registration, 3D reconstruction and

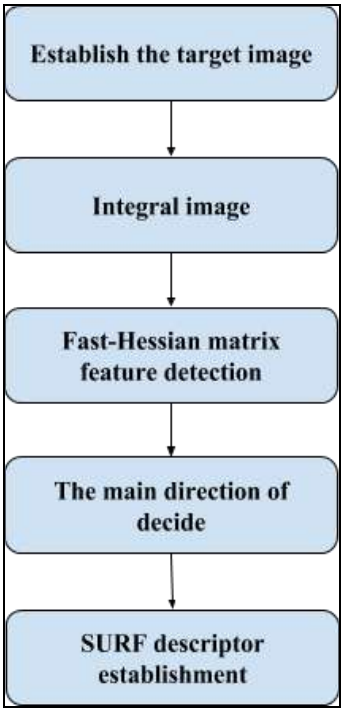

Fig 5: The training process for SURF technique

Conclusion

As we know that Face recognition is becoming very important in today's environment it is widely used in many detecting areas as offices, streets, used by police for recognition presently in tracking people at the time of lockdown, voting etc., has been since its advent a more secure and trustworthy form of authentication by including this feature with our present voting system we could enhance the capabilities of the system and can make it more secure and free from false voting. In this paper, we have discussed and compared three types of face recognition algorithm used, that is, Eigenfaces, Fisherfaces, and SURF (Speeded Up Robust Features). Aalso analyse their performance depend on how they classify faces in the images. Our training set consisted of 2316 images. The images in the training set were build up for further improvement of their features. Each build up set constituted of 4 more samples per image. Therefore, the complete set now constituted of 2316*4, that is, 9264 images. Based on our research, we observed that the accuracy of the algorithms based on the training data came out to be, 77% for Eigenface algorithm, 80% for Fisherface algorithm and 88% for SURF algorithm. The training data consisted of 2316 labelled image. Furthermore, we have also concluded that the in SURF algorithm higher accuracy is only comes when the image has some similar features in comparison to the training data. There can be many work done in future for enhancement of training dataset. These can be applied by using more techniques like SIFT, deep learning neural network, etc.

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