



FACE RECOGNITION-BASED LECTURE ATTENDANCE SYSTEM: A SURVEY PAPER

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ABSTRACT- This paper mainly concentrates on the concept of Face Recognition was summarized and its significance in a real life application are illustrated. Face Recognition using the Principle Component Analysis is researched in detail, the key to achieve Face Recognition using Sub-Spaces is also surveyed.

Keywords: Eigen Faces, Independent Component Analysis (ICA), Recursive Features Elimination (RFE), Support Vector Machines (SVM), Genetic Algorithm (GA).

I. INTRODUCTION

Face Recognition refers to a state-of-the-art technology which refines human faces from an image or a video. The term Face Recognition is appropriately named as “Facial Recognition” or “Facial Signature”.

The collection of facial data and its storage at lower costs with addition to soft computing methods, extracting and verifying features is the overall goal of the Facial recognition.

In [1], the following description is given,

The still images or video images extraction from a scene, in turn used for the identification or for verification purposes using the collection of databases of facial images, to refine the search pattern additional information such as age, gender, complexion maybe used. Further it includes face detection from extraction of features from the face its verification from the database or its recognition.

Facial recognition is also stated as essential process where intelligent methods are applied in order to extract and evaluate the facial data patterns.

Facial Recognition consists of three major elements:

- Detection of the facial data from the image.
- Post face recognition, extraction of the facial data from the detected image.
- Analyse and verify the extracted features with the available image data set.

The purpose of facial recognition is normally to either create a model which helps in recognition of the images from the given data set or to verify the identity and authenticate the user. The initial model which is provided with the facial data of the person, is trained and is used to recognise the person in a group as a whole. The second type of model is basically a pathway for giving access to the user, it can supposedly be any confidential information, or for simpler tasks such as verifying day-to-day attendance of a given individual.

There are lots of approaches to verify if the person in the data set is actually the person present. The classification can broadly be done into four, this can be interlaced, so an algorithm can belong to multiple categories mentioned. It is mentioned below:

- Knowledge Based Methods are Rule Based Methods which convert the facts of human faces.

- Features invariant method, are facial algorithms which seek the facial features independent of the angle of the face or its position.
- Appearance based model, a pre-set format evaluation method whose database pattern is established from an image set.
- Template matching method algorithms are used to compare the images taken as input, with the stored pattern of faces or features.

II. METHODOLOGIES OF FACIAL RECOGNITION

2.1 Eigen Faces

Facial Recognition, in 2D using Eigen Faces is the first kind of the method to exist [1]. Earlier in its initial days it was a ground breaking algorithm but in the recent years it was wiped out of existence. This involved a five-step process, where initially the system is to be trained using a set of face space images. This is a pre initialization of what the actual faces would look like. Later a series of statistical analysis is performed and determines does the image represented is a face or not. If the conclusion is to be a face, then further it determines if the face matches the image from the dataset. Optionally the system can be trained to recognise unknown faces. This is a simple, efficient technique, which can only be performed under the controlled circumstances and yields poor results under uncontrolled circumstances or an uncontrolled environment. The limitations exceed the fact that this method has unique 2D recognition properties. [2]. this falls under Appearance Based Model. The primary limitations are found to be Illumination, angle and distance.

2.2 Incremented Component Analysis based

Incremented Component Analysis is a process of separating multiple variable signals into additive components. Usually for the sector of facial recognition the I.C.A. is not the only methodology involved, it is combined with Recursive Feature elimination and with the support vector machines, only then the combinational output will yield desired result, I.C.A. is a special case for the blind source separation. Before implementing the detection, feature extraction and verification, the process of normalizing face images is to be performed so that the angle of the face i.e. the drawback will be eliminated. Later the ICA+RFE using SVM is performed. The primary drawbacks of using only the ICA as a combination is that the face of the person always has to be neutral, the image to be recognised should be taken under controlled illumination and frontal/near-frontal view faces are required. This model has higher rate of having detection errors such as false negative when face is not detected and false positive when non-face is detected.

2.3 Neural Networks

Neural Networks have been a part of perception problems like identifying objects and character etc., this part of pattern recognition can be implemented in the area of facial recognition in different ways. The implementation of neural networks is a two class problem, as the model has to be trained for the recognition of images that "contain faces" and "don't contain faces". The challenge was primarily in the representation of "images not containing faces". This is one of the major limitation and moreover the pose of the face should always be up-right to get accurate results.

2.4 Support Vector Machine(SVM)

SVMs are a type of linear classifiers which increase the range to a maximum extent. This makes decision between hyperplane and the training set images. Therefore, optimal hyperplane will reduce the errors during classifications of hidden test patterns.

2.5 Based on Principle Component

Analysis (PCA)

PCA is a measurable approach in statistics which is utilized for reducing the no. of factors in face acknowledgment investigation. In face acknowledgment technique every single picture in the preparation set is described as a straight blend of weighted eigenvectors called Eigen faces. These eigenvectors are

getting from the covariance grid of a preparation picture set. The loads are bringing into being out subsequent to choosing a lot of most pertinent Eigen faces. Acknowledgment is performed by anticipating a test picture onto the subspace spread over by the Eigen faces and the grouping is finished by estimating least Euclidean separation of distances. But there are a lot of limitations of this traditional based process, the combination of PCA with SVM yields better results when compared to the traditional PCA only method. Moreover the capacity to handle a growing amount of work is limited. For the new addition of data to the training set, the previous data has to be retained being another limitation of this technique.

2.6 Template Matching

Template matching is a method which explores the way to define a face as a mathematical variable. Which is used for finding the standard template of faces? If they have different characteristics exist in them, there are diverse ways of defining them. Furthermore, the facial model can be designed by using edges. Some of the limitations of these techniques are restricted to faces that are frontal and not occluded. This is a straightforward method to apply but insufficient in face detection due to limitations of the variations in pose, scale and shape.

2.7 Subspaces

Pictures of countenances, spoken to as high-dimensional pixel exhibits, frequently have a place with a complex of inherently low measurement. This method is a progression of Eigen Faces. As an aspect of the upgrade there are a ton of sub techniques, which are the headways and the best among it is the Bayesian Method. This specific Bayesian technique proposed by Moghaddam et al in [4], projects the standard face acknowledgment task into a parallel example grouping issue and is a significant progression in Subspaces system.

III. OVERVIEW OF THE MENTIONED ALGORITHMS

Summarizing all the major face recognition techniques, the major drawbacks of every algorithm is the illumination and the facial occlusions. The success rate is not satisfactory as far as the variation in the illumination occurs. Some of the methods to overcome illumination problem are listed below:

- Heuristic Methods
- Image Comparison Methods
- Class based Methods
- Model based Approach

3.1 Heuristic Methods

Heuristic strategies is a cycle of disposing of initial not many guideline parts for varieties under various lightning conditions. It has been recommended that, inside eigenspace space, three most noteworthy standard segment can be disposed of [5]. We should keep up the framework's exhibition with regularly lit up face pictures and we should accept the way that the initial three head parts catch varieties in light just because of brightening.

A methodology dependent on the evenness was proposed by Sirovich et al in 2009 [6]. The strategy depended on common evenness of human appearances. They infer that odd Eigen faces are brought about by light ancient rarities. Consequently are in the long run disposed of from their syntactic face development technique, this calculation shows practically flawless precision perceiving frontal face pictures under various enlightenments.

3.2 Image Comparison Methods

In [7], measurable methodologies dependent on picture examination have been assessed. This methodology depends on various picture portrayals and separation measures. The picture portrayals utilized are: edge maps, subsidiaries of dark level, picture separated with 2D Gabor-like capacities, and a portrayal that joins a log capacity of the force with these portrayals. The different separation estimates utilized are: point-wise separation, local separation, relative GL separation, neighbourhood relative GL separation, and LOG point-wise separation. It is seen that these portrayals alone are not adequate to conquer the varieties in the enlightenments.

3.3 Class-based Methods

This technique expects requirements to counter the light variety. Accepting Lambertian surfaces, no shadowing, 3D direct light subspace for an individual developed from a fixed view point. [5] Thus under ideal suspensions acknowledgment dependent on 3D straight light subspace is brightening invariant.

IV. MODEL BASED METHODS

In [5], [8], they suggest that Principle Component Analysis (PCA) could be a contraction for fathoming the parametric shape from covering issue. To get the eigen-head conjecture of a real 3D head in the wake of getting ready on around 300 laser-sifted expand data of certifiable human heads; this is also changed into a parametric issue. This is up 'til now under a doubt and doesn't work for most veritable face pictures. Moving onto the facial occlusion/ problem with the pose, researchers have taken various approaches to solve the pose issue. They are divided based on the variation in three classes [5]:

- Multiple Image based Method
- Hybrid Method
- Single image/ Shape based Method

4.1 Multi image-based method

At first among the top of the line of approaches, there exists Beymer's methodology [9] this methodology recommends a coordinating plan dependent on layout co connection. The assessment of the posture and its acknowledgment is joined in a circle to such an extent that the information picture is lined up with the picture relating to the information base with a chose present.

4.2 Hybrid Method

This crossover strategy is the most famous among the posture amendment instruments is one of the most mainstream and has an incredible achievement rate, all things considered, usage. This half breed technique has three portrayal strategies, straight class strategy being one of them. This technique recommends that picture amalgamation depends on the supposition of straight 3D object classes as the pictures are extended in 2D though the real model is in 3D. This broadens the direct authentic model into full pictures of items and the association is built up utilizing optical stream dependent on the highlights.

4.3 Single image/shape based Method

This is method which uses low-level features and features which are invariant to create a 3D model. This sector of invariant based methods have not been explored yet. However, these methods process in such a way that the shape of the face is represented using the polygonal model or by simulating the tissue using the mesh model. The major drawback why this method hasn't been implemented is because of its complexity and computational cost.

V. FUTURE WORK AND ENHANCEMENTS

Reviewing the algorithms with their limitations and the enhancements which can be performed. We take a step to explore the further enhancement of the pathway towards facial recognition using the Bayesian method in combination with Incremented Principle Component Analysis (IPCA). Due to the limitations of the traditional PCA this new method helps in the increasing the scalability of the previously existing models and further can be enhanced using soft computing methods. Further, the Principle Component Analysis as a whole can be improved in performance-wise by integrating it with Support Vector Machine (SVM) and thereby using a Genetic Algorithm to optimize the SVM Kernel. In addition to the two combinations Histogram Equalization can help in yielding better results thereby increasing the resolution of the data, for the goal of "Facial Recognition based lecture attendance system". Our proposal will determine the effectiveness and several classrooms under different illuminations and pose variations will be tested. Some setups are partial blockage of the image in the input dataset including facial occlusions.

The model which will yield favourable results will be enlisted for the actual implementation. Further work may involve tweaks and enhancements to the earlier tested methods.

Facial recognition using TensorFlow:

TensorFlow is a multipurpose AI structure. TensorFlow can be utilized anywhere from preparing gigantic models over the bunches in the cloud to running models locally on an implanted framework like a telephone/IoT gadget. It has a great deal of pre-prepared models which helps in making a task with an extra lift, rather than beginning without any preparation. Facial Recognition falls under picture classification. For this picture characterization utilizing TensorFlow, one of the techniques to execute to perceive faces is Transfer Learning. In Transfer Learning the last layer of Convolution Neural Network (CNN) of the model with the preparation information.

The advantage by utilizing TensorFlow is that there are a ton of open source archives across GitHub which are characterized dependent on the speed and execution. These can be utilized relying upon what suits the most for a given circumstance. These models are prepared with around 1.4 million pictures, which can assume different parts in facial acknowledgment model. It can make an entirely different model or simply be important for a model. A few facial acknowledgment ventures use Convolution Neural Networks as an underlying base and afterward create facial embeddings in TensorFlow. These are later prepared on a SVM Classifier.

Facial Recognition using CNN:

With regards to Convolutional Neural Networks as it were. OpenCV is favored as a result of simplicity to utilize the code. OpenCV library has Classifier Cascade, which is a face recognition calculation given by the library. The precision of the model here relies upon how immaculate the crate sizes line up with the essences of the individuals. Different models to perceive faces are a profound learning model. Perform multiple tasks network models are prepared on three errands (P-Net, R-Net and O-Net), this makes three kinds of forecasts they are face arrangement, jumping box relapse and facial milestone confinement. The MTCNN design is mind boggling to actualize however there exist open source libraries of MTCNN where the information can be prepared and be utilized, all things considered, situations. MTCNN open source venture is a mix of TensorFlow and OpenCV by MIT.

Different models incorporate utilizing FaceNet research paper by Google, which can be coordinated into either TensorFlow or CNN or both. These aides in accomplishing earth shattering exactnesses. This paper utilizes the pixel information rather than the crates. This model has accomplished 99.63% on the LFW dataset.

VI. CONCLUSION:

The combination of both TensorFlow and CNN seems to be a great viable option as the code can significantly run on the client side with less computational effort, as the TensorFlow does not require a GPU, this removes the effort on any mobile based system. The facial recognition can comfortably be done on the client side with low or minimal effort.

Vector embeddings and pre processing using Dlib and Docker can significantly decrease the time constraint and can result in faster training of the model.

VII. REFERENCES

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