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Face Recognition Using Zernike Moments, SIFT and Feed Forward Neural Network

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ABSTRACT: Biometrics refers to measure of any human trait for various purposes. Face is also an important human trait that can be measured and utilized for various purposes. Face recognition has gotten a lot of consideration in the course of the most recent couple of years in light of its numerous applications in different spaces. A great deal of face recognition algorithms have been produced amid the previous decades. These algorithms can be applied on face image to extract various local and global features from a face. In this paper we present Zernike moments and SIFT for extracting features from a face. Zernike moments are a fine method used for extracting global features of a face. Scale Invariant Feature Transform (SIFT) is method used for extracting local features of face. These techniques overcome various challenges in face recognition such as variance in pose, expression, scale, illumination and ageing. Features extracted using Zernike moments and SIFT can be fed into neural network for training and testing.

KEYWORDS: Face recognition, global features, local features, neural network, Zernike Moments, Verification.

I. INTRODUCTION

With time identity verification has turned out to be progressively necessary. People are required to be verified and identified before granting access to any information access system so as to ensure security of information. From long time methods like passwords, tokens and cards etc. are used. But these methods seldom prove risky for many crucial system access applications as they can be stolen, forgotten or revealed. Thus, use of biometric traits for security purposes proves to be more beneficial as they overcome several demerits of traditional methods used in security systems. Biometrics uses certain human measurable features. Among biometrics attribute face is the most common method to distinguish individuals.

Face is an important trait that can be used for recognition of individuals. As face of every individual is unique, so this property of face plays an important role in identification of an individual among a group of individuals. Before using a face for recognition a face, various features are to be extracted from a face. There are two categories of features that can be extracted from face – local and global features. Global features take into account the overall face and find out from overall image like amplitude, histogram etc. Local features consider local points in an image such as distance between various local features like nose and eyes, width of cheeks etc. Many techniques are available for extracting global and local features from an image. Zernike moments is the best global feature extraction method and SIFT is the best local feature extraction technique.

Two methodologies are followed for face recognition. These are image processing and artificial intelligence. Image processing implies extraction of features using techniques like Zernike moments and SIFT. Artificial intelligence is utilized for pattern recognition and classification. In the proposed algorithm Zernike Moments and SIFT are used for image processing and Neural Network is used for artificial intelligence. The principle target of this paper is to introduce accurate and high exactness human face recognition system utilizing Zernike moments, SIFT and neural network.

A. ZERNIKE MOMENTS

Zernike Moments is a feature extraction technique. It is used to extract global features from an image. ZMs are the features generated by transforming the input image on a complex set of Zernike functions. This strategy deals with unit circle which is produced over the face in picture. The pixels located outside the circle are not involved in calculation [13]. Then, it calculates the origin of the face to find the angle of the face. It provide a good recognition rate as the

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features extracted using it are invariant to changes in pose of the face. Rotating the image does not change the magnitudes of its Zernike moments [9]. These Zernike moments have ended up being better as far as their component representation capacity, quick calculation, multi-level representation for depicting the shapes of patterns and low sensitivity towards noise. We can calculate the Zernike moments using following equation [13]

$$A_{mn} = \frac{m+n}{\pi} \int_x \int_y f(x,y)[V_{mn}(x,y)] * dx\, dy \qquad (1)$$

$where\ x^2 + y^2 \leq 1$
Here n refers to the order of the object and m refers to the number of moments of object.
Angle and amplitude of images are calculated from Zernike Moments which helps to identify correct picture.

B. SIFT

SIFT (Scale Invariant Feature Transform) is also a feature extraction technique which is used to extract local features from an image. SIFT features have numerous properties that make them suitable for matching various pictures of an object such as invariance to picture scaling and rotation (partial) occlusion and to a certain extent also to changes in illumination and 3D camera view point [10]. SIFT technique works in four steps. In first step a number of interest points called key points are detected in a picture. Location of potential key points is detected by calculating maxima and minima of difference of Guassian filters. Second step refines the key points by discarding points of low contrast. In third step orientation is assigned to all the key points. In fourth step a local descriptor is assigned to each key point. A vector of dimension 128 is assigned for identifying the neighborhood around each key point. While matching feature vectors of two pictures, a simple Euclidian distance measure is utilized. A feature is considered matched with another feature when the distance to that feature is less than a specific threshold T of the distance to the next nearest feature. Then, the number of false matches can be reduced [14]. The SIFT features are greatly distinctive of pictures. It can match and recognize face images of variant sizes.

C. NEURAL NETWORK

Neural Networks, or more precisely artificial neural networks, are a branch of artificial intelligence [1]. An Artificial Neural Network (ANN) is a data processing model based on human biological nervous system. It consists of a number of neurons. Information is passed from one neuron to another, to solve a particular problem. Information passes through one neuron to other with the help of synaptic. This system can be trained for pattern recognition or classification. Neural networks are usually arranged in the form of various layers. Input values are passed to the neural network through the 'input layer'. The input layers communicate with one or more 'hidden layers'. Hidden layers perform the actual processing through a system of weighted 'connections'. The hidden layers are then connected to an 'output layer'. Output layer provides the final result given by neural network.

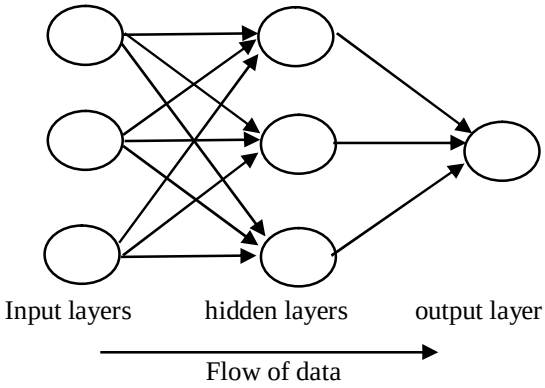

Fig. 1 Architecture of Neural Network

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In this system we use Feed Forward Neural Network with Back Propagation. In this FFNN makes use of activation function. Activation function is used to scale up the output of different layers in Neural Network. Back Propagation is a common method by which we can train the network. Weight Matrix of Neural Network is adjusted with training process to produce required results. In this system the value of perceptron depends upon the inputs and their weight values. In the implementation of perceptron we create a threshold value and assume if the result will be greater than the value output will be one otherwise zero.

D. OBJECTIVE

The main objective of the proposed approach is to generate an algorithm for face recognition that recognizes face with high accuracy. Also it aims to provide face recognition with variance in pose, scale, translation and partially with illumination. As face recognition is widely applicable in many security systems, since achieving face recognition with high accuracy is at most necessary. For this many algorithms and techniques are developed to make face recognition highly efficient and accurate. Zernike moments and SIFT are also one of those techniques. When Zernike moments and SIFT are used to extract features from face and these features after being fed into neural network, this helps to achieve high accuracy in face recognition. It recognizes faces at various poses and scales. It is more advantageous as compared to use of passwords or tokens as it does not suffer from the fear of being lost, forgotten or stolen. Thus face recognition as provided by Zernike moments and SIFT helps to achieve high accuracy and many useful applications.

II. RELATED WORK

Various techniques and algorithms have been developed for face recognition.

Henry A. Rowley et. al [2] presented a neural system based upright frontal face recognition framework. In this small windows of a picture are examined by a retinally connected neural network and a decision is made whether every window contains a face. Javad Haddadnia et al [3] applied Pseudo Zernike Moments (PZM) for recognition of human faces in two-dimensional pictures and Radial Basis Function (RBF) neural system is used as classifier for this application. Marian Stewart Bartlett et al [4] paper offers an algorithm Independent Component Analysis for face recognition. In this two approaches are used for recognition first is that in which random variables are images treated as input and output will produce in pixels form. Second approach is that in which random variables are pixels treated as input and output comes in the form of images.

S. Adebayo Daramola et al [12] projected a sturdy face recognition system. Within the projected system, 2 level haar ripple network is employed to decay frontal face image into seven sub-image bands. Thenceforth eigenface feature is extracted from these bands. The feature is given as input to the classification algorithmic rule supported Back Propagation Neural Network (BPNN). Wei Ge et al [14] proposed a SIFT strategy to research on face acknowledgment with variation expression. Two tests utilizing SIFT strategy are performed on a variation appearance face database. In test 1, two pictures of one individual with various expressions are compared. In test 2, two pictures of various persons with the same expression are thought about. R. Pavithra et al [20] presents face recognition based on granular computing and robust feature extraction using Scale Invariant Feature Transform (SIFT) approach.

III. PROPOSED ALGORITHM

A. METHODOLOGY:

Methodology of the proposed work extracts features using Zernike moments and SIFT. These features are then fed into neural network for training. Again features of the image to be tested are extracted and fed into the neural network for testing. Neural network compares the test data with the trained data and a result is declared accordingly that whether the image exists in the database or not. Following flowchart shows the working of proposed system :-

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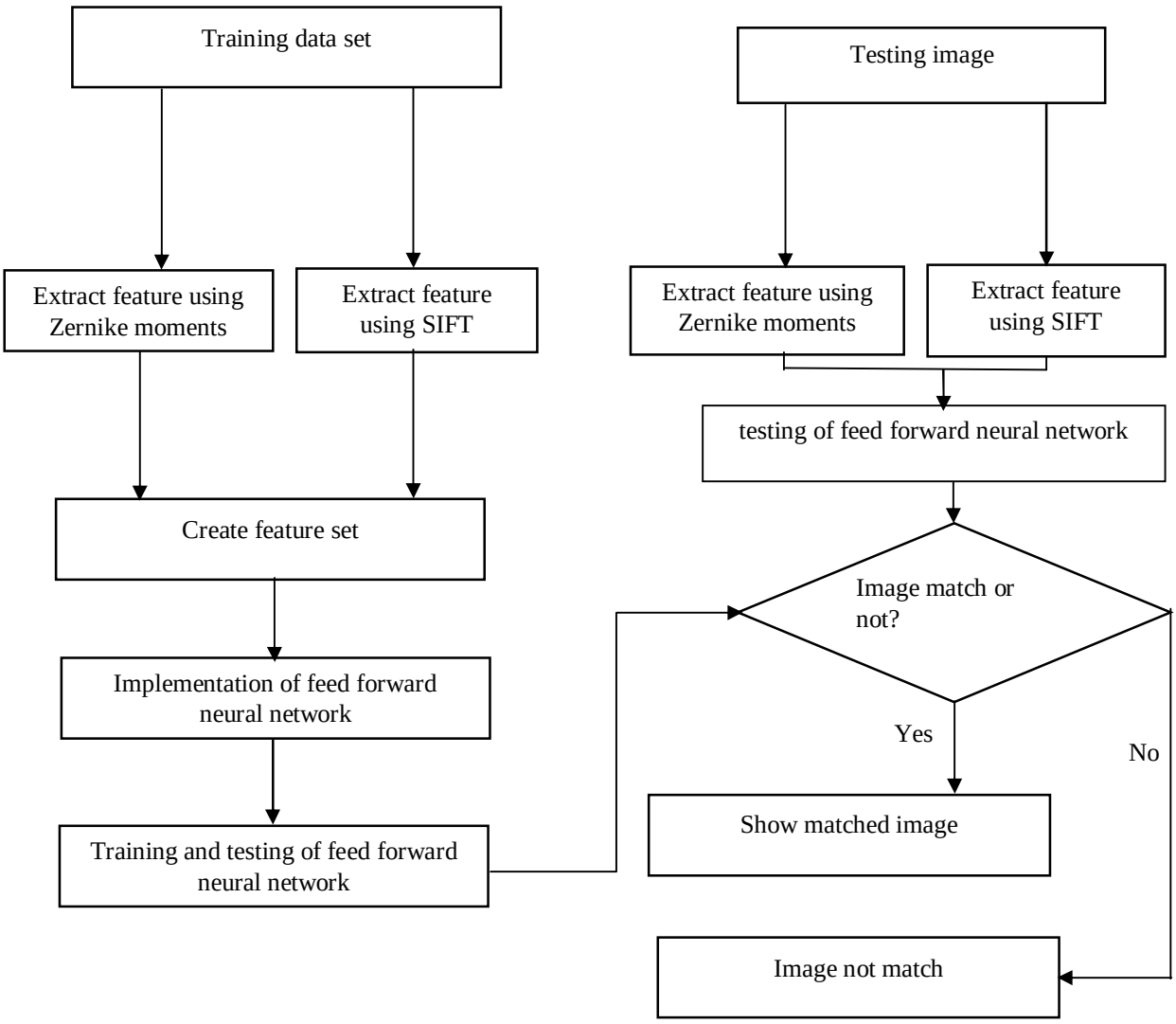

Fig. 2 Flow chart of proposed work

*B. **ALGORITHM***

Proposed algorithm extracts features using Zernike Moments and SIFT. These extracted features are then fed into neural network for training as follows:-

1. Prepare the database.
2. Add images to the database 1 by 1.
3. Calculate the Zernike Moments of each image for global features.
4. Calculate SIFT of each image for local features.
5. Remove unstable keypoints from local SIFT features i.e. low contrast points and poorly localized points along the edges.
6. Select the test image.

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7. Calculate Zernike Moments and SIFT of test image.
8. Run the neural network.
9. SIFT features and Zernike Moments of the database are input to neural network for training and calculate the weights of neural network.
10. Pass the test image values to neural network.
11. Compare the test image values with database values to find out the matching image.

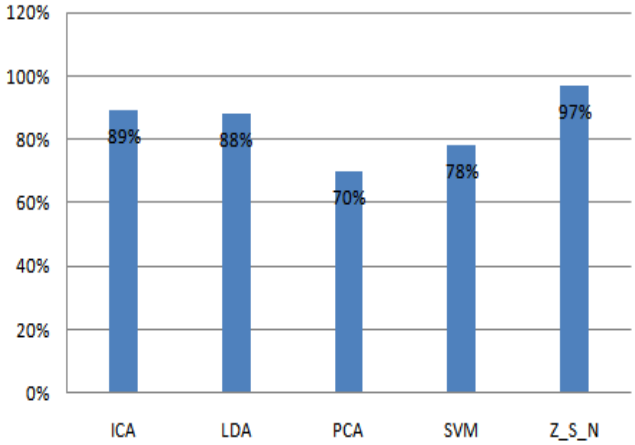
IV. RESULTS AND DISCUSSION

When applied on a large data base of pictures the proposed methodology gives superior results as compared to existing techniques. We tested the proposed technique on face pix database which contains images of 90 various people having every persons' 74 images at various angles from -90 degree to +90 degree. It provides recognition of images at various poses. So the technique shows high recognition rate even at different poses as we tested it on images between -90 degree to +90 degree. A recognition rate of 97% is noted after testing the technique on the database of images. It offers a high recognition rate as compared to other techniques for face recognition.

TABLE 1 Comparison of various face recognition algorithms

S. No.	Algorithm	Database	Performance rate
1.	ICA	FERET	89%
2.	LDA	AR-Faces	88%
3.	PCA	AR-Faces	70%
4.	SVM	FERET	78%
5.	Z_S_N	Face Pix	97%

Table 1 shows the difference of performance rate between the various face recognition techniques. The proposed technique Z_S_N i.e. Zernike moments, SIFT and Neural networks shows high performance rate as compared to techniques like ICA (Independent Component Analysis), LDA (Linear Discriminant Analysis), PCA (Principal Component Analysis) and SVM (Support Vector Machines).



Graph No. 1 Comparison of proposed technique with other techniques

V. CONCLUSION AND FUTURE WORK

Face recognition is a significant technique of biometrics that work on many local and global features for recognition in many security based applications. This technique is additionally useful in security and authentication in contrast to password, token or other biometrics techniques as in it there is no need to remember any password or activity. Also it

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does not suffer from the fear of being stolen, lost. The proposed work is based on face recognition system that will be useful in recognizing faces against different poses and scales. In this system two methods are used for feature extraction, which are Zernike Moments (ZMs) and Scale Invariant Feature Transform (SIFT), to collect global and local features of image respectively. Zernike Moments extract angle and amplitude of images and SIFT finds potential key points of images.

We described many techniques in literature survey that helps to attain fine recognition rate for recognition but these all can also fail in case of pose variation, light effects, makeup, age variation and some other conditions. More work in future can be made for advancing the recognition rates of recognition system. Research work can be further done for betterment of duration taken by system for recognition of faces. Also failure in system is possible for recognizing images in low resolution. Smartness of recognition system can be increased by making them work in real time situation and by reducing time taken to recognize. Future scope of research is never ending documentary for any research topic because technology is never ending process for change and easy life, this is improving day by day by different researchers according to their ideas.

REFERENCES

1. M. W. GARDNER and S. R. DORLING, "Artificial Neural Networks (The Multilayer Perceptron) A Review of Applications in the Atmospheric Sciences," ELSEVIER, vol. 32, no. 14/15, pp. 2627-2637, 1998.
2. Henry A. Rowley, Shumeet Baluja, Takeo Kanade, "Neural Network-Based Face Detection", Institute of Electrical and Electronics Engineers, pp. 23-38, vol. 20, no. 1, 1998.
3. Javad Haddadnia, Karim Faez, Payman Moallem, "Neural Network Based Face Recognition with Moment Invariants", Institute of Electrical and Electronics Engineers, pp. 1018-1021, 2001.
4. Marian Stewart Bartlett, Javier R. Movellan, J. Sejnowski, "Face Recognition by Independent Component Analysis", Institute of Electrical and Electronics Engineers, Transactions On Neural Networks, vol. 13, no. 6, pp. 1450-1464, 2002.
5. David G. Lowe, "Distinctive Image Features from Scale-Invariant Keypoints", International Journal of Computer Vision, pp. 91-110, 2004.
6. Javad Haddadnia, Majid Ahmadi "N-feature neural network human face recognition", ELSEVIER, pp. 1071-1082, 2004.
7. Chong-Yaw Wee, Raveendran Paramesran, "On the computational aspects of Zernike moments", ELSEVIER, pp. 967-980, 2006.
8. Cong Geng, Xudong Jiang, "Face recognition using sift features," Institute of Electrical and Electronics Engineers, pp. 3313-3316, 2009.
9. Seyed Mehdi Lajevardi, Zahir M. Hussain, "Higher order orthogonal moments for invariant facial expression recognition", ELSEVIER, pp. 1771-1779, 2010.
10. J Krizaj, V. Struc, N Pavesi, "Adaptation of SIFT Features for Face Recognition under Varying Illumination", MIPRO, pp. 691-694, 2010.
11. 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, vol. 3 , no. 1, pp. 45-49, 2012.
12. S.Adebayo Daramola and O. Sandra Odeghe, "Efficient Face Recognition System using Artificial Neural Network", International Journal of Computer Applications, vol. 41, no. 21, 2012.
13. Chandan Singh, EktaWalia, Neerja Mittal, "Fusion of Zernike Moments and SIFT Features for Improved Face Recognition", International Journal of Computer Applications, pp. 26-31, 2012.
14. Wei Ge, Zhiwen Xu, Chunlei Shi, Weida Zhan, "Recognition of Expression-variant Faces using SIFT Method", Institute of Electrical and Electronics Engineers, pp. 398-401, 2012.
15. Sundus Y. Hasan, "Study of Zernike moments using analytical Zernike polynomials", Advances in Applied Science Research, vol. 3, no. 1, pp. 583-590, 2012.
16. Atul N. Kataria, Dipak M. Adhyaru, Ankit K. Sharma3, Tanish H. Zaveri, "A Survey of Automated Biometric Authentication Techniques", Institute of Electrical and Electronics Engineers, pp. 1-6, 2013.
17. Renu Bhatia, "Biometrics and Face Recognition Techniques", International Journal of Advanced Research in Computer Science and Software Engineering, vol. 3, no. 5, 2013.
18. Divyarajsinh N. Parmar, Brijesh B. Mehta, "Face Recognition Methods & Applications", International Journal of Computer Technology & Applications, vol. 4, no. 1, pp. 84-86, 2013.
19. Surabhi Varshney, Deepak Arya, Rashmi Chourasiya, "Face Recognition Techniques Using Artificial Neural Networks", International Journal of Engineering Research and Applications, pp. 44-48, 2014.
20. R. Pavithra, Dr. J. Goerge Chellin Chandra, "Scale Invariant Feature Transform based face recognition from a Single Sample per person", International Journal of Computational Engineering Research, vol. 04, no. 10, pp. 41-47, 2014.
21. 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, vol.2, no.1, pp. 1-7, 2014.
22. Amit Verma, Charanjeet Kaur, Shruti Gujral,, "Design an algorithm for face recognition using Zernike and Neural Network", International Journal of Computer Science Research, vol. 3, no. 2, pp: 179-182, 2015.