

Lie Recognition using Eye Patterns



Kartik Mehta, Arjun Sharma, Rishabh Suri

Abstract: *The recognition of lie done by a person could be identified by various facial gestures, such as the reaction of the eye blinks to different situations, and also in the case of a lie as proposed by the NLP(Neuro Linguistic Programming) theory. These patterns could be identified by using statistical tools such as SVM(Support Vector Machine), PCA(Principal Component Analysis) and LDA(Latent Dirichlet Allocation). This paper proposes lie detection technique using Python programming language based on the PCA (Principal Component Analysis) algorithm based on the eye images.*

Keywords: *Nlp, Pca Algorithm, Matplot, Lfw, Python.*

I. INTRODUCTION

The necessity to know the human behaviour associated within the case of lie and lots of different factors has been in need of the society for varied factors like criminal investigations involving the resolution of the many cases wherever the detection through the utilization of material body reactions are useful like eye patterns, industrial espionage etc. This issue of attribute has not been comprehensible for an awfully while attributable to that has result in several dangerous outcomes. According to the NLP(Neuro Linguistic Programming) that is related to the flexibility to create USA perceive and teach our mind to attribute, accordingly the various reaction of eyes in several conditions square measure referred to as as eye accessing cues, like accessing of the auricular data, our eyes moves to completely different directions consequently like left or right within the case of the actual conditions. the attention movements square measure divided into completely different sections like the dormant hemisphere, non-dormant hemisphere, dormant sense modality hemisphere and also the non-dormant sense modality hemisphere. The condition that required to be remembered was that some individuals have habitual habit of moving their eyes around in completely different directions that could lead on to different results. This type of methodology related to the attention pattern analysis to justify a lie recognition by someone is a lot of correct, as compared to the reaction of the various body components as a result of it is the most tough task to cover the analysis of the attention beneath the feeling of stress and worry.

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The facial features will be hidden simply for those one who show neutral facial features however cannot hide their eyes as there's an incontrovertible fact that eyes ne'er lies then herein lies the potential to choose informed different people's makes an attempt to deceive you. If you raise somebody World Health Organization they saw yesterday and their eyes move to visual construct, then that might indicate that they're lying to you (and creating up a pretend image in their head to inform you about).

However, it may conjointly mean that they're reverse organized. Or, it may be that they saw 2 individuals and square measure selecting that to inform you concerning (comparing instead of constructing). The technique mentioned within the current ways is that the use of detection formulas like HAAR cascade algorithm that has been used for a protracted time for the facial detection patterns because it focuses on all the portion that it finds vital and not on those that we wish it to focus thus accuracy through HAAR cascade reduces however it may be increased by the utilization of analytical tools that square measure a lot of increased within the detection of the actual outlined region, but compared to the analytical algorithms it focuses a lot of accurately to the outlined region. The HAAR cascade formula essentially focuses on the summing of the pixel intensities of a picture and then summing them up to visualize the variations, these may be enforced by exploitation completely different programming languages with bound libraries that permits the implementation of the detection model. HAAR calculation speed is high as comparison to different formula used for detection because it takes constant time to calculate.

II. PROCEDURE FOR PAPER SUBMISSION

The already proposed system was the one enabling the use of the HAAR cascade algorithm to analyse the patterns of eyes or any body part through the implementation of any programming language such as MATLAB to analyse the data which is input, but the problem associated is the less accuracy of the HAAR cascade algorithm.

III. REVIEW CRITERIA

The system described by our model implements the use of statistical tools such as PCA(Principal Component Analysis) which provides the execution through the process of analyzing the data through the means of eigenvalues and vectors by dividing the image into different small pigments and segregate the image accordingly to the given patterns. The planned system is as follows:-

A. Principal element Analysis (PCA)

Principal component analysis (PCA) was fabricated in 1901 by Karl Pearson. PCA could be a variable reduction procedure and helpful once obtained knowledge have some redundancy.



this can lead to reduction of variables into a smaller variety of variables that are referred to as Principal parts which is able to account for many of the variance within the discovered variables.

Problems arise after we want to perform recognition in an exceedingly high-dimensional house. Goal of PCA is to cut back the spatial property of the knowledge by holding the maximum amount as variation attainable in our original data set. On the opposite hand spatial property reduction implies info loss.

The best low-dimensional house is determined by best principal parts. the foremost advantage of PCA is victimisation it in eigenface approach that helps in reducing the dimensions of the information for recognition of a take a look at the pictures. the photographs are hold on as their feature vectors within the information that are discovered sticking out every and each trained image to the set of Manfred Eigen faces obtained. PCA is applied on Eigenface approach to cut back the spatial property of an oversized knowledge set.

B. Eigen Eye Pattern Approach

It's adequate and economical methodology to be employed in eye recognition because of its simplicity, speed and learning capability. Manfred Eigen eye patterns are a group of Eigenvectors employed in the pc Vision downside of external body part recognition. They discuss with a look based mostly approach to eye recognition that seeks to capture the variation in an exceedingly assortment of eye pictures and use this info to write and compare pictures of individual eyes in an exceedingly holistic manner.

The Manfred Eigen eye patterns are Principal parts of a distribution of eyes, or equivalently, Manfred Eigen vectors of the variance matrix of the set of the attention pictures, wherever a picture with N by N pixels is taken into account a degree in N two dimensional house. Previous work on eye recognition unheeded the problem of eye stimulant, forward that predefined measure were relevant and comfortable. this means that committal to writing and decipherment of eye pictures could provide info of eye pictures accentuation the importance of options.

These options could or might not be associated with eye options like eyes, nose, lips and hair. we wish to extract the relevant info in an exceedingly eye pictures, write it with efficiency and compare one eye cryptography with an information of eye encoded equally. an easy approach to extracting the data content in a picture of an eye fixed is to somehow capture the variation in an exceedingly assortment of eye pictures.

We want to seek out Principal parts of the distribution of eyes, or the Eigenvectors of the variance matrix of the set of eye pictures. every image location contributes to every Eigenvector, so we will show the Eigenvector as a form of eyes. every eye image is painted precisely in terms of linear combination of the Manfred Eigen faces.

The number of attainable Manfred Eigen eye patterns is up to the amount of eye image within the coaching set. The eyes also can be approximated by victimisation best Manfred Eigen face, those who have the most important Eigenvalues, and that account for many variances between the set of eye pictures. the first reason for victimisation fewer Manfred Eigen eye patterns is process potency.

C. Eigen Values and Eigen Vectors

In linear algebra, the eigenvectors of a linear operator are non-zero vectors which, when operated by the operator,

resulting in a scalar multiple of them. The value is called as eigenvalue. Eigen vector is a vector that is scaled by linear transformation. It is a property of matrix. The matrix produces only magnitude but not direction

$BY = \lambda Y$, where B is a vector function

$(B - \lambda I)Y = 0$, where I is the identity matrix.

This forms linear algebra and homogeneous equations. We know a non-trivial solution exists if and only if

$\text{Det}(B - \lambda I) = 0$, where det shows the determinant value.

When evaluated becomes a polynomial of degree N. This is called the characteristic polynomial of B. If B is an M by M then there are n solutions or n roots of the characteristic polynomial. Thus there are n Eigen values of B satisfying the equation.

$BY_i = \lambda_i Y_i$, where $i = 1, 2, 3, \dots, n$

If the Eigen values are all distinct, there are n associated linearly independent eigenvectors, whose directions are unique, which span an n dimensional Euclidean space.

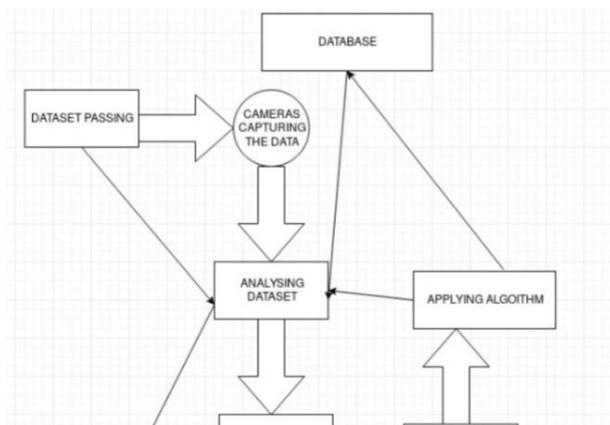
IV. SYSTEM DESCRIPTION

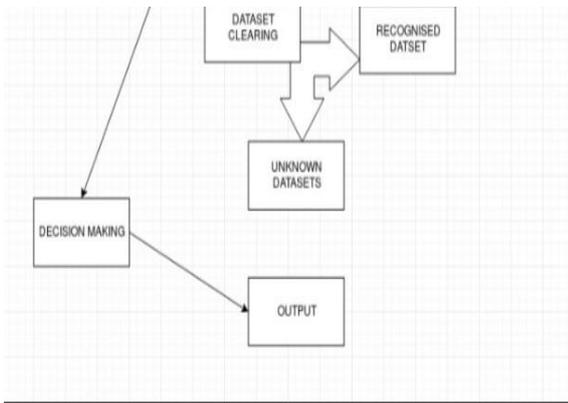
The proposed model is based on the taking of the dataset from the user by the application of the high definition cameras that could enable us to capture very minor details efficiently in such a way that they could be analysed from the PCA(Principal Component Analysis) through the python programming language and then looking for the already described database that could be looked upon and understand the characteristic and then deliver the result that whether it is a truth or a lie .

The module is divided into different parts such as it could deliver the parts of the data through different aspects such as to deliver dataset to the algorithm applying PCA(Principal Component Analysis) in order to characterise the different dataset accordingly the different parts accordingly to the parts to be provided with:

- 1.Collection of the dataset from the user
- 2.Capturing the dataset through the camera
- 3.Analyzing the dataset through the PCA algorithm
- 4.Categorizing the dataset accordingly to the character set
- 5.Understanding condition according to the character set
- 6.Decision making according to the data analysing

V. SYSTEM ARCHITECTURE





Description:

1. Collection of the dataset from the user:

The first step involved in the occurring of the process is the accumulation of the data from the user which could be used for the detection process and then enable the processing process which would determine the result associated with the process of the given process of the given associated result and then pass the information to the required aspect further in the process of analysis

2. Capturing the dataset through the camera:

The dataset captured accordingly could be used to send the given information or capture the high end detailing about the result to be calculated which could be used to produce the associated result and could be associated with the given result ,these results could be used to provide information to be analysed further through the algorithm of the proposed model.

3. Analyzing the dataset through the PCA algorithm:

The data set captured through the camera is then passed to the associated PCA(Principal Component Analysis) which then calculated accordingly to the algorithm dividing into different colour segment and dividing them on the basis of the vectors and the eigenvalues which could be associated and then could be delivered as a result on the basis of the characteristic set previous values and then they are being passed to the decision making step where the final analysis of the result takes place.

4. Categorizing the dataset accordingly to the character set:

The data which is analyzed by the PCA(Principal Component Analysis) algorithm are then made to pass through the final step which is the anaysiation part which involves seeing from the previous values of the character sets that are being used and could be passed to get to a decision step that the data accordingly to the previous version is correct accordingly then if not matches then matched accordingly to the other character set.

5. Understanding condition according to the character set:

The data set is then tried to be matched with the already made character set which is then applied accordingly and then used to capture the data values and then compared to the given and already captured values and then are captured to the decision making step.

6. Decision making according to the data analysing:

The final step involved in the module is the process of taking the process of giving the decision of the set of value

that is being passed as a part of the module compared to the previously acquired dataset which could be delivered as a decision to tell whether a person is telling a lie or not.

VI. ALGORITHM USED

The algorithm implemented in the particular module is the PCA(Principal Component Analysis) which could be used to statistically remove the different components from the image into the vectors and the eigenvalues that could be used for the image detection process.The algorithm is implemented as follows:

In this case of algorithm we are implementing the use of the dataset of LFW ,the algorithm could be implemented as:



Fig 1:Image patterns in different situations

ALGORITHM

n_components = 100

pca =

PCA(n_components=n_components,
whiten=True).fit(X_train)

X_train_pca = pca.transform(X_train)

XX_test_pca = pca.transform(X_test)

X_test_pca=pca.transform(X_test)

The following algorithm implements on the use of the given principal of PCA on the basis of dividing into different eigenvalues of different faces and characterise on the basis of the patterns that are associated with the division of the image into different pigments.

These results help us reach to the decision whether the person is telling a lie or not on the basis of the comparison of the eye patterns from the previous set on the value of different previous character sets that are being used.These algorithms enables us to take a set of character set and then divide into a different set of values which would enable us to segregate the image patterns on the basis of the the vectors dividing into different character sets that could be used for the characterisation of the lie told by a person and the storing of the data of individual person on the basis of previous pattern.

VII. FUTURE SCOPE

The following model proposed is full of various ways to be implemented such as it could be used to identify the lie of a person on the basis of the eye patterns ,which could be enhanced by future and upcoming technologies implementing the such.

VIII. ACCURACY

The accuracy to be calculated of the system depends on various factors such as the rate at which the processed image is being passed to the system to be analysed ,the following patterns are being observed on the basis of the results analysed:-

| persons | precisio n | recall | f1-score | support |
|--------------|---------------|--------|----------|---------|
| first | 0.91 | 0.86 | 0.90 | 77 |
| second | 0.86 | 0.88 | 0.89 | 62 |
| third | 0.84 | 0.82 | 0.85 | 150 |
| fourth | 0.92 | 0.93 | 0.92 | 38 |
| avg/mea n | 0.89 | 0.89 | 0.89 | 327 |

Table 1

Therefore,the following result help us reach to the conclusion that the model proposed by our system produces an accuracy Of 89% where different factors and conditions are taken into consideration.

IX. CONCLUSION

Therefore we have reached the final part of our model which is the conclusion which helps us to analyse the model proposed accuracy which is as good as 89% and enables us to predict the decision of a lie told by a person on the basis of the analysis of the eye patterns in accordance to the NLP(Neuro-Linguistic Programming) in use with the PCA(Principal Component Analysis) which is a statistical tool which can be used to perform the following analystion process involved in our model and the result is produced accordingly.The future studies could be made in providing a better platform or a better statistical tool that could be used in the analysis of the image conditions and the segregation of the patterns.

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Kartik Mehta, I am a student currently pursuing a bachelor's degree in computer science and engineering from SRM Institute of Science and Technology ,Chennai, India , completed my schooling in the year 2017 achieving a percentage Of 89.8 and my senior secondary schooling in the year 2015 with a CGPA of 9.6 from J.D. Tytler school,New Delhi.This is my first research paper publication.My area of interests involves around the domain of security research,cyber security and reverse engineering.I recently did my internship in a renowned company in the field of network security in New Delhi.Currently I am learning more and more in my domain and will be doing research on furthermore technologies.



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