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Comparison of Z_N N Algorithm with exiting Algorithms

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Abstract
Human face recognition is best application in pattern recognition for identification and recognition. Development of face recognition system is increasing day by day in market and research organizations. Different parameters and methods are used for face recognition. In this paper we will discuss about the different algorithms used for face recognition that are Principal Component Analysis (PCA), Independent Component Analysis (ICA), Linear Discriminate Analysis (LDA), Zernike Moments (ZMs), Neural Network (NN), Support Vector Machine (SVM) etc. and compare these algorithms with proposed algorithm Z_NN. Z_NN algorithm provide best recognition rate for human face recognition 97%. In this algorithm we use Zernike Moments and correlation for global feature extraction and after that these features are compared by using neural network.

Keywords—image processing; Zernike Moments; Neural network; Face Recognition .

INTRODUCTION

Face recognition is a growing research area in biometrics; this is the only one characteristic of human body which has more than 180 points to differentiate one person to another [5]. There are many techniques are used for face recognition and research is also going on but still face recognition is not perfect as real time applications against lighting effects and other poses [16]. Every face recognition system is developed on the basis of some features of human face that may be local or global; local features are those in which features are collected from different parts of face like difference between two eyes, width of nose etc. Face is the unique identity of every person by which we can recognize each other, this is the most commonly method of every person to recognize other person at first look. Basically face recognition is a method to search other image of face with matching features of one image. This technique was started to identify the criminals and authorized person for any secure entry. Now this system is common in schools, colleges and industries for attendance purposes. This is a cheap technology for restriction to unauthorized person. This technology is used to stop fake identification and driver's fake licenses. Yet face recognition is a good and fast growing technology in computer vision but it has many challenges to find a right person against different poses, makeup, wearing glass, light effects and different moods. This would be most useful technology of the world for easy recognition.

Steps for face recognition:
Facial recognition is including five steps to complete their process.
Step1: Acquiring an image for recognition, there are two ways to acquire an image either from database or direct take from camera.
Step2: Find the location of face in that image.
Step3: Extract feature from image that can be local or global.
Step4: Compare the extracted features with the help of software we are using for recognition.
Step5: Decision will generated if the face is recognised then provide the identity of that face otherwise that face is unknown.

RELATED WORK

1 PCA

Essential part examination (PCA) is a factual technique that uses an orthogonal change to change over an arrangement of perceptions of perhaps corresponded variables into an arrangement of estimations of straightly uncorrelated variables called chief segments. The quantity of essential parts is not exactly or equivalent to the quantity of unique variables. This change is characterized in such a route, to the point that the first important part has the biggest conceivable fluctuation (that is, records for however much of the variability in the information as could be expected), and every succeeding segment thusly has the most elevated difference conceivable under the limitation that it is orthogonal to (i.e., uncorrelated with) the former segments. The vital parts are orthogonal in light of the fact that they are the eigenvectors of the covariance lattice, which is symmetric. PCA is touchy to the relative scaling of the first variables.

TABLE.1. PCA Algorithm

PCA Algorithm
1. Mean center the data (optional)
2. Compute the covariance matrix of the dimensions
3. Find eigenvectors of covariance matrix
4. Sort eigenvectors in decreasing order of eigenvalues
5. Project onto eigenvectors in order
6. Assume data matrix is B of size m x n
7. For each dimension, compute mean μ_i
8. Mean center B by subtracting μ_i from each column i to get A
9. Compute covariance matrix C of size n x n
a. If mean centered, $C = A^T A$
10. Find eigenvectors and corresponding eigenvalues (V,E) of C
11. Sort eigenvalues such that $e_1 \geq e_2 \geq e_3 \geq e_4 \geq e_n$
12. Project step-by-step onto the principal components v_1, $v_{2,\ldots}$ Etc.

TABLE.2. ICA Algorithm

ICA Pseudo code
1) Center x (remove the mean from x)
2) Whiten x (uncorrelated components)
3) For I = 1 to n
a) W = random vector
b) Orthogonalize initial vector W in terms of the previous components
c) Normalize W
d) While (W not converged)
i) W = approximation of negentropy of $W^T X$
ii) Orthogonalize W in terms of the previous components
iii) Normalize W
e) End while
f) W(i,:) = W;
4) End for
5) S = W*whiteindex
6) Return S

2 ICA

Free segment examination (ICA) is a measurable and computational strategy for uncovering shrouded elements that underlie sets of irregular variables, estimations, or signs [17]. ICA characterizes a generative model for the watched multivariate information, which is normally given as a huge database of tests. In the model, the information variables are thought to be direct blends of some obscure idle variables, and the blending framework is additionally obscure. The idle variables are accepted non-gaussian and commonly free, and they are known as the autonomous parts of the watched information. These autonomous segments, additionally called sources or variables, can be found by ICA. ICA is externally identified with chief segment investigation and element examination. ICA is a significantly more effective strategy, then again, equipped for discovering the fundamental components or sources when these fantastic techniques fizzle totally. The information broke down by ICA could begin from a wide range of sorts of utilization fields, including computerized pictures, report databases, financial pointers and psychometric estimations. Much of the time, the estimations are given as a situated of parallel flags or time arrangement; the term visually impaired source partition is utilized to describe this issue. Common samples are blends of concurrent discourse flags that have been gotten by a few mouthpieces, cerebrum waves recorded by numerous sensors, meddling radio signs landing at a cellular telephone, or parallel time arrangement got from some modern procedure.

3 SIFT

SIFT is the most prevalently utilized interest point descriptor. It is fundamentally used to discover stable interest focuses in items or scenes [16]. Since the presentation of scale invariant feature transform (SIFT), the numerous PC vision calculations have been centered around neighborhood highlights for item discovery, scene acknowledgment, picture coordinating and so forth. Filter is scale invariant component change. These components are utilized most prominently for coordinating comparative articles or scenes. These elements are invariant to scale and revolution which means SIFT components are hearty to change in scale or pivot of item.

TABLE .3. SIFT Algorithm

Algorithm 1: Scale Invariant Feature Transform
i. Detection of scale-space extrema- first stage of algorithm searches locations that are invariant to scale changes. This can be found by searching extrema in Difference-of-Gaussian (DoG) function at pre-defined scales.
i. Key-point localization- Each pixel is compared with its 26 neighbor pixels to find local maxima or minima. If the local maxima or minima are found at any point, then that point is selected as invariant point. All other points are discarded.
i. Eliminating edge responses- DoG has strong response to edge points. So edge points also need to be rejected.
v. Orientation assignment-Consistent assignment of orientation to key-points makes these features invariant to scale and orientation.

4 PCNN

Pulse-coupled networks or pulse-coupled neural networks (PCNNs) are neural models proposed by demonstrating a feline's visual cortex and produced for elite biometric picture preparing. In 1989, Eckhorn acquainted a neural model with

imitate the instrument of feline's visual cortex. The Eckhorn model gave a straightforward and compelling instrument for concentrating on little warm blooded creature's visual cortex, and was soon perceived as having critical application potential in picture preparing. At the point when the limit drops underneath zero it is reset to a high esteem and the procedure begins once again. This is not the same as the standard coordinate and-flame neural model which aggregates the info until it passes a furthest cutoff and viably "shorts out" to bring about the beat.

Initialize the parameters for the PCNN model.

TABLE.4. PCNN Algorithm

PCNN Algorithm
1. Apply Image processing steps for the pre-processing module
2. Compute weight matrix w for PCNN iteration
3. Y[n] and import image [do “and” operation] on the image matrix
4. Compute the minimum variance
If variance ratio difference is greater than 0
Return to step 3
Otherwise
Circulatory arrest output result Y[n]

5 CFF

A colored picture in the RGB shading space comprises of the red, green, and blue part pictures. Other shading spaces are figured from the RGB shading space by method for either direct or nonlinear changes. The corresponding qualities of shading spaces can be connected to enhance face acknowledgment execution. The study uncovers that melding elements crosswise over shading spaces can upgrade the separating force of the mixture shading components. As the part picture in the RGB shading space is more successful than the luminance, another half and half shading space is characterized, the RIQ shading space, where is from the RGB shading space and are from the YIQ shading space. In particular, the top line demonstrates the R, G, and B segment pictures in the RGB shading space, and the base column shows the Y, I and Q part pictures in the YIQ shading space. The hybrid Color and Frequency Features (CFF) method separates the reciprocal recurrence includes in the new half breed RIQ shading space for enhancing face acknowledgment execution. To start with, the R, I and Q segment pictures in the RIQ shading space are gotten from the RGB shading space. Second, the EFM extricates the reciprocal recurrence elements utilizing diverse covers as a part of the recurrence space from the R, I and Q segment pictures, separately. Third, the correlative components are combined (by method for linking) at the element level to infer similitude scores for characterization. At last, the similitude scores got from the R, I and Q pictures are intertwined (through a weighted summation) at the choice level for face acknowledgment.

Load the image

TABLE.5. CFF Algorithm

Algorithm CFF	
i.	Extract R Component
i.	Extract the Real part
a.	Frequency set selection using 8 x 16 mask
b.	Feature concatenation XRri, 256 x 1
c.	Feature extracted by EFM
i.	Extract the imaginary part
a.	Frequency set selection using 32 x 64 mask
b.	Feature concatenation XRri, 4096 x 1
c.	Feature extracted by EFM
v.	Extract the magnitude
a.	Frequency set selection using 32 x 64 mask
b.	Feature concatenation XRri, 2048 x 1
c.	Feature extracted by EFM
v.	Feature concatenation
i.	Feature extraction EFM

6 Z_NN

Initialize training set: this is the first step of algorithm where we select dataset for n face images.

Extract Features: After the initialization of training set Zernike Moments is used to extract the global features of images that are angle and amplitude, and feature vector set generated by Zernike Moments is further becomes the input of Correlation.

Matching: Now we initialize a Feed Forward Neural Network for matching the features of face images.

Output: If the value of test image feature is equal to the value of image in dataset then output will be the identity of that face, otherwise change threshold value and repeat the process.

This algorithm is designed for face recognition and after the experiment it show better results than other algorithms.

Table.6. Z_NN Algorithm

Z_NN Algorithm

Initialize Tset-I (i-1, 2,3 …….n)
 	
for (Tset-i =1, Tset-i< =Tset(n), Tset(i)++)
{
Extract Fvector(K) Tset(i)
 	
for(Zvector(K)=1, Zvector(K)<=Fvector(last), Zvector++)
{
Apply correlation
 	
For given threshold and last feature vector set
for(Cvector (i) ,Cvector=Fvector(last), Cvector ++)
}
}
 	
Cset(i) = Tset(i)+ Zvector(K) Initialize FNN
 	
for(Tseti=1, FNN (j) =1, Tset-< Tset(n) , Tset(i)++, FNN (j) ++)
{
 	
If (Cset(i) = Tset(j)) Image match exit(1)
else
Change threshold and repeat
}

COMPARISON

Comparison: Proposed technique show better result as compare to existing techniques, when we apply it on a large dataset of images

TABLE.7. Comparison of different algorithms

s.no.	Algorithm	Database	Recognition rate	Advantage	Disadvantage
1	PCA	AR-Faces	70	Reduce dimensionality	Class seperability remain same
2	ICA	FERET	89	Exploits higher order statistics	N/A
3	SIFT	MORPH album 2 FG-NET	83.9	Age-invariant face recognition	It fails when encounters large pose changes
4	PCNN	FRGC version 2 and Yale	85	Facilitates efficient hardware mapping	N/A
5	CFF	FRGC version 2	80.3	Good recognition rate	N/A
6	Z_NN	Face Pix Database	97	Pose variations and high performance rate	

THIS TECHNIQUE ALLOWS RECOGNITION AGAINST POSE VARIATIONS AND AT ANY ANGLE BETWEEN -90 DEGREE TO +90 DEGREE AND PROVIDE BETTER RECOGNITION RATE. THE COMPARISON TABLE OF EXISTING ALGORITHMS AND PROPOSED ALGORITHM IS AS FOLLOWS.

CONCLUSION AND FUTURE WORK

Conclusion: This research shows proposed algorithm Z_NN is much better then exiting algorithms for face recognition. Z_NN algorithm has high recognition rate as compare to other algorithms, it also work against the different poses and light effects. In future work response time may be increased and different classifier can be use with Zernike Moments.

References

1. Marian Stewart Bartlett, , Javier R. Movellan, J. Sejnowski, "Face Recognition by Independent Component Analysis," IEEE TRANSACTIONS ON NEURAL NETWORKS, ISSN 0162-8828, VOL. 13, NO. 6, page no. 1450-1464, Year 2002.
2. Marian Stewart Bartlett, Javier R. Movellan and Terrence J. Sejnowski," Face Recognition by Independent Component Analysis",IEEE, ISSN 0162-8828, VOL. 13, NO. 6,page no 1450-1464, Year 2002.
3. Javad Haddadnia, Majid Ahmadi, Karim Faez, "An Efficient Feature Extraction Method with Pseudo-Zernike Moment in RBF Neural Network-Based Human Face Recognition System," EURASIP Journal on Applied Signal Processing, ISSN: 1687-6180, page no 890-901,Year:2003
4. Javad Haddadnia and Majid Ahmadi "N-feature neural network human face recognition," ELSEVIER, doi:10.1016/j.imavis.2004.03.011, Page no: 1071-1082, Year 2004.
5. Anil K. Jain, Arun Ross and SalilPrabhakar, "An Introduction to Biometric Recognition," IEEE, ISSN 0162-8828 , Vol. 14, No. 1,page number 114-132, Year 2004.
6. Marian Beszedes & Milos Oravec "A System For Localization Of Human Faces In Images Using Neural Networks", Journal Of Electrical Engineering, Vol. 56, No 7-8, Year: 2005.
7. Chong-Yaw Wee, RaveendranParamesran," On the computational aspects of Zernike moments", ELSEVIER, doi:10.1016/j.imavis.2006.07.010, page no. 967-980, Year: 2006.

8. Nabatchian, E. Abdel-Raheem, M. Ahmadi, "Human Face Recognition Using Different Moment Invariants: A Comparative Study", IEEE, DOI 10.1109/CISP.2008.479, page no 661-666, Year 2008
9. Zhiming Liu and Chengjun Liu, "A Hybrid Color and Frequency Features Method for Face Recognition," IEEE Transactions on Image Processing, ISSN 1057-7149, VOL. 17, NO. 10, page no 1975-1980, Year 2008
10. Seyed Mehdi Lajevardi, Zahir M. Hussain, "Higher order orthogonal moments for invariant facial expression recognition," ELSEVIER, doi:10.1016/j.dsp.2010.03.004, Page NO 1771-1779,Year 2010
11. Nor Ashidi Mat Isa, Wan Mohd Fahmi Wan Mamat, "Clustered-Hybrid Multilayer Perceptron network for pattern recognition application,"doi:10.1016/j.asoc.2010.04.017, ELSEVIER, Vol 12, issue 5, page no 1457–1466, Year 2010
12. Tran Binh Long1,Le Hoang Thai2, Tran Hanh, "Facial Expression Classification Method Based on Pseudo-Zernike Moment and Radial Basis Function Network," International Conference on Machine Learning and Computing,IEEE, DOI: 978-1-4244-925 3-4 /11/$26.00, Page no: 310-313, Year: 2011
13. Xin Shu, YaoGao,HongtaoLu, "Efficient linear discriminant analysis with locality preserving for face recognition," doi:10.1016/j.patcog.2011.11.012, ELSEVIER, page no 1892–1898, Year 2011
14. S.Adebayo Daramola and O. Sandra Odeghe, "Efficient Face Recognition System using Artificial Neural Network", International Journal of Computer Applications, ISSN 0123-4560, Volume 41– No.21, Year: 2012
15. Rakesh Rathi , Manish Choudhary , Bhuwan Chandra, "An Application of Face Recognition System using Image Processing and Neural Networks," International Journal of Computer Technology and Applications, ISSN:2229-6093, Vol 3 , issue 1, page no 45-49, Year 2012
16. Chandan Singh, EktaWalia, Neerja Mittal, "Fusion of Zernike Moments and SIFT Features for Improved Face Recognition," International Journal of Computer Applications, ISSN 0975-8887 page no. 26-31, 2012
17. Sundus Y. Hasan,"Study of Zernike moments using analytical Zernike polynomials," Advances in Applied Science Research, ISSN: 0976-8610, Vol 3, Issue 1, page no 583-590, Year 2012
18. Hayet Boughrara, Mohamed Chtourou, Chokri Ben Amar, "MLP Neural Network Based Face Recognition System Using Constructive Training algorithm", IEEE, ISSN 0162-8828, Year 2012
19. Evangelos Sarıyanidi, Volkan Da˘gl, Salih Cihan Tek, Birkan Tun, Muhittin G¨okmen, "Local Zernike Moments: A New Representation for Face Recognition", IEEE, ISSN 0162-8828, page no 585-588, Year 2012
20. chandan Singh, Rahul Upneja, "Fast and accurate method for high order Zernike moments computation",ELSEVIER,doi:10.1016/j.amc.2012.01.040, Page no 7759–7773, Year 2012
21. Ripal Patel, Nidhi Rathod, Ami Shah, "Comparative Analysis of Face Recognition Approaches: A Survey," International Journal of Computer Applications,ISSN: 0975 – 8887, Volume 57– No.17,Page no. 50-61, Year: 2012
22. Aryaz Baradarani n, Q.M.Jonathan Wu,Majid Ahmadi, "An efficient illumination invariant face recognition framework via illumination enhancement and DD-DTCWT filtering," ELSEVIER, DOI 10.1016/j.patcog.2012.06.007, Vol 46, issue 1, page no 57–72, Year 2013
23. Renu Bhatia, "Biometrics and Face Recognition Techniques ",International Journal of Advanced Research in Computer Science and Software Engineering", Volume 3, Issue 5, Year 2013
24. C. Saravanan, M. Surender, "Algorithm for Face Matching Using Normalized Cross-Correlation", International Journal of Engineering and Advanced Technology, ISSN: 2249 – 8958, Volume-2, Issue-4 , page no 930-934, Year 2013
25. Divyarajsinh N. Parmar, Brijesh B. Mehta, "Face Recognition Methods & Applications," International Jounal ofComputer Technology & Applications, ISSN:2229-6093, Vol 4, issue 1, page no.84-86, Year 2013
26. Omaima N. A. AL-Allaf, Abdelfatah Aref Tamimi, Mohammad A. Alia," Face Recognition System Based on Different Artificial Neural Networks Models and Training Algorithms," International Journal of Advanced Computer Science and Applications, ISSN 2156-5570, Vol. 4, No. 6, Page no: 40-47, Year: 2013
27. Hoda Marouf and Karim Faez ,"An Efficient feature extraction method With Pseudo-Zernike moment for facial Recognition of identical twins," International Journal of Computational Science and Information Technology, DOI:10.5121/ijcsity.2014.2101, Vol.2, No.1, page no 1-7, Year 2014
28. Surabhi Varshney, Deepak Arya, Rashmi Chourasiya, "Face Recognition Techniques Using Artificial Neural Networks", International Journal of Engineering Research and Applications, ISSN: 2248-9622, Page no. 44-48, Year: 2014
29. Hoda Marouf and Karim Faez, "An efficient feature extraction method with Pseudo-Zernike Moment for facial recognition of identical twins," International Journal of Computational Science and Information Technology, DOI : 10.5121/ijcsity.2014.2101Vol.2, No.1, Year: 2014
30. Yaniv Taigman, Ming Yang, Marc'Aurelio Ranzato, Lior Wolf "DeepFace: Closing the Gap to Human-Level Performance in Face Verification," IEEE, DOI: 10.1109/CVPR.2014.220, page no. 1-8, Year: 2014