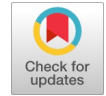# An IOT Method for Reducing Classification Error In Face Recognition With The Commuted Concept Of Conventional Algorithm

Abhishek Kumar, Pramod Singh Rathore, Vishal Dutt

Abstract: *The initial work has discussed the conventional approach of algorithms along with their drawbacks and features. Apart from that types of face recognition methodologies have been discussed with application of IOT trends. We specifically depicts a descriptive idea about working and applications of all conventional algorithms which have been commuted concept wise in proposed methodologies section of our work Our work consists of literature survey so we can provide a reason for the previous work and get basic ground for performing and implementing proposed work. One of a common procedures of face detection has been discussed that's has been worked out in past with accuracy .The observation in this work leads to propose the method by commuting the conventional algorithm, Basically the work done with conventional approach has been discussed in this section with a strong focus over the role of Iot in face recognition and what is importance of Iot in this domain and what changes Iot concept has bring about as far as face recognition with different approach has been concerned . Not only PCA concept has been commuted but along with Pca, Svm, naïve bayes classifier, DCT, Gabor, neural network efficiency and their combined effect has been performed and analyzed later. Our work has been focusing around commuted concept of conventional algorithms so this particular chapter is very much important to discuss the conventional methodologies perform by classical mathematically implemented techniques for classifications. With the help of the analysis we will discuss the problem formulation and comparison of proposed work with existing work .So our work is basically about the problem existing with conventional algorithm for classifications and what lead us to propose the commuted concept further to deal or minimize the effect of that particular problem ,Our work is not primarily based on face recognition but to calculate the classification error through conventional algorithm and then compare it with our proposed commuted concept and combined effect of conventional algorithms as well, like PCA+SVM PCA+ Kernel SVM, Commuted Concept of PCA +Naïve bayes Classifier .We have gone through with different cases to ensure the minimization of classification error through proposed method .The goal of the work is to associate the application of*

IOT and proposed algorithm can proved to be efficient in getting better accuracy in the results. As we have compared the results on different methodologies discussed earlier and our proposed work, Even the Iot concept has efficient collaboration with proposed method as far as minimization of classification error is concerned.

Keywords: MATLAB, PCS, SVM, Decision Tree. Face Recognition, Iot.

I. INTRODUCTION

Facial expression methods will be pulling in significant consideration in the headway of human machine overlap

since it gives a characteristic and good approach to convey among people. Some application areas related of facial expression understand by identification the person with their known ones or by his / her voice, videophone as well as remotely coordinating[1] scientific mechanisms, person-PC communication, computerized controlling by user etc. Yet, the execution of the face location absolutely influences the execution of the considerable number of uses. Numerous techniques will be implemented to distinguish motion expression of a person by the help of photos which these methods are treated to 4 classes: information dependent strategies, highlight dependent strategies, template based methods and appearance-based methods. When utilized independently, these strategies can't unravel all the problems of face discovery like posture, demean or, introduction, impediment. Subsequently it is smear to work with several successive or parallel strategies. The majority of the outward appearance acknowledgment strategies answered to date are focused on acknowledgment of six essential demean or classifications, for example, bliss, bitterness, fear, anger and grief.[2,3] For a depiction of point by point outward appearances, the Facial Action Coding System (FACS) is structured with the help of Ekman at the period of 70's.[4] In FACS, movements of person facial expressions and facial muscles as per expression are divided to 44 activity methods of other outward appearance are depicted by their blends facial[5,6]
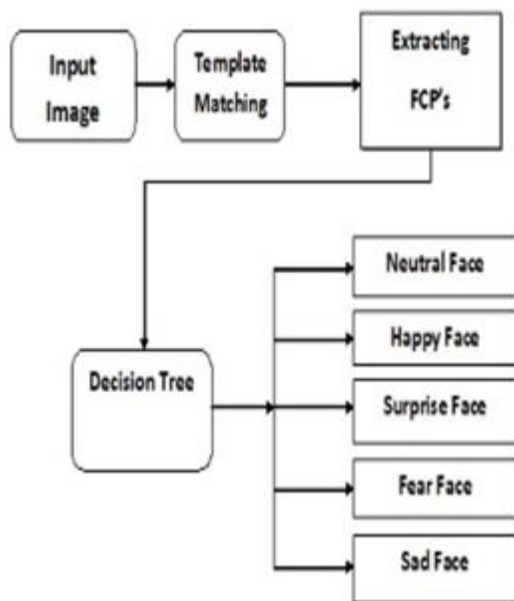
Fig 1: Architecture

Expression analysis was basically an exploration theme for clinicians. However, recent advances in picture handling and example acknowledgment have persuaded significant research works[7,8] on programmed outward appearance acknowledgment. Previously, a ton of exertion was devoted to recognize facial isolation in still pictures. For this reason, numerous systems have been connected: neural networks, Gabor wavelets and dynamic appearance models. A critical restriction to this system is the reality that still pictures more often than not catch the peak of the isolation, i.e., the moment at which the pointers of feeling are generally checked. In their day by day life, individuals only here and there show peak of their outward appearance during normal correspondence with their peers, except if for very specific cases and for extremely concise periods of time. The programmed outward appearance acknowledgment framework incorporates:[9,10]

The facial feature recognition system has the following blocks:

- Face Detector.
- Face movement extraction mouth and both eyes.
- Person face character is dependent on FCP extractor algorithm.
- Face feature identifier.[11,12]

It comes up to think of an answer for the outward appearance acknowledgment issue by Sub Problems separating it into sub-issues of classifications of some specific Action Units. The projects scope incorporates not just the two class issues which tell about whether an Action Unit is on or off, but also the multi-class issues that will educate the client about multi events of more than one Action Unit in the meantime.[13,14] For this, diverse procedures and systems for highlight extraction, normalization, choice and classification. Solutions to these issues just as taking the computational complexity and timing issues into thought. The task objective is to actualize face recognition in an ideal route as far as run time onto the installed framework. Different calculations and strategy ologies are examined and equipment assets arranging will be done to accomplish the goal. This sort of face recognition implanted framework can be broadly utilized in our everyday life in various ps. We trust

that human life can be incredibly assisted with this innovation.[11,12]

Some commonplace applications are recorded as pursues:- Business Meeting, Gathering.

- Education teaching assistant.
- Audio-video speech acknowledgment

Compared to theatrical conditions in practical conditions, appearances of individuals were blended by other faces just like different cases in pictures. For the acknowledgment the mechanism is to work naturally, appearances ought to be distinguished and restricted in the very beginning is to be in a valuable for the acknowledgment application. Face discovery, an uncommon instance of item location, utilizes a pursuit calculation whose objective is finding the area of a face in a picture. To do this, few tests are edited from original picture along broke down with a paired classifier which chooses that a picture fix having faced. Later this sub-pictures that having facial properties images were returned back as recognized faces. The outstanding best in class face indicator has been created by Viola which utilizes Ada Boost as an AI technique joined by highlights. [15, 16].

II. INTERNET OF THINGS (IOT)

This is the mechanism which alludes to a wireless framework among things. This term is Originated from depict different profits what's more, inquire about encourage that engage the overall network to interface to present truth of different things which are connected to Internet. These are different innovations which empower the concept:

- RFID
- Optical labels as well as speedy reaction
- Bluetooth low Energy
- ZigBee

Here we used raspberry pi 3 as a solitary PC made in UK by the raspberry pi foundation. Rpihas numerous ages. The things that we are utilizing here is pi3 which is supplanted pi2.Rpi3 is accepted that it is 79%fast then Rpi2 for parallel functioning. Cost was around of US 19$to 29$.It has engineering of ARM v8 of either 64 or 32 bit size. Broadcom BCM 2837 System on chip utilized alongside the CPU of 1.2GHz 64/32 bit quad centre ARM cortex A53. The memory of Raspberry pi 3 is 1GB and the capacity is in the miniaturized scale SDHC opening. It has an extra component of Wi-Fi as well as Bluetooth as contrasted with different forms of RaspberryPi.[17,18] PCA take in a rigorous and effective supposition: linearity. It simplifies the hassle by using restricting the set of ability bases. With the

assumptions we're going to have or we've made PCA is now restricted to re-evaluating given information as a linear mixture of its foundation vectors. Main problem is arising in this case when we st our process of gender identification and to get perform in higher dimensional space is not at all suitable for efficient results. So we have to map the data that is available in to lower dimensional subspace for the significant improvements.

$$X = \begin{bmatrix} a1 & a2 \\ a3 & ...aN \end{bmatrix} \longrightarrow \text{diminish}$$

$$\text{dimensionality} \longrightarrow y = \begin{bmatrix} b1 & b2 \\ b3 & ...bK \end{bmatrix}, \text{ (where k<<n)...}$$

(eq.1.)

III. BACKGROUND DETAILS & RELATED WORK

Proposed procedure yields better results in examination with various techniques. Jian Huang et al., [JPWJ, 2007] proposed p subspace straight Discriminant examination (KSLDA) technique. The proposed methodology surveyed with three benchmark databases FERET, YaleB, CMU PIE and yields favored execution over other LDA based procedures. Pohsiang Tsai, [PTT, 2007], have used two nonlinear based piece strategies in facial classification. The two procedures KPCA and KFLDA yielded preferable recognition rate over the customary straight systems against enunciation assortment of JAFEE database. Jianming Lu et al., [JXT, 2007] have shown a methodology reliant on sub-gathering of face precedents using Fuzzy C-Means and orchestrated using parallel neural frameworks. The proposed methodology yielded better results at 98.75% with 240 instances of 20 classes when stood out from customary Back causing Neural Network. M. Samer Charifa et al., [MAM, 2007] have proposed two frameworks for face recognition. These are see based face recognition and biometric-based face recognition. In the essential procedure eyes, nose, and mouth are separated and features expelled from them are give as data vector for Back spread Neural Network (BPN). In the second system, save

Abhilash. Et al. [4] proposed continuous permission rights for face identification acknowledgment utilizing, Raspberry Pi rather than GSM. The confinements of the task not able to handle the foundation light circumstance and surrounding light situations.

Xiaoyang Tan.et al. [5] has introduced Door lock get to a framework which comprises of 3 pitions: to be explicit face acknowledgment, face identification, along secure entryway gets to control. Someone is needed at the area in verifying unapproved individual's pictures for framework as well as make more proper move. A (PC) is related to the microcontroller, the whole framework won't perform if device is slammed or Non-Function.

Alexander Hinneburg.et al. [6] had actualized privacy framework weather an individual came at the entryway it was informed to the mortgage holder by means of email as well as social networking sites then the client could see the individual remaining at the entryway utilizing the camera from a remote area.

Vapnik, V.et.al.[7] proposed the picture and contrasted it and the database yet the constraint was the framework couldn't work legitimately in the surrounding light condition. NelloCristianin.et.al. [8] developed a work on Face Recognition System dependent on Eigen face strategy in which they utilized Eigen technique for face acknowledgment and Euclidean separation technique to analyze the picture of the individual worried about the pictures in the database. It was an extremely effective and quick strategy and furthermore gave high exactness.

Chopra.et.al [9] designed a mechanism for developing the automatic door accessing system that performs face detection and reorganization mechanism. For face location and PCA for the correlation of pictures.

Madan Lal.et al [10] created in associate any entryway by the web. Here the client additionally executed a PIR sensor as well as camera. PIR sensor utilized for recognizing individual and camera utilized for catching the record data of individual at the entryway. The video was visualized by the 3g dongle to an approved individual. They had additionally talked about a few favorable circumstances of this framework. They had closed utilization of this framework in banks, medical clinics and so on.

ShraddhaArya.et. al [11] designed two types of frameworks are proposed, one depends on GSM innovation along different uses a camera to recognize the gatecrasher

A. Different Approaches of Classical PCA

The primary notion behind this approach is getting the frontal facial characteristic in mathematical term in place of the bodily face functions with the useful resource of the usage of the usage of linear mathematical transforms. It moreover involves a mathematical approach that transforms some of probably correlated variables right into a smaller type of uncorrelated variables referred to as important components. In quick, the set of rules we are going similarly with for gender identity approximately will test the principle additives of a hard and speedy of the frontal facial photos [1, 5]. PCA is a manner of figuring out patterns in statistics, and expressing the information on this sort of way for identification on their resemblance and variations of the face snap shots. Each face photograph in database could be presented exactly in phrases of a linear mixture of the Eigen faces. This procedure permits the machine to symbolize the important info for evaluating the faces by use of the little facts as short due to the reality the mathematical example completed which it's miles need to have a number of faces to be preserve. As an opportunity, it suffers a piece from the reality that facial picture want to be normalized that due to this all of them want to be the equal period and the eyes, nose, and mouth in the pattern images want to be covered up earlier than the PCA finished. Image processing toolbox will provide a tough and speedy of algorithms and graphical machine for picture processing assessment, set of guidelines development, and visualization, pattern recognition and hundreds of different fields. As a protracted manner as photo processing toolbox is involved it lets in scientists and engineers in areas which includes an extended manner flung sensing, biometric surveillance, gene expression, semiconductor trying out, image sensor format, and color technological expertise. It additionally allows the studying and training of picture processing strategies. The primary hassle assessment is one of the maximum inexperienced and correct tools that have been finished in gender detection. [19,20] PCA is the use of mathematical rigor beneath the large call of hassle assessment. The PCA set of pointers diminishes the huge dimensionality of the facts we are having to the lesser dimensionality of autonomous characteristic vicinity which may be needed to depict the facts. The roles of PCA are to do information compression, prediction, redundancy removal, competencies extraction, and so on.

As PCA is a mathematical approach that might perform a few element in the linear vicinity, packages having linear fashions are appropriate, which encompass photo processing, signal processing, tool and communications control idea, and so on. Face identity has many applicable regions. Moreover, it may be classified into face identity, face type or sex electricity of will. The maximum useful programs embody crowd surveillance, video content cloth material indexing, and personal identification (ex. The use of pressure's license), mug photographs matching, the front protection, and so on.[13]

B. Physical Differences between Genders

It's far very apparent regarded that ladies and men have a few difference, variations and profits concerning their bodily look. Though, a few coinciding functions additionally exist there, of the women and men that now and again may want to result in complexity to apprehend the simple variations among male and woman. A frontal face is complete of complexity though of route the rate of masculinity or femininity varies from one character to some other person. Now, not only a single feature makes a face male or woman, the diploma of masculine or female skills that counts [14]

IV. HOW FACIAL RECOGNITION FUNCTIONS

We may be great at perceiving faces. We most likely discover it a snap to recognize the face of a relative, companion, or colleague. We're acquainted with their facial highlights — their eyes, nose, mouth — and how they meet up. That is the manner by which a facial recognition framework works, yet on a fantastic, algorithmic scale. Where we see a face, recognition innovation sees information. That information can be put away and got too. For example, half of every American grown-up have their images put away in at least one facial-recognition databases that law implementation offices can look, as indicated by a Georgetown University think about. So how does facial recognition work? Advances fluctuate, however here are the essential advances:

Stage 1: An image of our face is caught from a photograph or video. Our face may seem alone or in a crowd. our picture may demonstrate we looking straight ahead or about in profile.

Stage 2: Facial recognition programming peruses the geometry of our face. Key variables incorporate the separation between our eyes and the separation from temple to jaw line. The product recognizes facial tourist spots — one framework recognizes 68 of them — that are critical to recognizing our face. The outcome: our facial mark.

Stage 3: our facial mark — a scientific recipe — is contrasted with a database of known faces. Also, think about this: in any event 117 million Americans have images of their faces in at least one police databases. As per a May 2018 report, the FBI has approached 412 million facial images for inquiries.

Stage 4: An assurance is made. Our face print may coordinate that of a picture in a facial recognition framework database.

A. Motivations to be worried about our security

Security matters: Security alludes to any rights we need to control our own data and how it's utilized — and that can

incorporate our face print. Things being what they are, what are the issues? Here are a few:

Security: Our facial information can be gathered and put away, frequently without our consent. It's potential programmers could access and take that information.

Predominance: Facial recognition innovation is winding up increasingly broad. That implies our facial mark could finish up in a ton of spots. We most likely won't realize who approaches it. [19,20]

Proprietorship: We possess our face — the one on our neck — yet our computerized images are unique. We may have surrendered our entitlement to proprietorship when we joined on an online life arrange. Or on the other hand perhaps somebody tracks down images of us on the web and sells that information.

Safety: Facial recognition could prompt online badgering and stalking. How? For instance, somebody takes our picture on a metro or some other open spot and uses facial recognition programming to discover precisely our identity.

Mixed up character: State, for example, law authorization utilizes facial recognition to attempt to distinguish somebody who ransacked a corner store. Facial recognition frameworks may not be 100 percent exact. Consider the possibility that the police think the suspect is we?

V. PROPOSED METHOD

In face recognition techniques feature extraction and then its classification should be very efficient to increase the efficiency of the system. As to increase the efficiency global and local features are combined to make a feature vector. This section includes main steps of feature extraction, training and testing process:

i. The DCT is applied on input image. The DCT coefficients are selected using zigzag manner by keeping dominant frequency components. This makes our feature vector.

ii. Initialize 40 classes one class (face id) for each person. Each class containing 10 images of different person. Therefore 40 target vectors are initialized one vector for each class.
So that if the image related to the one of 10 images of first person then target vector is 1 and if the image related to the one out of 10 images of second person target vector is 2 and so on.

iii. The DCT feature vector for each image is fed to the neural network with randomly assigned weight vector and bias.

iv. When input and weights are fed to network output is calculated according to weights.

v. Then output is checked with desired output using the mean square error and if error is not within the limits weights are updated to minimize the error.

vi. Until the system found error within the limit or its stopping condition previous step is repeated.

vii. When system is trained then efficiency of system is tested using images in test data set similarly feature vector is calculated using DCT and fed to the input layer of trained ANN and then output is calculated
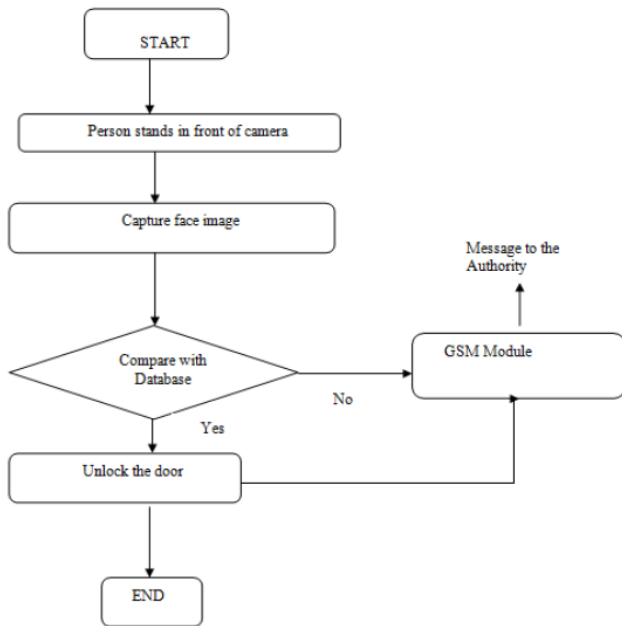
according to training algorithm.

viii. Check if the output belongs to the one of the 40 classes and on the basis of true and false recognition, recognition rate is calculated using the formula:

$$r = \frac{\text{no. of correct recognised face}}{\text{total no. of test images}} \times 100$$

VI. FLOWCHART OF THE PROJECT

Fig. 2: Flowchart of Image Capturing and Image comparison

VII. EXPERIMENTAL SETUP AND RESULTS

A MATLAB is used for implementing the program. The images used for training and testing were selected from ORL database [18]. We have divided the database randomly in different ratio and check the performance. To evaluate the performance of ANN model we used MSE and recognition rate.

Here we used three layers ANN, one input, one hidden and one output layer. We have selected 35 the most significant feature using DCT to form feature vector and we have tested for different pair of training and testing images. Training of neural network is done with 50, 70 and 90 neurons in hidden layer and best result with 70 neuron in hidden layer and output layer with 40 neurons for 40 classes (face id). The network parameters are:

Activation function: tansig
Learning rate: 0.2
Training Algorithm: traingdm
Number of epochs: 5000
Performance function: mse

We tested the system to validate the performance of proposed method using randomly selected test and training data and K-fold cross validation.

To classify the objects correctly performance goal is setup to 10^{-7} the learning process will stop either reaching this value or reaching the maximum number of epoch. The

performance graph shows the network performance by plotting the number of epochs. The performance plot for a test image is shown in Fig.6
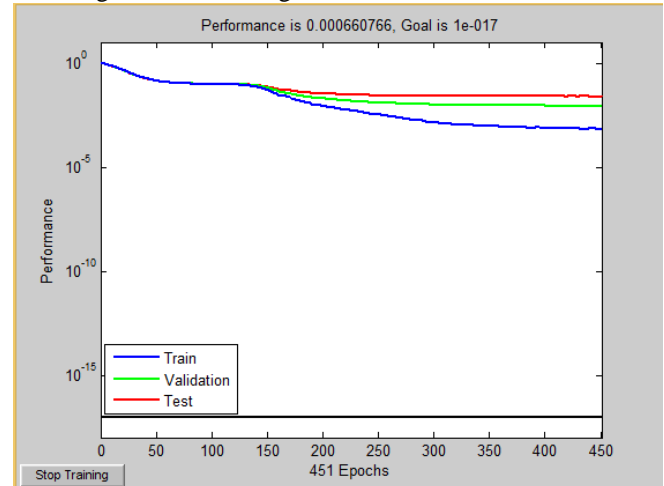
Fig. 3: Performance Graph of ANN Training Process

Initially we take 4 images per person for training and remaining for testing so we divided the total 400 images as 160 for training and remaining 240 for testing then we take 5 images of per person for training and remaining for testing so we divided the total 400 images as 200 for training and remaining 200 for testing and so on. We tried with different number of testing and training images we get best results with 98.75% for 320 training images(8 images per person) and 80 testing images (2 images per person) so there is no overlap between training and test images. There is difference between the training time of process if we increase the number of training images, but the difference amount is less so we can neglect if we have requirement of system whose accuracy or recognition rate is high. In this Hybrid method we have tested accuracy of system with 40 classes and recognition rate gradually decreases as number of classes increases [9].

We can solve this problem if we increase the training data that means if we increase number of images per person in training data. We have tested this for our proposed system and accuracy plot with respect to number of training samples per image is shown in Fig.7 which shows that recognition rate gradually increases with increase in training sample per person or we can say error rate decreases with increase in training sample of same class.

Fig. 4: Performance with Different Number of Training Sample

Fig. 5: Performance with Different Number of Training Sample

Fig. 6: Training Sample (2)

Fig. 7: Training Sample (3)

Fig. 8: Training Sample (4)

VIII. CONCLUSION

The proposed method is able to recognize faces in a percentage which vary between 95% and 98.75% depending upon number of training samples per image. DCT is used to reduce the feature space by preserving only important features which dramatically reduces the computation requirements. Our method is tested on ORL database and compared with other face recognition methods tested on ORL database, shows better results. This methodology can be

tested on other database and efficiency of system can be verified. This low cost and high efficient system shows that it is well suited for. Here, we depicted another face ID calculation, specifically a pack of visual words utilizing extricated highlights in histogram in different arranged angles with L2-SVM as classification mechanism. This technique was planned to adapt for a little example sizes in the preparation set, which is a test for getting great exhibitions. Over the LFW dataset, aside from fort=3 with the non-reflected cases, it additionally works fundamentally superior to alternate techniques. We moreover contrasted our outcomes and two cutting edge face acknowledgment calculations with following comparable dataset choices. By outcomes it tends to be observed that, Hoard BOW gets cutting edge exhibitions for face acknowledgment with hardly any preparation precedents.

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