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E-voting using Facial Recognition based on Machine Learning and Deep Learning

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A B S T R A C T

In India voting is mainly carried out by two methods which are carried out from a long time; they are EVM-Electronic Voting Machine and Ballot Paper. Both of these methods have a drawback that both of them are a little bit vulnerable, that is the count of actual votes can be manipulated intentionally. To counter this problem, we are proposing a new alternate system for voting which is E-voting.

In our system we made use of a three level security model so that we can carry out a secure, comfortable and malpractice free voting environment. The system comprises of four stages, first is the registration of the user, second is the login, third is the face recognition and last is casting the vote. Whereas, The security system comprises of three levels , first level is the verification of Aadhar ID and Unique voter ID using mobile number OTP verification, second level is the face recognition, third and last level is captcha verification.

The model includes data pre-processing, image segmentation and its comparison using face recognition model from python library. The second phase of the extracted features is being used as input during casting of vote.

***Key Words*:**Elections , Voting , E-voting , Face Recognition , Image Processing , Verification

1. INTRODUCTION

The process of election is one of the major processes in any democratic country, it decides that which candidate or which political party will run the country's administration. In India, the election is carried out by performing the Electronic Voting Machine (EVM) voting or the traditional Ballot Paper System.

As we have observed for a long time that this voting systems are somehow conducted with a high risk of bogus or dummy voting. The existing systems are easily manipulated, a corrupt candidate or officer can perform bogus voting either in ballot paper by doing bogus stamps and also he can cast bogus vote on EVM as there is no biometric verification. Both these systems are made to carry under keen observation and with security personnel.

Hence, we are up with an E-voting system that is highly secure and it will carry out facial recognition to consider ones vote. Only the actual person registered with his unique voter id, aadhar number and face value stored in the cloud server will be able to cast his vote. The ongoing scam of bogus voting will be halted as the biometrics can't be stolen from someone or used by any other person.

The elections will be carried out comfortably as one can vote from anywhere he/she want; just they have to do is login on the voting portal, recognize his biometrics and cast his vote. The loop holes in the existing systems will be tackled with this proposed e-voting system.

1.1 Proposed System

With due respect to the Indian Government and Election Commission of India we are proposing an alternate way of voting. This voting system is the electronic voting system carried out using facial recognition. Hence, biometrics are added to the voting it will definitely decrease the frauds in the elections.

It comprises of multi-layer security, first level being the verification of Aadhar ID using mobile OTP, second is the registration and recognition of face values, third is the googlecaptcha verification. Hence providing a high level of security.

We have used basic web development languages like HTML5, CSS3, JS for the front end and Python, django for backend. The database used in our system is SQLite. The algorithm used for face recognition is Local Binary Pattern Histogram (LBPH) which gives 89% accuracy. The API's used for OTP verification is Twilio and Sms4India. The project has less hardware requirements as a device with any optimal 2MP camera and an internet connection can be used for voting.

The problems that can be faced are twin identification, changes in acquisition and physical appearances may reduce matching values. The problem of storing such large and sensitive data is also a big concern.

1.2 Solutions to the problems identified

The system is designed with a three level security out of which first level is authenticating UID number and Aadhar number from database of pre-registered voters which resolves twin identification problem.

User should use the system in an environment where he has stable internet connection in this way we can resolve the acquisition environment issue.The changes in physiological characteristics of user can be reduced by taking real time facial impressions of voter at the time of registration with current physiological features.

Maintaining large data on the data base can be executed in accurate way by dividing the data by using appropriate format and structure and storing it on the cloud.The number of voters voted in the particular area can be recognised by accessing the data of that particular location stored on the cloud via admin.

2. LOCAL BINARY PATTERN HISTOGRAM

"Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number."[1]

Human beings carry out face recognition automatically in day to day life and practically without any effort. Although it sounds like a very simple task for us, it has proven to be a complex task for a computer, as it has many variables that can impair the accuracy of the methods, for example: illumination variation, low resolution, occlusion, amongst other. In machine learning, face recognition is the process of recognizing a person based upon his/her facial image.

"Face Recognition: With the facial images already extracted, cropped, resized and usually converted to grayscale, the face recognition algorithm is responsible for finding characteristics which best describe the image."[1]

1. The LBPH uses 4 parameters:

Radius: The circular local binary pattern is build using the radius and it represents radius around the central pixel. It is usually set to 1.

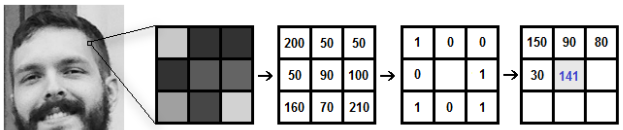
Neighbors: the number of sample points to build the circular local binary pattern. Better remember: the more number of sample points you include, the higher will be the computational cost. It is usually set to 8.

Grid X: the count of cells in horizontal direction. The greater the number of cells, the finer is the grid, and hence higher dimensionality of the final resulting feature vector. It is usually set to 8.

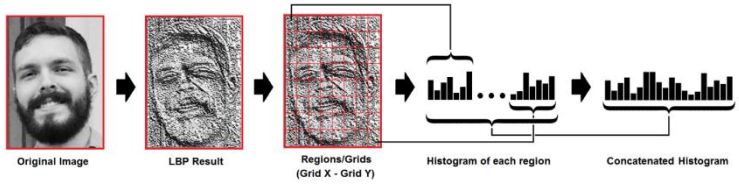
Grid Y: the count of cells in vertical direction. The greater the number of cells, the finer is the grid, and hence higher dimensionality of the final resulting feature vector. It is usually set to 8.

2. Training the Algorithm: First of all, we have to train the algorithm. For that, we need to use a dataset having the facial images of people we have to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so this information will be used by the algorithm for recognizing the input image and give you the output.

3. Applying the LBP operation: Creating an intermediate image to describe the original image, by highlighting the facial characteristics is the first computational step. For performing this task, the sliding window concept is used by the algorithm, based on parameters like the **radius** and the **neighbors**. The image below will help you to understand it better;



4. Extracting the Histograms: Now, using the image generated in the last step, we can use the *Grid X* and *Grid Y* parameters to divide the image into multiple grids, as shown in the image below:



5. Performing the face recognition: The algorithm is already trained in this step. To represent each image from the training dataset each histogram created is used. So, given any input image, the steps are performed again for new image and it creates a histogram which will represent the image.
The Euclidean distance formula can be used (which is quite known):

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

So the algorithm output is the ID from the image with the closest histogram. "The algorithm should also return the calculated distance, which can be used as a '*confidence*' measurement."[1]

3. CONCLUSIONS

As we can see that existing voting system has many defects such as lengthy process, time consuming, not secure, bogus dummy or fake 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.The voters can cast their voting from anywhere by login to our proposed smart voting system through internet."[2]. "As every operation is performed through internet connectivity so, it is one time investment for government.Voters' location is not important but their voting is important."[3]

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