GALGOTIAS UNIVERSITY

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FACE DETECTION APP

A Project Report of Capstone Project

Submitted by

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SCHOOL OF COMPUTING AND SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

Certified that this project report **“FACE DETECTION APP”** is the bonafide work of **“GAJENDRA SINGH(1613112018)”** who carried out the project work under my supervision

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ABSTRACT

This project will show how we can implement algorithms for face detection and recognition in image processing to build a system that will detect and recognize frontal faces of human beings. “A face is the front part of a person’s head from the forehead to the chin, or the corresponding part of an animal”. In human interactions, the face is the most important factor as it contains important information about a person or individual. All humans have the ability to recognize individuals from their faces. The proposed solution is to develop a working prototype of a system that will facilitate detecting the frontal faces of a person from a picture taken from a webcam or camera. The second part of the system will also be able to perform a facial recognition against a small database. A large scale evaluation of automatic face recognition technology, and its conclusions are also given.We first present a diagram of face acknowledgment and its applications. At that point, a writing audit of the latest face acknowledgment strategies is introduced. Portrayal and confinements of face databases which are utilized to test the exhibition of these face acknowledgment calculations are given.In recent years, research has been carried out and face recognition and detection systems have been developed. Some of which are used on social media platforms, banking apps, government offices e.g. the Metropolitan Police, Facebook etc.

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1. INTRODUCTION

This project will show how we can implement algorithms for face detection and recognition in image processing to build a system that will detect and recognize frontal faces of human beings. “A face is the front part of a person’s head from the forehead to the chin, or the corresponding part of an animal” (Oxford Dictionary). In human interactions, the face is the most important factor as it contains important information about a person or individual. All humans have the ability to recognize individuals from their faces. The proposed solution is to develop a working prototype of a system that will facilitate detecting the frontal faces of a person from a picture taken from a webcam or camera. The second part of the system will also be able to perform a facial recognition against a small database. In recent years, research has been carried out and face recognition and detection systems have been developed. Some of which are used on social media platforms, banking apps, government offices e.g. the Metropolitan Police, Facebook etc.Face acknowledgment is a significant research issue

spreading over various fields and teaches. This in light of the fact that face acknowledgment, in extra to having various functional applications, for example, bankcard distinguishing proof, get to control, Mug shots looking, security observing, and observation framework, is a principal human conduct that is fundamental for compelling correspondences and collaborations among individuals. A conventional strategy for ordering faces was first proposed in [1]. The creator proposed gathering facial profiles as bends, finding their standard, and afterward arranging different profiles by their deviations from the standard. This order is multi-modular, for example bringing about a vector of autonomous estimates that could be contrasted and different vectors in a database. Progress has progressed to the point that face acknowledgment frameworks are being exhibited in true settings [2]. The fast advancement of face acknowledgment is because of a mix of elements: dynamic advancement of calculations, the accessibility of an enormous databases of facial pictures, and a strategy for assessing the exhibition of face acknowledgment calculations. In the literary works, face acknowledgment issue can be detailed as: given static (still) or video pictures of a scene, recognize or check at least one people in the scene by contrasting and faces put away in a database. When contrasting individual confirmation with face acknowledgment, there are a few angles which vary.

Computationally this implies it isn't important to counsel the total arrangement of database pictures (indicated model pictures beneath) so as to check case. An approaching picture (alluded to as a test picture) is therefore contrasted with a little number of model pictures of the individual whose character is guaranteed and not, as in the acknowledgment situation, with each picture (or some descriptor of a picture) in a conceivably huge database. Second, a programmed validation framework must work in close continuous to be worthy to clients. At long last, in acknowledgment tests, just pictures of individuals from the preparing database are introduced to the framework, while the case of a faker (in all probability a formerly concealed individual) is of most extreme significance for validation. Face acknowledgment is a biometric approach that utilizes robotized techniques to confirm or perceive the personality of a living individual dependent on his/her physiological qualities. In general, a biometric recognizable proof framework utilizes either physiological qualities, (for example, a unique finger impression, iris design, or on the other hand face) or standards of conduct, (for example, hand-composing, voice, or key-stroke design) to distinguish an individual. In light of human characteristic defense of his/her eyes, a few people are hesitant to utilize eye distinguishing proof frameworks. Face acknowledgment has the advantage of being an inactive, non meddling framework to check individual personality in a "characteristic" and cordial way. When all is said in done, biometric gadgets can be clarified with a three step strategy (1) a sensor takes a perception. The sort of sensor and its perception rely upon the kind of biometric gadgets utilized. This perception gives us a "Biometric Mark" of the person. (2) a PC calculation "standardizes" the biometric signature with the goal that it is in the equivalent design (size, goals, see, and so forth.) as the marks on the framework's database. The standardization of the biometric signature gives us a "Standardized Signature" of the person. (3) a matcher contrasts the standardized mark and the set (or on the other hand sub-set) of standardized marks on the framework's database also, gives a "closeness score" that analyzes the person's standardized mark with every mark in the database set (or sub-set). What is then finished with the closeness scores relies upon the biometric framework's application? Face acknowledgment begins with the identification of face designs in at times jumbled scenes, continues by normalizing the face pictures to represent geometrical and light changes, potentially utilizing data about the area and appearance of facial tourist spots, distinguishes the faces utilizing fitting arrangement calculations, and post forms the outcomes utilizing model-based plans and strategic input

2. LITERATURE REVIEW

The Eigen face Methods Firstly Kirby and Sirvoich demonstrated Eigenfaces method for recognition. Pentland and Turk made improvements on this re-search by employingEigenfaces method based on Principle Com-ponent Analysis for the same reason[41]. PCA is a Karhumen-Loeve transformation. PCA is a realized linear dimensionality reduction method used to determine a set of mutually orthogonal basis func-tions and as shown in fig 1. It uses the vanguard eigenvectors of

Figure 2: Example of Six Classes Using LDA [17]

thesample covariance matrix to characterize the lower dimensional.It is used to reduce dimension of image matrix. Ex: If a faceimage is represented in g dimensional space, PCA aims to obtainan h dimensional sub space using linear transforms, which answersHmaximum variance in g dimensional space and g is too big according to h. Subtracting the normalized training images from the calcu-lated mean images thus mean centered images are calculated. If wis mean centered training image matrix Wi(i=1,2,........,L) and l is the number of training images, matrix d is calculated from as inequation 1D = WWT(1)To reduce the size of covariance matrix D, we can use D =WTW instead. Eigenvectors ei and eigen values are obtainedfrom covariance matrix.Zi = ETwi(i = 1, 2, ..., L) (2)In the equation 2, Zi represents the new feature vector of lowerdimensional space. Negative aspect of this method, it tries to maxinter and intra class scattering. Inter class scattering is good forclassification where intrascatteringis not. If there is variance il-lumination, increases intra class scattering very high, even classes seems stained.

Belhumeur introduced the Fisher Face method in 1997, [43] a derivative of Fishers Linear Discriminant (FLD) which has linear discrim-inant analysis (LDA) to gain the vast discriminant structures. Both PCA and LDA which are used to produce a subspace projection ma- trix is similar to eigen face and Fisher face methods. LDA describes a pair of projection vectors which form the maximum between-class scatter and minimum in the class scatter matrix concurrently [44]produces lower error when compared to Eigen face method. Six different classes using LDA with large variances within classes, butlittle variance within classes are shown in Fig 2.Kernel FLD is capable of extracting the most distinct features in the feature space, which is common to the nonlinear features in the reference input space and shows better results when compare to the conventional Fisher face which is established on second order statistics of an image-set without considering the high order statistical dependencies. Few of the modern LDA-based algorithms include [46]: Direct LDA [47] constructing the image scatter matrix obtained from a normal two dimensional image and it is capable of resolving small sample size problem. Further, to resolve the same problem Dual-Space LDA algorithm requires full discriminative information of face. Both LDA and weighted pair wise Fisher criteria privileges are used together by Direct-Weighted LDA. Block LDA[50] algorithm segments the entire image into several blocks and structures each block as a row vector. Linear discrimination analysis is performed on the row vectors for block which from the two dimensional matrices. The K-Nearest Neighbor approach (KNN) and the Nearest Mean approach (NM) are the two approaches fused using LDA and PCA [52], was done on the AT&T and Yale datasets

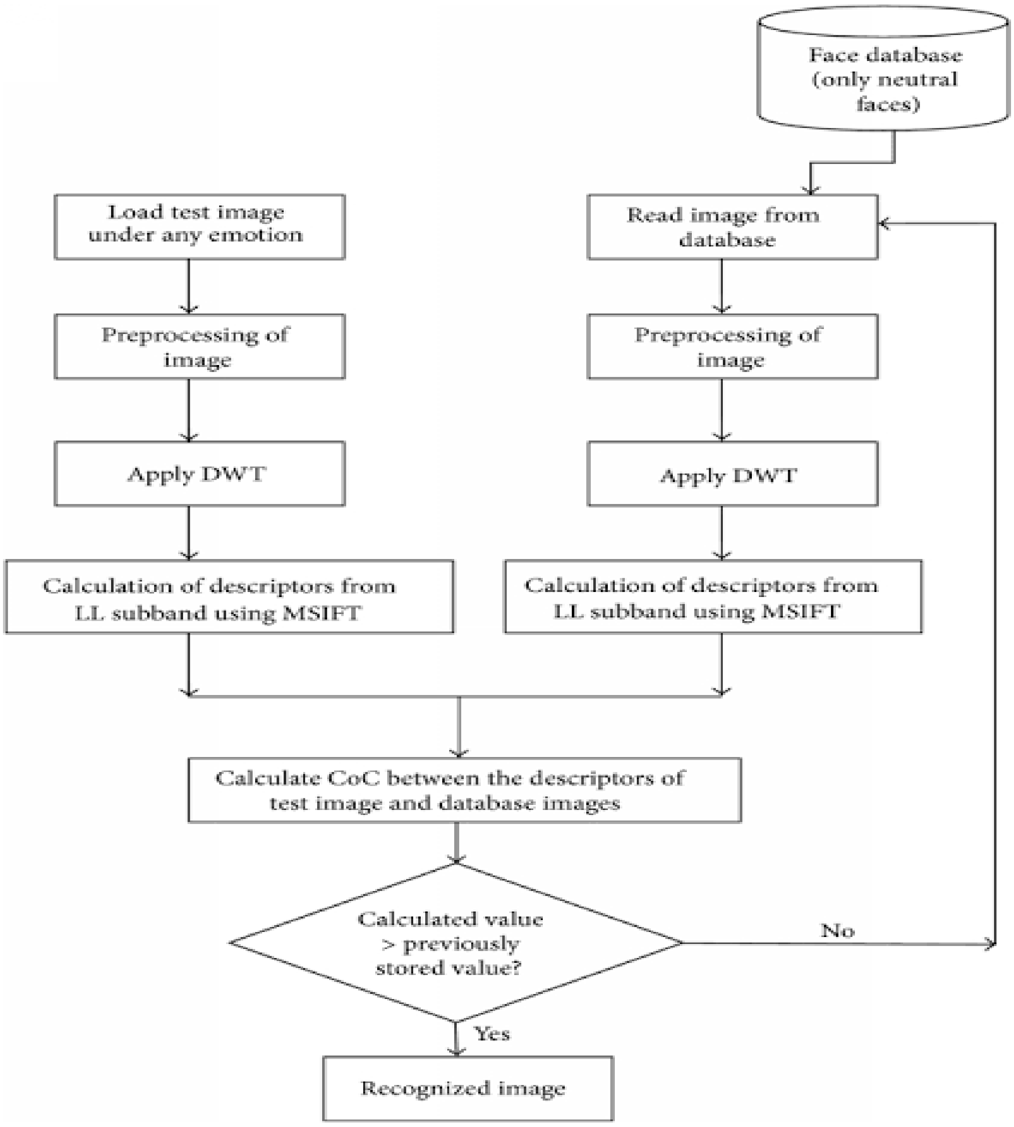
Fisher face or Linear Discriminant Analysis (LDA) aims to increase inter class differences and are not used to increase data representation.

Above are intra class (Equation 3) and inter class (Equation4) scatter matrices respectively. The indices, i is image number,

is class. j is the mean of class j , and is mean of all classes. Mj shows the number images in class j, and R is the number of classes. Sb is maximized while Sw is minimized for the classification to be done[3]. Intrinsic factors are independent of theobserverand represents the objective of the face. Further it can be divided intointrapersonal and interpersonal

3. PROPOSED MODEL

The system architecture consist of camera, detecting face. Face recognition training set storing in database and Finally marked the attendance. This system works using the python Programming language. The proposed automated attendance system based on face detection .



4. IMPLEMENTATION

This segment gives a diagram on the significant human face acknowledgment systems that apply generally to frontal faces, points of interest and inconveniences of every strategy are likewise given. The strategies considered are eigenfaces (eigenfeatures), neural systems, dynamic connection engineering, concealed Markov model, geometrical element coordinating, and format coordinating. The methodologies are broke down as far as the facial portrayals they utilized. A. Eigenfaces Eigenface is one of the most altogether explored ways to deal with face acknowledgment. It is otherwise called Karhunen-Loève extension, eigenpicture, eigenvector, and head part. References [26, 27] utilized head segment examination to proficiently speak to pictures of countenances. They contended that any face pictures could be around recreated by a little assortment of loads for each face and a standard face picture (eigenpicture). The loads depicting each face are acquired by anticipating the face picture onto the eigenpicture. Reference [28] utilized eigenfaces, which was persuaded by the method of Kirby and Sirovich, for face recognition and distinguishing proof. In scientific terms, eigenfaces are the important parts of the dispersion of countenances, or the eigenvectors of the covariance framework of the arrangement of face pictures. The eigenvectors are requested to speak to various measures of the variety, separately, among the countenances. Each face can be spoken to precisely by a direct mix of the eigenfaces. It can likewise be approximated utilizing just the "best" eigenvectors with the biggest eigenvalues. The best M eigenfaces develop a M dimensional space, i.e., the "face space". The creators detailed 96 percent, 85 percent, and 64 percent right orders arrived at the midpoint of over lighting, direction, and size varieties, individually. Their database contained 2,500 pictures of 16 people. As the pictures incorporate an enormous amount of foundation zone, the above outcomes are impacted by foundation. The creators clarified the hearty presentation of the framework under various lighting conditions by critical relationship between's pictures with changes in brightening. In any case, [29] demonstrated that the relationship between's pictures of the entire countenances isn't proficient for agreeable acknowledgment execution. Light standardization [27] is normally important for the eigenfaces approach. Reference [30] proposed another strategy to register the covariance network utilizing three pictures every wa taken in various lighting conditions to represent discretionary enlightenment impacts, if the article is Lambertian. Reference [31] broadened their initial work on eigenface to eigenfeatures comparing to confront segments, for example, eyes, nose, and mouth. They utilized a secluded eigenspace which was made out of the above eigenfeatures (i.e., eigeneyes, eigennose, and eigenmouth). This strategy would be less touchy to appearance changes than the standard eigenface technique. The framework accomplished an acknowledgment pace of 95 percent on the FERET database of 7,562 pictures of around 3,000 people. In synopsis, eigenface shows up as a quick, straightforward, and reasonable technique. In any case, all in all, it doesn't give invariance over changes in scale and lighting conditions. As of late, in [32] tries different things with ear and face acknowledgment, utilizing the standard head part investigation approach , indicated that the acknowledgment execution is basically indistinguishable utilizing ear pictures or face pictures and joining the two for multimodal acknowledgment brings about a measurably huge presentation improvement. For instance, the distinction in the rank-one acknowledgment rate for the day variety explore utilizing the 197-picture preparing sets is

Universal Journal of Signal Processing Volume 2 Number 290. 90.9% for the multimodal biometric versus 71.6% for the ear and 70.5% for the face. There is generous related work in multimodal biometrics. For instance [33] utilized face and unique finger impression in multimodal biometric distinguishing proof, and [34] utilized face and voice. In any case, utilization of the face and ear in mix appears to be increasingly pertinent to reconnaissance applications

B. Neural Networks

The allure of utilizing neural systems could be because of its non linearity in the system. Consequently, the element extraction step might be more proficient than the direct Karhunen-Loève strategies. One of the main fake neural systems (ANN) strategies utilized for face acknowledgment is a solitary layer versatile system called WISARD which contains a different system for each put away individual [35]. The path in developing a neural system structure is significant for fruitful acknowledgment. It is particularly reliant on the expected application. For face recognition, multilayer perceptron [36] and convolutional neural system [37] have been applied. For face confirmation, [38] is a multi-goals pyramid structure. Reference [37] proposed a cross breed neural system which consolidates neighborhood picture testing, a self-sorting out guide (SOM) neural system, and a convolutional neural system. The SOM gives a quantization of the picture tests into a topological space where inputs that are close by in the first space are additionally close by in the yield space, in this way giving measurement decrease and invariance to minor changes in the picture test. The convolutional arrange removes progressively bigger highlights in a various leveled set of layers and gives halfway invariance to interpretation, turn, scale, and twisting. The creators announced 96.2% right acknowledgment on ORL database of 400 pictures of 40 people. The order time is under 0.5 second, yet the preparation time is up to 4 hours. Reference [39] utilized probabilistic choice based neural system (PDBNN) which acquired the secluded structure from its forerunner, a choice based neural system (DBNN) [40]. The PDBNN can be applied viably to 1) face identifier: which finds the area of a human face in a jumbled picture, 2) eye localizer: which decides the places of the two eyes so as to produce significant element vectors, and 3) face recognizer. PDNN doesn't have a completely associated organize topology. Rather, it separates the system into K subnets. Every subset is committed to remember one individual in the database. PDNN utilizes the Guassian enactment work for its neurons, and the yield of each "face subnet" is the weighted summation of the neuron yields. As such, the face subnet gauges the probability thickness utilizing the mainstream blend of-Guassian model. Contrasted with the AWGN conspire, blend of Guassian gives a considerably more adaptable and complex model for approximating the time probability densities in the face space. The learning plan of the PDNN comprises of two stages, in the principal stage; each subnet is prepared by its own face pictures. In the subsequent stage, called the choice based learning, the subnet parameters might be prepared by some specific examples from other face classes. The choice based learning plan doesn't utilize all the preparation tests for the preparation. Just misclassified designs are utilized. On the off chance that the example is misclassified to an inappropriate subnet, the legitimate subnet will tune its parameters with the goal that its choice locale can be drawn nearer to the misclassified test. PDBNN-based biometric recognizable proof framework has the benefits of both neural systems and factual methodologies, and its conveyed registering standard is moderately simple to execute on equal PC. In [39], it was accounted for that PDBNN face recognizer had the ability of perceiving up to 200 individuals and could accomplish up to 96% right acknowledgment rate in around 1 second. Be that as it may, when the quantity of people expands, the processing cost will turn out to be all the more requesting. As a rule, neural system approaches experience issues when the quantity of classes (i.e., people) increments. Besides, they are not appropriate for a solitary model picture acknowledgment test on the grounds that various model pictures per individual are essential all together.

C. Graph Mapping

Diagram coordinating is another way to deal with face acknowledgment. Reference [41] introduced a powerful connection structure for bending invariant item acknowledgment which utilized versatile diagram coordinating to locate the nearest put away chart. Dynamic connection engineering is an expansion to traditional fake neural systems. Retained articles are spoken to by meager charts, whose vertices are named with a multiresolution depiction as far as a nearby force range and whose edges are named with geometrical separation vectors. Article acknowledgment can be detailed as versatile diagram coordinating which is performed by stochastic advancement of a coordinating cost work. They announced great outcomes on a database of 87 individuals and a little arrangement of office things including various articulations with a turn of 15 degrees. The coordinating procedure is computationally costly, taking around 25 seconds to contrast and 87 put away articles on an equal machine with 23 transputers. Reference [42] expanded the procedure and coordinated human appearances against an exhibition of 112 nonpartisan frontal view faces. Test pictures were contorted because of turn inside and out and changing outward appearance. Empowering results on faces with enormous turn edges were acquired.

They revealed acknowledgment paces of 86.5% and 66.4% for the coordinating trial of 111 appearances of 15 degree revolution and 110 countenances of 30 degree turn to a display of 112 nonpartisan frontal perspectives. All in all, unique connection design is better than other face acknowledgment procedures as far as pivot invariance; nonetheless, the coordinating procedure is computationally costly.

D. Hidden Markov Models (HMMs)

Stochastic modeling of nonstationary vector time series based on (HMM) has been very successful for speech applications. Reference [43] applied this method to human face recognition. Faces were intuitively divided into regions such as the eyes, nose, mouth, etc., which can be associated with the states of a hidden Markov model. Since HMMs require a one-dimensional observation sequence and images are two-dimensional, the images should be converted into either 1D temporal sequences or 1D spatial sequences. International Journal of Signal Processing Volume 2 Number 2 In [44], a spatial observation sequence was extracted from a face image by using a band sampling technique. Each face image was represented by a 1D vector series of pixel observation. Each observation vector is a block of L lines and there is an M lines overlap between successive observations. An unknown test image is first sampled to an observation sequence. Then, it is matched against every HMMs in the model face database (each HMM represents a different subject). The match with the highest likelihood is considered the best match and the relevant model reveals the identity of the test face. The recognition rate of HMM approach is 87% using ORL database consisting of 400 images of 40 individuals. A pseudo 2D HMM [44] was reported to achieve a 95% recognition rate in their preliminary experiments. Its classification time and training time were not given (believed to be very expensive). The choice of parameters had been based on subjective intuition.

E. Geometrical Feature Matching

Geometrical element coordinating systems depend on the calculation of a lot of geometrical highlights from the image of a face. The way that face acknowledgment is conceivable even at coarse goals as low as 8x6 pixels [45] when the single facial highlights are barely uncovered in detail, infers that the general geometrical arrangement of the face highlights is adequate for acknowledgment. The general setup can be depicted by a vector speaking to the position and size of the principle facial highlights, for example, eyes and eyebrows, nose, mouth, and the state of face diagram. One of the spearheading takes a shot at robotized face acknowledgment by utilizing geometrical highlights was finished by [46] in 1973. Their framework accomplished a pinnacle execution of 75% acknowledgment rate on a database of 20 individuals utilizing two pictures for every individual, one as the model and the different as the test picture. References [47,48] demonstrated that a face acknowledgment program furnished with highlights extricated physically could perform acknowledgment clearly with agreeable outcomes. Reference [49] naturally separated a lot of geometrical highlights from the image of a face, for example, nose width and length, mouth position, and jaw shape. There were 35 highlights extricated structure a 35 dimensional vector. The acknowledgment was then performed with a Bayes classifier. They detailed an acknowledgment pace of 90% on a database of 47 individuals. Reference [50] presented a blend separation procedure which accomplished 95% acknowledgment rate on a question database of 685 people. Each face was spoken to by 30 physically removed separations. Reference [51] utilized Gabor wavelet decay to identify include focuses for each face picture which extraordinarily decreased the capacity necessity for the database. Regularly, 35-45 component focuses per face were created. The coordinating procedure used the data introduced in a topological realistic portrayal of the element focuses. In the wake of making up for various centroid area, two cost esteems, the topological expense, and similitude cost, were assessed. The acknowledgment precision regarding the best match to the ideal individual was 86% and 94% of the right individual's countenances was in the main three applicant matches.

In rundown, geometrical component coordinating dependent on definitely estimated separates between highlights might be generally valuable for discovering potential matches in a huge database, for example, a Mug shot collection. In any case, it will be reliant on the precision of the component area calculations. Current computerized face include area calculations don't give a high level of precision and require impressive computational time.

F. Template Matching

A straightforward rendition of format coordinating is that a test picture spoke to as a two-dimensional cluster of force esteems is analyzed utilizing a reasonable measurement, for example, the Euclidean separation, with a solitary layout speaking to the entire face. There are a few other progressively modern forms of format coordinating on face acknowledgment. One can utilize more than one face format from various perspectives to speak to a person's face. A face from a solitary perspective can likewise be spoken to by a lot of various particular littler formats [49,52]. The face picture of dark levels may likewise be appropriately prepared before coordinating [53]. In [49], Bruneli and Poggio consequently chose a lot of four highlights layouts, i.e., the eyes, nose, mouth, and the entire face, for the entirety of the accessible appearances. They looked at the presentation of their geometrical coordinating calculation and format coordinating calculation on a similar database of faces which contains 188 pictures of 47 people. The format coordinating was predominant in acknowledgment (100 percent acknowledgment rate) to geometrical coordinating (90 percent acknowledgment rate) and was likewise less difficult. Since the vital segments (otherwise called eigenfaces or eigenfeatures) are direct blends of the formats in the information premise, the method can't accomplish preferred outcomes over connection [49], yet it might be less computationally costly. One disadvantage of layout coordinating is its computational intricacy. Another issue lies in the portrayal of these layouts. Since the acknowledgment framework must be lenient to specific inconsistencies between the layout and the test picture, this resilience may average out the distinctions that make singular faces one of a kind. As a rule, format based methodologies contrasted with include coordinating are an increasingly intelligent methodology. In outline, no current method is liberated from constraints. Further endeavors are required to improve the exhibitions of face acknowledgment methods, particularly in the wide scope of situations experienced in genuine world.

G. 3D Morphable Model

The morphable face model is based on a vector space representation of faces [54] that is constructed such that any convex combination of shape and texture vectors of a set of examples describes a realistic human face. Fitting the 3D morphable model to images can be used in two ways for recognition across different viewing conditions: Paradigm 1. After fitting the model, recognition can be based on model coefficients, which represent intrinsic shape and texture of faces, and are independent of the imaging conditions: Paradigm 2. Three-dimension face reconstruction can also be employed to generate synthetic views from gallery probe images [55-58]. The synthetic views are then International Journal of Signal Processing Volume 2 Number 2 transferred to a second, viewpoint-dependent recognition system. More recently, [59] combines deformable 3 D models with a computer graphics simulation of projection and illumination. Given a single image of a person, the algorithm automatically estimates 3D shape, texture, and all relevant 3D scene parameters. In this framework, rotations in depth or changes of illumination are very simple operations, and all poses and illuminations are covered by a single model. Illumination is not restricted to Lambertian reflection, but takes into account specular reflections and cast shadows, which have considerable influence on the appearance of human skin. This approach is based on a morphable model of 3D faces that captures the class-specific properties of faces. These properties are learned automatically from a data set of 3D scans. The morphable model represents shapes and textures of faces as vectors in a high-dimensional face space, and involves a probability density function of natural faces within face space. The algorithm presented in [59] estimates all 3D scene parameters automatically, including head position and orientation, focal length of the camera, and illumination direction. This is achieved by a new initialization procedure that also increases robustness and reliability of the system considerably.

The new initialization uses image coordinates of between six and

database, based on side-view gallery, was 95% and the corresponding percentage on the FERET set, based on frontal view gallery images, along with the estimated head poses obtained from fitting, was 95.9%.

RECENT TECHNIQUES

A.Line Edge Map (LEM)

Edge data is a helpful item portrayal include that is uncaring toward enlightenment changes to certain degree. Despite the fact that the edge map is broadly utilized in different example acknowledgment fields, it has been disregarded in face acknowledgment with the exception of in late work detailed in [60]. Edge pictures of articles could be utilized for object acknowledgment and to accomplish comparable exactness as dark level pictures. Reference [60] utilized edge maps to quantify the likeness of face pictures. A 92% exactness was accomplished. Takács contended that procedure of face acknowledgment may begin at an a lot prior stage and edge pictures can be utilized for the acknowledgment of appearances without the association of elevated level subjective capacities. A Line Edge Map approach, proposed by [61], separates lines from a face edge map as highlights. This methodology can be considered as a mix of layout coordinating and geometrical element coordinating. The LEM approach not just has the upsides of highlight based methodologies, for example, invariance to enlightenment and low memory prerequisite, yet in addition has the benefit of high acknowledgment execution of layout coordinating. Line Edge Map coordinate the basic data with spatial data of a face picture by gathering pixels of face edge guide to line fragments. Subsequent to diminishing the edge map, a polygonal line fitting procedure [62] is applied to produce the LEM of a face. A case of a human frontal face LEM is represented in Fig. 1. The LEM portrayal lessens the capacity prerequisite since it records just the end purposes of line fragments on bends. Additionally, LEM is relied upon to be less touchy to enlightenment changes because of the way that it is a transitional level picture portrayal got from low level edge map portrayal. The fundamental unit of LEM is the line section gathered from pixels of edge map. A face prefilering calculation is suggested that can be utilized as a preprocess of LEM coordinating in face distinguishing proof application. The prefilering activity can accelerate the hunt by diminishing the quantity of competitors and the real face (LEM) coordinating is just completed on a subset of residual models. Trials on frontal faces under controlled/perfect conditions demonstrate that the proposed LEM is reliably better than edge map. LEM accurately distinguish 100% and 96.43% of the info frontal faces on face databases [63,64], individually. Contrasted and the eigenface strategy, LEM performed similarly as the eigenface technique for faces under perfect conditions and essentially better than the eigenface strategy for faces with slight appearance varieties (see Table I). In addition, the LEM approach is considerably more powerful to measure variety than the eigenface strategy and edge map approach (see Table II) . In [61], the LEM approach is demonstrated to be altogether better than the eigenface approach for distinguishing faces under changing lighting condition. The LEM approach is likewise less delicate to present varieties than the eigenface technique however increasingly touchy to enormous outward appearance changes.

Fig. 1. An Illustration of a Face LEM

B. Support Vector Machine (SVM)

SVM is a learning technique that is considered an effective method for general purpose pattern recognition because of its high generalization performance without the need to add other knowledge [65]. Intuitively, given a set of points belonging to two classes, a SVM finds the hyperplane that separates the largest possible fraction of points of the same class on the same side, while maximizing the distance from either class to the hyperplane. According to [65], this hyperplane is called Optimal Separating Hyperplane (OSH) which minimizes the risk of misclassifying not only the examples in the training set but also the unseen example of the test set. SVM can also be viewed as a way to train polynomial neural networks or Radial Basis function classifiers. The training techniques used here are based on the principle of Structure Risk Minimization (SRM), which states that better generalization capabilities are achieved through a minimization of the bound on the generalization error. Indeed, this learning technique is just equivalent to solving a linearly constrained Quadratic Programming (QP) problem.

SVM is suitable for average size face recognition systems because normally those systems have only a small number of training samples. But in a large number of QP problems, Reference [66] presented a decomposition algorithm that guarantees global optimality, and can be used to train SVMs over very large data set. In summary, the main characteristics of SVMs are: (1) that they minimize a formally proven upper bound on the generalization error; (2) that they work on high-dimensional feature spaces by means of a dual formulation in terms of kernels; (3) that the prediction is based on hyperplanes in these feature spaces, which may correspond to quite involved classification criteria on the input data; and (4) that outliers in the training data set can be handled by means of soft margins. The application of SVMs to computer vision problem have been proposed recently. Reference [67] used the SVMs with a binary tree recognition strategy to tackle the face recognition problem. After the features are extracted, the discrimination functions between each pair are learned by SVMs. Then, the disjoint test set enters the system for recognition. They propose to construct a binary tree structure to recognize the testing samples. Two sets of experiments were presented. The first experiment is on the Cambridge Olivetti Research Lab (ORL) face database of 400 images of 40 individuals. The second is on a larger data set of 1079 images of 137 individuals. The SVM based recognition was compared with standard eigenfaces approach using the Nearest Center

Classification (NCC) criterion. Both approaches start with the eigenface feature, but different in the classification algorithm. The error rates are calculated as the function of the number of eigenface, i.e., the feature dimension. The minimum error of SVM is 8.79%, which is much better than the 15.14% of NCC. In [68], the face recognition problem is formulated as a problem in difference space, which models dissimilarities between two facial images. In different space they formulate face recognition as a two class problem. The cases are: (i) Dissimilarities between faces of the same person, and (ii) Dissimilarities between faces of different people. By modifying the interpretation of the decision surface generated a similarity metric between faces, that is learned from examples of differences between faces. The SVM-based algorithm is compared with a principal component analysis (PCA) based algorithm on a difficult set of images from the FERET database. Performance was measured for both verification and identification scenarios. The identification performance for SVM is 77-78% versus 54% for PCA. For verification, the equal error rate is 7% for SVM and 13% for PCA. Reference [69] presented a component-based technique and two global techniques for face recognition and evaluated their performance with respect to robustness against pose changes. The component-based system detected and extracted a set of 10 facial components and arranged them in a single feature vector that was classified by linear SVMs. In both global systems the whole face is detected, extracted from the image and used as input to the classifiers. The first global system consisted of a single SVM for each person in the database. In the second system, the database of each person is clustered and trained on a set of view-specific SVM classifiers. The systems were tested on a database consisting of 8.593 gray faces mages which included faces rotated in depth up to about 400. In all experiments the component-based system outperformed the global systems even though a more powerful classifier is used (i.e. non-linear instead of linear SVMs) for the global system. This shows that using facial components instead of the whole face pattern as input features significantly simplifies the test of face recognition. Reference [70] presented a new development in component based face recognition by incorporation a 3D morphable model into the training process. Based on two face images of a person and a 3D morphable model into they computed the 3D face model of each person in the database. By rendering the 3D models under varying poses and lighting conditions, a large number of synthetic face images is used to train the component based recognition system. A component based recognition rates around 98% is achieved for faces rotated up to ± 360 in depth. A major drawback of the system was the need of a large number of training images taken from viewpoints and under different lighting conditions. In [71], a client-specific solution is adopted which requires learning client-specific support vectors. This representation is different from the one given in [68]. Where in [68], as mentioned before, SVM was trained to distinguish between the populations of within-client and between-client difference images respectively. Moreover, they investigate the inherent International Journal of Signal Processing Volume 2 Number 2 potential of SVM to extract the relevant discriminatory information from the training data irrespective of representation and pre-processing. In order to achieve this object, they have designed experiments in which faces are represented in both Principal Component (PC) and Linear Discriminant (LD) subspace. The latter basis (Fisherfaces) is used as an example of a face representation with focus on discriminatory feature extraction while the former achieves simply data compression. They also study the effect of image photometric normalization on performance of the SVM method, the experimental results showing superior performance in comparison with benchmark methods. However, when the representation space already captures and emphasizes the discriminatory information, SVMs loose their superiority . The results also indicate that the SVMs are robust against changes in illumination provided these are adequately represented in the training data. The proposed system is evaluated on a large database of 295 people obtaining highly competitive results: an equal rate of 1% for verification and a rank-one error rate of 2% for recognition. In [72], a novel structure is proposed to tackle multi-class classification problem for a K-class classification test, an array of K optimal pairwise coupling classifier (O-PWC) is constructed, each of which is the most reliable and optimal for the corresponding class in the sense of cross entropy of square error. The final decision will be got through combining the results of these K O-PWC. This algorithm is applied on the ORL face database, which consists of 400 images of 40 individuals, containing quite a high degree of variability in expression, pose and facial details. The training set included 200 samples (5 for eacH individual). The remaining 200 samples are used as the test set. The results show that, the accuracy rate is improved while the computational cost will not increase too much. Table III shows the comparison of different recognition methods on ORL database.A Support Vector Machine based multi-see face discovery and acknowledgment system is portrayed in [74]. Face discovery is done by building a few indicators, every one of them accountable for one explicit view. The even property of face pictures is utilized to disentangle the intricacy of the demonstrating. The estimation of head present, which is accomplished by utilizing the Support Vector Regression system, gives vital data to picking the fitting face locator. This assists with improving the exactness and diminish the calculation in multi-see face discovery contrasted with different techniques. For video successions, further computational decrease can be accomplished by utilizing Pose Change Smoothing technique. At the point when face identifiers discover a face in frontal view, a Support Vector Machine based multi-class classifier is initiated for face acknowledgment. All the above issues are coordinated under a Support Vector Machine structure. A significant attribute of this methodology is that it can get a strong presentation in an ineffectively obliged condition, particularly for low goals, huge scope changes, and revolution top to bottom. Test results on four video groupings are introduced, among them, identification rate is above 95%, acknowledgment precision is above 90%, and the full discovery and acknowledgment speed is up to 4 casings/second on a PentiumII300 PC. In [75], another face acknowledgment strategy, which consolidates a few SVM classifiers and a NN mediator is introduced. The proposed technique doesn't utilize any unequivocal element extraction conspire. Rather the SVMs get the dark level estimations of crude pixels as the information design. The justification for this setup is that a SVM has the capacity of learning in highdimensional space, for example, dark level face-picture space. Besides, the utilization of SVMs with a nearby relationship piece (altered type of polynomial part technique) gives a successful mix of highlight extraction and characterization, in this way taking out the requirement for a deliberately planned element extractor. The scaling issue that happens while mediating various SVMs is settled by embracing a NN as a trainable scalier. From trial results utilizing the ORL database (see Fig. 3), the proposed strategy brought about a 97.9% acknowledgment rate with a normal preparing time of 0.22 seconds for a face. Global Journal of Signal Processing Volume 2 Number 2 design with 40 classes. Besides, correlation with other known outcomes on a similar database. Table V shows an outline of the presentation of different frameworks for which results utilizing the ORL database are accessible. The proposed strategy demonstrated the best execution and critical decrease of mistake rate (44.7%) from the subsequent best performing framework convolutional NN.Then again, [76] examined SVMs with regards to confront confirmation (check). Their investigation bolsters the speculation that the SVM approach can extricate the applicable unfair data from the preparation information and this is the fundamental purpose behind its better execution over benchmark techniques. At the point when the portrayal space as of now catches and underlines the prejudicial data content as on account of Fisherfaces, SVMs free their predominance. SVMs can likewise adapt to brightening changes, gave these are enough spoken to in the preparation information. Be that as it may, on information which has been cleaned by highlight extraction (Fisherfaces) and additionally standardization, SVMs can get over-prepared, bringing about the loss of the capacity to sum up. The accompanying end can be drawn from their work: (1) the SVM approach can separate the pertinent prejudicial data from the information completely naturally. It can likewise adapt to enlightenment changes. The significant job in this trademark is played by the SVMs capacity to learn nonlinear choice limits, (2) on information which has been disinfected by highlight extraction (Fisherfaces) as well as standardization, SVMs can get over-prepared, bringing about the loss of the capacity to sum up. (3) SVMs include numerous parameters and can utilize various bits. This makes the improvement space fairly broad, without the assurance that it has been completely investigated to locate the best arrangement. (4) a SVM takes around 5 seconds to prepare per customer (on a Sun Ultra Enterprise 450). This is about a request for greatness longer than deciding customer explicit edges for the Euclidean also, relationship coefficient classifiers. In any case, from the viable perspective the thing that matters is immaterial. Reference [77] depicts a methodology for the issue of face present segregation utilizing SVM. Face present separation implies that one can mark the face picture as one of a few known stances.. They treat the membership authentication as a two-class face classification problem to distinguish a small size set (membership) from its complementary set (non-membership) in the universal set. In the authentication, the false-positive error is the most critical. Fortunately, the error can be validly removed by using SVM ensemble, where each SVM acts as an independent membership/ non-membership classifier and several SVMs are combined in a plurality voting scheme that chooses the classification made by more than half of SVMs. For a good encoding of face images, the Gabor filtering, principal component analysis and linear discrimination analysis have been applied consecutively to the input face image for achieving effective representation, efficient reduction of the data dimension and storing separation of different faces, respectively. Next, the SVM ensemble is applied to authenticate an input face image whether it is included in the membership group or not. Experiment results showed that the SVM ensemble has the ability to recognize non-membership and a stable robustness to cope with the variations of either different group sizes or different group members. The correct authentication rate is almost constant in the range from 97% to 98.5% without regard to the variation of members in the group in the same group size. However, one problem with the proposed authentication method is that the correct classification rate for the membership is highly degraded when the size of members is small (<20), due to the limited training data set. Nevertheless, simulation results show that the authentication performance of the proposed method can keep stable for the member group with a size of less than 50 persons.

C. Multiple Classifier Systems (MCSs)

Recently, MCSs based on the combination of outputs of a set of different classifiers have been proposed in the field of face recognition as a method of developing high performance classification systems. Traditionally, the approach used in the design of pattern recognition systems has been to experimentally compare the performance of several classifiers in order to select the best one. However, an alternative approach based on combining multiple classifiers has emerged over recent years and represented a departure from the traditional strategy. This approach goes under various names such as MCS or committee or ensemble of classifiers, and has been developed to address the practical problem of designing automatic pattern recognition systems with improved accuracy. A parameter-based combined classifier has been developed in [79] in order to improve the generalization capability and hence the system performance of face recognition system. A combination of three LVQ neural networks that are trained on different parameters proved successful in generalization for invariant face recognition. The combined classifier resulted in improved system accuracy compared to the component classifiers. With only three training faces, the system performance in the case of the KUFB is 100%. Reference [80] presents a system for invariant face recognition. A combined classifier uses the generalization capabilities of both LVQ and Radial Basis Function (RBF) neural networks to build a representative model of a face from a variety of training patterns with different poses, details and facial expressions. The combined generalization error of the classifier is found to be lower than that of each individual classifier. A new face synthesis method is implemented for reducing the false acceptance rate and enhancing the rejection capability of the classifier. The system is capable of recognizing a face in less than one second. The well-known ORL database is used for testing the combined classifier. In the case of the ORL database, a correct recognition rate of 99.5% at 0.5% rejection rate is achieved. Reference [81] represents a face recognition committee machine (FRCM), which assembles the outputs of various face recognition algorithms, Eigenface, Fisherface, Elastic Graph Matching (EGM), SVM and neural network, to obtain a unified decision with improved accuracy. This FRCM outperforms all the individuals on average. It achieves 86.1% on Yale face database and 98.8% on ORL face database. In [82], a hybrid face recognition method that combines holistic and feature analysis-based approach using a Markov random field (MRF) model is presented. The face images are divided into small patches, and the MRF model is used to represent the relationship between the image patches and the patch ID's. The MRF model is first learned from the training image patches, given a test image. The most probable patch ID's are then inferred using the belief propagation (BP) HM. Finally, the ID of the image is determined by a voting scheme from the estimated patch ID's. This method achieved 96.11% on Yale face database and 86.95% on ORL face database. In [83], a combined classifier system consisting of an ensemble of neural networks is based on varying the parameters related to the design and training of classifiers. The boosted algorithm is used to make perturbation of the training set employing MLP as base classifier. The final result is combined by using simple majority vote rule. This system achieved 99.5% on Yale face database and 100% on ORL face database. To the best of our knowledge, these results are the best in the literatures.

COMPARISON OF DIFFERENT DATABASES

In Section 2, a number of face recognition algorithms have been described. In Table

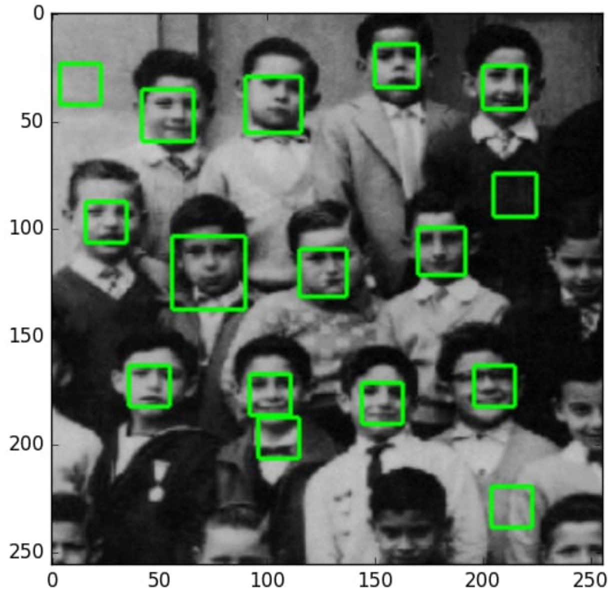
VIII, we give a comparison of face databases which were used to test the performance of these face recognition algorithms. The description and limitations of each database are given. While existing publicly-available face databases contain face images with a wide variety of poses, illumination angles, gestures, face occlusions, and illuminant colors, these images have not been adequately annotated, thus limiting their usefulness for evaluating the relative performance of face detection algorithms. For example, many of the images in existing databases are not annotated with the exact pose angles at which they were taken. In order to compare the performance of various face recognition algorithms presented in the literature there is need for a comprehensive, systematically annotated database populated with face images that have been captured (1) at variety of pose angles (to permit testing of pose invariance), (2) with a wide variety of illumination angles (to permit testing of illumination invariance), and (3) under a variety of commonly encountered illumination color temperatures (permit testing of illumination color invariance). Reference [84] presents a methodology for creating such an annotated database that employs a novel set of apparatus for the rapid capture of face images from a wide variety of pose angles and illumination angles. Four different types of illumination are used, including daylight, skylight, incandescent and fluorescent. The entire set of images, as well as the annotations and the experimental results, is being placed in the public domain, and made available for download.

APPLICATIONS

Various applications of text detection and recognition from images and video have been emerged in past few years with advancements in image processing techniques. Developments of various embedded systems and increasing work in the field of computer vision and machine learning gives further rise to the increase in applications of text detection and recognition. Text detection and recognition is used in industries for reading package labels, numbers etc. It is used to retrieve video captions as well as specific text contents from web pages. It is used for automatic number plate recognition at toll booths as well as for street boards reading purpose in case of unmanned vehicles. Text detection and recognition has very important application in form of assisting blind or visually impaired people for reading, making their daily life easy. It is also used in automatic cheque signature reading. Automatic document scanning is another application of text recognition. Signature is straightforward; the PDF or PowerPoint form of the original electronic documents is converted into a relatively high-resolution image (TIFF, JPEG, etc.) on which the signature is computed Finally, the captured document’s signature is compared to with all the original electronic documents’ signatures in order to find a match.

5. OUTPUT

I . Face Detected by Face detector Application



6. FUTURE WORK

This application works fine with face detection app,but what if we integrate this application with AI Assistant. This would be next level application, where user do not need to say anything but the application will do the work automatically. Edge data is a helpful item portrayal include that is uncaring toward enlightenment changes to certain degree. Despite the fact that the edge map is broadly utilized in different example acknowledgment fields, it has been disregarded in face acknowledgment with the exception of in late work detailed in [60]. Edge pictures of articles could be utilized for object acknowledgment and to accomplish comparable exactness as dark level pictures. Reference [60] utilized edge maps to quantify the likeness of face pictures. A 92% exactness was accomplished. Takács contended that procedure of face acknowledgment may begin at an a lot prior stage and edge pictures can be utilized for the acknowledgment of appearances without the association of elevated level subjective capacities. A Line Edge Map approach, proposed by [61], separates lines from a face edge map as highlights. This methodology can be considered as a mix of layout coordinating and geometrical element coordinating.

7. CONCLUSION

In this paper we proposed and discussed method text recognition. The OCR is a wide area for researcher in pattern recognition. A lot of research work has been done and is still being done in OCR for various languages. More and more researchers are attracted to this challenging field.

Each stage of optical character recognition has its own significance and should be designed properly for better results. Stages of text detection and recognition and various methods used for that have been presented. This process is further divided into text detection and localization, classification, segmentation and text recognition. These stages are presented in this paper along with comparison of approaches used to undergo the above mentioned stages. Analysis of advantages, disadvantages and applications of different approaches have also been performed over here. Text detection is applicable in real world scenarios like optical character recognition, artificial intelligence, distinguish between human and machine inputs and spam removal. Text detection is the process of locating areas in an image where, a meaning full text is occurred. Variation in environment in which the image is captured makes it a difficult process.

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