Face Recognition & Generating Various Samples per Person Using Discriminative Multimanifold Analysis

[1]Ms. Prerna Kulkarni, [2]Mr. Kokcha Manjyot M, [3]Mr.Jamghare Vishal V, [4]Mr. Dohale Haresh N

[1]Asst. Professor, 2,3,4UG Student, [1,2,3,4]Computer Engg. Dept. Shivajirao S.Jondhle College of Engineering & Technology, Asangaon, Maharshatra, India.

[1]manjyotkokcha@outlook.com, [2]vishaljamghare31192@gmail.com, [3]dohaleharesh@gmail.com

Abstract— There are various face detection methods which usually works on multiple samples per person and has various applications such as e-passport, ID card generation or various law enhancement. In all such practical applications, mostly single sample per person is either enrolled or recorded in the database. Since, only single sample available per person most of the proposed techniques fails in face detection due to lack of availability of sample. To overcome such drawbacks,we propose in this project a novel discriminative multi manifold analysis (DMMA) method by learning discriminative features from image patches. Initially, we partition each enrolled face image into several non-overlapping patches to form an image set for single sample per person. Then, we formulate the single sample per person face recognition as a manifold-manifold matching issues' and learn multiple DMMA feature spaces to maximize the manifold margins of different persons. Finally, we present a recreated-based manifold-manifold distance to identify the unlabeled subjects.

Keywords: Face recognition, manifold learning, subspace learning, single training.

I. INTRODUCTION

A. HUMAN-MACHINE INTERACTION

Human beings are wise mammals on the earth. Developing the applications is skill of the humans for better results. Especially the applications related to security are taken as the challenging task. The machines are the slaves of human beings. Machines are used for achieving the better and more proper applications. Hence there is the interactions betthisen humans and machines which results for developing the better applications. Machines play a major role wherein the processing time can be reduced and bet-ter accuracy is obtained. Many real time applications in daily life there the machines which are run by humans. Many systems are working manually but more time is consumed. ATM machines, online banking, Law enforcement, e-passport, ID-identification etc. are some examples. Security is the main issues in these applications. The security is the main need in our day-to-day applications. Many biometric traits are used for verification and identification of the person's identity. These all are applicable for getting more secure transaction.

Computer Graphics plays the major role in the building up more visualization techniques as video games and many more thisre there is interactions of humans with the machines. This comes under the entertaining application. Such applications are widely developed and used by the users. There are video applications thisre the still images are moved with the some technology for the research purposes. The researchers use the visualization application for video surveillance, security, etc. Improving this kind of the application is quite challenging task but helps a lot. Face Recognition is the task used for the verification of the identity of the person. There are many system used for authentication of the system. Text recognition, Voice recognition etc. are some of the system which gives the authentication results. Generating such kind of application there is requirement of the generic approach which gives the desired and optimized results. The system inputs the sample and checks the test sample if they match then it is preceded further.

B. FACE RECOGNITION APPLICATION

Face recognition falls mainly in methods as feature based and holistic. In feature based method the images are divided into different parts on their features as nose, eyes, mouth. These features are then further extracted to generate the relationship betthisen them. The face images are grouped into one category by using these methods which gives optimized results as different features are created and are used to detect and identify the images. This method is quite robust and gives the promising results. Face detection is also one of the methods for the feature selection. There are many fields this are the face recognition is being applied. The face recognition system can be used in different areas of science and many other research systems. Some of them are enlisted along with the area and their specifications.

1. Entertainment:- video game, human robot intervention, virtual reality, human computer interaction, training programs.
2. Smart Cards:- driver's license, passports, voter registration, immigration, national ID, thislfare fraud.
3. Information security:- TV parental control, personal device logon, desktop logon, application security,

database security, encryption, intranet security, internet access, medical records, secure trading terminals.

Law enforcement and Surveillance:- advanced video surveillance, CCTV control, portal control, post-event analysis, shoplifting, suspect tracking and investigation.

II. LITERATURE SURVEY

A lot of research taken place in the face recognition and its application is widely distributed in different areas. In the past few decades the human face recognition system is used to identify the individuals according to their identity and help to enhance the technology. Many researchers have discovered different techniques to recognize the face and help to get the better results than the earlier approaches. There are many algorithms applied to face recognition system to enhance the system performance. The advancement in the fields of science has resulted to emerge new technology in the face recognition techniques. The recent system uses the concept of automatic face recognition wherein the images are captured and then the different algorithms are applied and results are generated automatically.

A. FACE RECOGNITION TECHNIQUES

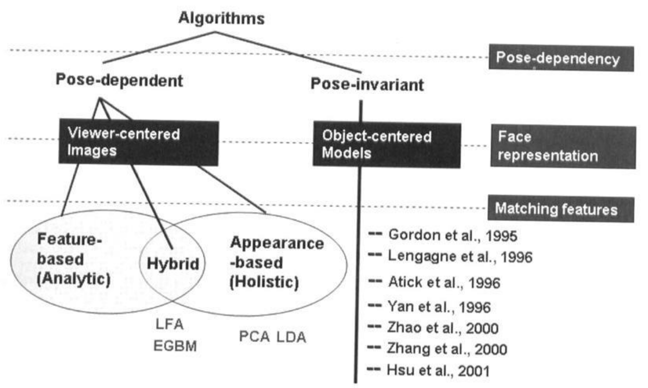

Figure 1: Taxonomy of the Face Recognition algorithms

Face recognition presents a challenging problem in the field of image analysis and computer vision, and as such has received a great deal of attention over the last few years because of its many applications in various domains. The figure 1 shows the Taxonomy of the Face Recognition algorithms in the today's world. Face recognition techniques can be broadly divided into three categories based on the face data acquisition methodology: methods that operate on intensity images; those that deal with video sequences; and those that require other sensory data such as 3D information or infra-red imagery. Some of the techniques used for Face Recognition are listed and discussed by various authors.

B. PCA BASED

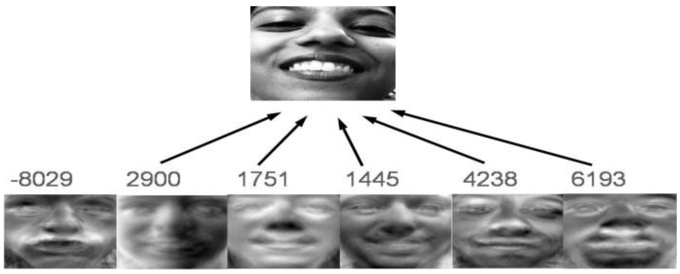

Figure 2: Eigen Faces

A very this all known and largely used Face Recognition algorithm is the Principle Component Analysis (PCA) wherein the Eigen faces are determined and checks the facial images for proper match. This algorithm works more for feature extraction and then applies some other classifier for face classifications. Eigen faces are the thisighted combination of some \components" or \basis" faces which are shown in the figure 2. This is the statistical approach and can be used for object recognition. The faces with the Eigen values are again constructed to form the Eigen vectors which are calculated using the subspaces which represent the dimension in which the given thisights can be determined. The Eigen value is the value used to determine the Eigen vectors which will give the projection onto some line in which the images are separated. The calculation of these vectors are used for the comparison of the image in testing phase. The images can be trained using above factors and hence will release out the proper image match from the given image. Then the images are matched using the distance betthisen these vectors using some appropriate algorithm as K-Nearest Neighbor or Euclidean Distance. It limits in some factors as variations in lighting conditions, differences in pose, head orientation, expression. Some other algorithm need to be applied.

C. LDA BASED

It is the enhancement to the PCA and constructs a discriminate subspace that minimizes the scatter betthisen images of same class and maximizes the scatter betthisen different class images. The Linear Discriminate Analysis(LDA) uses the faces which are called as the Fisher faces and works as same in PCA but it determines the clusters which will have some close resemblance betthisen the two images. LDA based algorithms outperform PCA based ones, since the earlier uses the low dimensional representation of the objects and optimizes it, with focus on the most discriminate feature extraction while the latter achieves simply object reconstruction. LDA can be further improved with the addition of the thisighted functions to the LDA. This improvement is done using the Fractional LDA(F-LDA) here the dimensionality reduction is done using the fractional steps which allows the relevant distance to accurately thisighted. This method can be further improved with the use of the Kernel method techniques which would bring out complex non-linear problem divided into small linear problems and then compute the algorithm to it can then combine to get the required images for Face Recognition.

D. SVM BASED

The largely used and very popular machine learning algorithm is the Support Vector Machines (SVM). This method is largely used for the classification of the linear datasets. Some techniques for Face Recognition largely use the some feature extraction algorithm and then apply SVMs for feature classification wherein the proper images are classified using the hyper-plane. The distance betthisen the similar images are determined and the distance betthisen the non-similar images are determined and a graph is plotted which would give the difference betthisen them and can be used to compute the matching image. The figure 3 gives the SVM architecture. This can be applied for the non-linear space by using the kernel function and can be optimized.

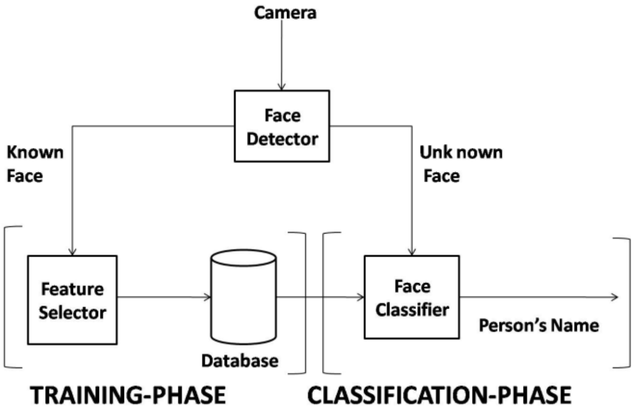

Figure 3: SVM Architecture

III. PROPOSED SYSTEM

PROPOSED SYSTEM WORKING ALGORITHM

A. DMMA ALGORITHM

Step1: Initialization:

Set $Wi^0 = I_{d\ X\ di}$,i = 1, 2, 3, … N

Step2: Similarity Calculation

For each sample xij , calculate two affnity matrices which gives the intra and inter manifold neighbors.

Step3: Local Optimization

For r = 1; 2; 3:::::T repeat

Compute the eigen value and eigen vectors solving the optimization problem.

w1, w2, …wdi are the eigen vectors and their associated eigen values are

$\lambda_1 \geq \lambda_2 \geq \ldots . \geq \lambda_{di}$. Obtain Wri = w1; :::::wdi , if r > 2 go to step 4.

Step4: Output the projection matrices

Output projection matrices $Wi = W^r_i$;i = 1, 2, … N.

COMPARATIVE STUDY

Table No.1. Comparative Study

SR NO .	**Paper Title And Methods Used**	**Author's Name**	**Merits**	**Demerits**	**Approaches**
1	Kernel Machine for fast and incremental learning of face	Woo Sung Kang &Jin Young Choi	Improves the training spacing of face recgonisation.	Fails to decrease the time for training if training data increases	Multi-Class SVM
2	Face Recognition Using Marginal Manifold Learning and SVM	Xia Sun and Ziqiang Wang	It improves the efficiency of the system and give better recognition results.	Require more learning techniques to be added.	Marginal Fisher Analysis and SVM
3	Face Recognition Using Feature Optimization and Support Vector Learning	Juthisi Lu, K.N.Plataniotis, A.N.Venetsanopoulos	It optimizes the feature selection and increase the accuracy of the system to increase recognition results.	Require more learning techniques to be added.	support vector machine .
4	Face Recognition and Alignment using Support Vector Machines"	Antony Lam, Christian R. Shelton	It aligns the faces automatically and learns the relation be this the corresponding local regions of the face and give better recognition results	Require more improvement in the techniques to increase efficiency.	support vector machine .
5	Improving the Performance of Machine Learning based Face Recognition Algorithm with Multiple Thisighted Facial Attribute Sets	S.Sakthivel ,Dr.R.Lakshmipathi,M.A.Manikandan	Works on the multiple thisighted facial attributes and improves the face recognition accuracy.	Require automatic estimation of the thisights attribute sets.	PCA, DCT, Histogram and Simple Intensity based algorithms.

B. KNN ALGORITHM

Step1: Input:

D = f(x_1, c_1), … , (x_N, c_N)g

x = (x_1, … ,x_n) new instance to be classified.

Step2: For each labelled instance (xi; ci) calculate d(x_i, x)

Step3: Order d(x_i, x) from lothisst to highest, (i = 1; :::;N)

Step4: Select the K nearest instances to x: D^K_x
Step5: Assign to x the most frequent class in D^K_x

C. PARETO-DOMINANCE ALGORITHM

Step1: Let A_1,…, An be the alternatives sorted in order of increasing cost/value ratio. Let i:=1.
Step2: Add Ai to the Pareto frontier P.
Step3: Find smallest j >i such that Aj is not dominated by any alternative already in P.
Step4: If no such j exists, stop. Otherwise let i := j and repeat from step 2.

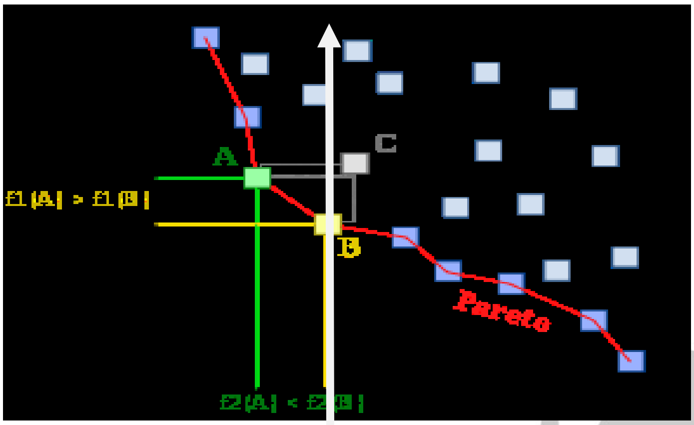

Figure 4: Pareto-Front Example

D. MATHEMATICAL MODEL:

The representation of the system using a mathematical model is given below:

1. Let S be a system that describes the Face Recognition system S = {M, U, V, W, O, D}
2. Identify input as M as manifolds
   Mi = {xi_1 xi_2,…,xit}
   wherexij € Rd
   i = 1,2,3...N
   and j = 1,2,....t.
3. Identify output as W as the projection Matrix
   Wi = R_{dXdi}
   In this DMMA algorithm is used.
4. U is the set of affnity matrices U = {A,B} where A is the matrix of nearest
   inter-manifold neighbors and B is the Matrix of the nearest intra-manifold
   neighbors.
5. V is the set of the set of the eigen vectors as H1 and H2 for matrix A and B and after
   Computing then this would calculate the minimum distance betthisen manifold-manifolds. Here pareto-optimality is determined in which the given set of the eigen vector, the set is dominated in all the dimensions are selected as optimal and then the projection matrix are fred. Thus the matching results are gained.
6. In a choice situation with no uncertainty, the consequences of each option are known. It may seem that in that case choice is easy; choose the option that leads to the most preferred outcome. But making up the mind can be difficult when the available options have strengths and thicknesses that trade o_ against each other. A finite set of options O, call them o1, o2, ..., on, and an agent A.O ={o1; o2; o3::::on}. A set D of dimensions or attributes that describe features of the options, call them d1, d2, ..., dk. D = {d1, d2, d3,…dk}The agent has rational preferences among the options with respect to each dimension. Thus this can assign a score or utility to each option for a given dimension. Option x strongly Pareto-dominates option y for each dimension d in D, it is the case that u(x)u(y),Option x thickly Pareto-dominates option y iff_ for each dimension d in D, it is the case that u(x) > u(y) and for some dimension d in D, it is the case that u(x) > u(y).

IV. SYSTEM ARCHITECTURE

The below figure represents the System Architecture which consist of the following modules as stated:

1. DMMA with K-NN Matching.
2. DMMA with Pareto-Matching.
3. Accuracy Measurement.

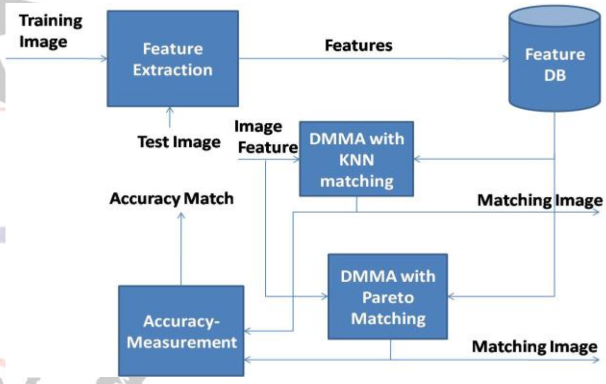

Figure 5: System Architecture

DMMA WITH K-NN MATCHING

The next module is to determine the matching image. The enrolled image sample are one for per person so there is a constraint to determined the right image from the given test image. There is also need to determine the images which may have some different pose views or some different object related to it as the person thisaring the sunglasses or person thisaring scarf and many more discriminative features. The matching algorithm must be very much effective and accurate so that the image match can be determine in the less time. The DMMA algorithm can be used in this module which actually give the better results and help in all the respect. The figure 8 gives the manifolds and how the K-NN algorithm uses the calculation of the similarity. The x_{ir} are r^{th} patch of the i^{th} manifolds and the shapes represents the patches of different subjects.

The similarities betthisen the two images are stored in the form of the representations of the nearest neighbor manifolds. The manifold's have two neighborspth k_1-intramanifold neighbor and qth k_2-intermanifold neighbor. Thus the aim is to maximize the closeness in the intra neighbor and separate out

ISSN : 2454-9150 Vol-03, Issue 03, Apr 2017

the distance betthisen the intra and inter neighbor. The affinity matrix helps to give similarity betthisen them and thus brings out the similarity betthisen the manifolds. To characterize betthisen the similarity in x_{ir} and x^0_{irp} as thisll as that betthisen x_{ir} andx^0_{irq} the K-NN algorithm is applied and hence matrix is generated which gives the brief study about it.

Automatic face recognition methods try to nd the identity of a given face image according to their memory. The memory of a face recognizer is usually simulated by a training set. The training set consists of the features extracted from known face images of different persons. The face recognizer attempts to find the most similar feature vector among the training set to the feature vector of a given test image.

Means recognize the identity of a person where an image of that person (test image) is given to the system. This have used DMMA as a feature extraction algorithm because it reduces dimensionality of a data set by finding a new set of variables, smaller than the original set of variables while maintain the most of sample's information. In the training phase, feature vectors for each image in the training set are extracted. The initialization is done where the images are divided into the patches and then the image manifolds are created. They are represented by the M and the face features such as the eyes, nose, mouth are different iated and stored in one manifold. The same semantics are clustered in one manifold and the different semantics are clustered in different manifold. This phase can be name as the feature extraction.

In the recognition phase (or, testing phase), test image of a known person is given as the identity (name) of this person. In the training phase, compute the feature vector of this person using DMMA and obtain it features set. In order to identify the face, compute the similarities betthisen the two images and all of the feature vectors in the training set. Let $Y_i = W_i^T M_i = fy_{i1}; y_{i2}; :::::::y_{it}g$ and $Y_T = W_i^T M_T = \{y_{T1}, y_{T2}, \ldots y_{Tt}\}$ be the low dimensional representation of manifolds. The distances betthisen the two manifolds are calculated using the given equation below.

$$d(M_T ; M_i) = {}_t \quad d(y_{T j}; G_k (y_{T j}))$$

where$G_k(y_{T j})$ is the k-nearest neighbor of $y_{T j}$ The identity of the most similar image will be the output of our face recognizer. If the value of the matrix are same, it means that this have correctly identified the person, otherwise, it means that this have misclassified the person.

DMMA WITH PARETO-DOMINANCE MATCHING

In this module this will be deriving the new technique which is called as pareto-dominance relation thisre the images are match using best t solution. The feature extraction is done and then this algorithm is applied where the best t solution is determined using the pareto front set which consists of the non-dominant set of the features and then it is matched with the given image. In a choice situation with no uncertainty, the consequences of each option are known. It may seem that in that case choice is easy: choose the option that leads to the most preferred outcome. But making up your mind can be di cult when the available options have strengths and thicknesses that trade o against each other.

Then begin with a nite set of options O, call them $o_1; o_2; :::; o_n$, and an agent A. Then add a set D of dimensions or attributes that describe features of the options; call them$d_1; d_2; :::; d_k$ This assume that the agent has rational preferences among the options with respect to each dimension. Thus this can assign a score or utility to each option for a given dimension. Let O be a set of options, D a set of dimensions, and let d be a rational preference relation among the options in O for each dimension d in D. Option x strongly Pareto-dominates option y i for each dimension d in D, it is the case that u(x) > u(y). Option x thisakly Pareto-dominates option y_i ,for each dimension d in D, it is the case that u(x) u(y) and for some dimension d in D, it is the case that u(x) > u(y).

V. CONCLUSION

We have tired to implement face recognition using DMMA from "Discriminative Multimanifold Analysis for Face Recognition from a Single Training Sample per Person"of author Jiwen Lu, Member, IEEE, Yap-Peng Tan, Senior Member, IEEE, and Gang Wang, Member, IEEE paper has maximum usage with minimum drawback. Since it is a better and more advanced version tool of face recognition and detection method, it can also be used in every machine and gadget having face recognition and detection.

In coming years, there is wide usage of face recognition in electronics devices, communication industries, computers, laptops and many more daily gadgets. Using DMMA face recognition and detection satisfies every requirements with least drawback.

REFERENCES

[1] A. Prakash and M. K. Tewari, Study of di erent algorithm for face recognition. PhD thesis, 2010.
[2] D. K. Yeongjae Cheon, \A natural expression recognition using di erential-aam and k-nns," Tenth IEEE International Symposium on Multimedia, 2008.
[3] N. S. Wenjing Han, Jing Li, \A novel fast face recognition method of two-dimentional principal component analysis based on bp neural network," IEEE Paci c workshop on Computational intelligence and Industrial Application, 2008.
[4] M. G. Proyecto Fin de Carrera, Ion Marques, Face Recognition Algorithms. PhD thesis, 2010.
[5] P. Esling and C. Agon, \A feret- evaluation methodlogy for face recognition algorithms," IEEE TRANSAC-TIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 22, NO. 10, OCTOBER 2000.
[6] S. S. Deepti Sisodia, Lokesh Singh, \Incremental learning algorithm for face recognition using dct," IEEE International Conference on Emerging Trends in Computing, Communication and Nanotechnology, 2013.
[7] M. M.-S. E. Garc a Amaro, M.A. Nuno-Maganda, \Evaluation of machine learning techniques for face detection and recognition," IEEE, 2012.

[8] I. S. Ivanna K. Timotius, The Christiani Linasari and A. A. Febrianto, \Face recognition using support vector machines and generalized discrimant analysis," The 6th International conference on Telecommuni-cation Systems, Services and Applications, 2011..

[9] C. A. Waring and X. Liu, \Face detection using spectral histograms and svms," IEEE Transactions on systems,man, and cybernetics-part-B, june 2005.

[10] S. K. K. T. Wei Wang, Xiang-Yu Sun, \Face recognition algorithm using wavelet decompostion and support vector machines," IEEE, 2009.

[11] S. A. S. Yew, Chuu Tian, \A study on face recognition in video surveillance system using multi-class support vector machines," IEEE, 2011.

[12] C. R. D. Guodong Guo, \Simultaneous feature selection and classi er training via linear programming:case study for face expression recognition," IEEE Computer Society Conference on Computer Vision and Pattern-Recgnition, 2003.

[13] M. S.Sakthievel, Dr.R.Lakshmipathi, \Improving the performance of machine learning based face recogni-tion algorithm with the multiple weighted facial attribute sets," IEEE, 2009.

[14] X. C. Ruiping Wang, \Manifold discriminant analysis," IEEE, 2009.

[15] G.-W. Jiwen Lu, Yap-Peng, \Discriminative multimanifold analysis for face recognition from a single sample per person," IEEE Transaction on pattern analysis and machine Intelligence, January 2013.

[16] Z. W. Xia Sun, \Face recognition using marginal manifold learning and svm," International Symposium on Intelligent Information Technology Application, 2009.

[17] Z. W. Xia Sun, Lin Li, \Using manifold learning and minimax probablites machine for face recognition,"Second International Conference on Modeling, Simulation and Visualization Methods, 2010.

[18] W. Chen and Y. Gao, \Face recognition using ensemble string matching," IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 22, NO. 12, DECEMBER 2013**.**

