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Design and Develop an Algorithm for Face Recognition Using Feed Forward Neural Network and Zernike Moment

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ABSTRACT
Face Recognition system is widely useful in security and authentication systems to recognize authorized and right person for particular system, this is a challenging problem in the field of image analysis and computer vision. The security of information is becoming very important and difficult. Face recognition is a biometric system used to identify or verify a person from a digital image. Face recognition system should be able to automatically detect a face in an image. This involves extracts its features and then recognize it, regardless of illumination, expression, ageing, changes and position, which is a difficult task. We perform this task by using Zernike moments and Feed Forward Neural Network. Zernike moments are used to calculate the angle and to find different views of same person in different poses and it can find the reconstructed images by using the amplitude and angle of images. We also use feed forward neural network to train a particular dataset which helps to match the features of testing image.

General Terms
Methodology, Security, Authentication.

Keywords
Biometrics, Zernike Moments, Neural Networks, Correlation, Face recognition

1. INTRODUCTION

In biometrics we have many ways to reco gnize a person but face recognition is one of the be st from them because in this recognition there are no n eed to involve person to whom we are recognized, In face recognition we use images to match a person or take direct data from camera and camera can record the fa ce from some distance also even person did not have attention. Face recognition is an important topic in security system for recognition was started in 1960 by Wood y Bledsoe[1], Helen Chan Wolf, and Charles Bisson with a semi-automated system, in this system administrator was required to match the distance and ratio of points included ear, eyes, nose and mouth from photograph to compare with reference data. This is computer based security system which provides an identity to a face if that face is stored in database. This topic is growing more and more to make face recognition perfect against poses, lighting, noise, makeup, and aging. The first step of facial recognition is to take a picture and extract already extracted. Human face is very unique idea for recognition and also accurate because it has 80 nodal points can be used for recognition like distance between eyes, width of nose, shape of cheekbones etc [2]. Third step of face recognition is to match these features with database images according to respective nodal points. Finally system will return you an output with matching identity if image will match otherwise input data is not related to database. We can take a face for recognition in different ways like from an image or direct from camera. There are different types of system are used for face recognition in different ways. Popular technologies are used in face recognition Principal Component Analysis (PCA), Independent Component Analysis (ICA), Linear Discriminate Analysis (LDA), Zernike Moments (ZMs), Neural Network (NN), Support Vector Machine (SVM) etc.

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 recognized then provide the identity of that f ace otherwise that face is unknown.

1.1 Zernike Moments
Zernike Moments is a feature extraction method from an image by which we can extract global features like amplitude and angle [7]. The set of orthogonal Zernike moments for image analysis was first introduced by Teague. It is a set of complex orthogonal functions with

a simple rotational invariant property which forms a complete orthogonal basis over the class of square integrable functions named as Zernike polynomials which are defined over the unit circle [8]. Zernike moments have rotational invariance, and can be made scale and translational invariant, making them suitable for many applications. Zernike moments are accurate descriptors even with relatively few data points. Reconstruction of Zernike moments can be used to accurate descriptor. We can calculate the Zernike moments using following equation.

$$A_{mn} = \frac{m+n}{\pi} \int_x \int_y f(x,y)[V_{mn}(x,y)] * dx\,dy \quad (1.1)$$

$$where\ x^2 + y^2 \leq 1$$

Here the n is the order of the object and m is the no of moments of an object.
From Zernike Moments we calculate the angle and amplitude of images which is helpful for us to recognize the right image.

1.2 Neural Network

An Artificial Neural Network (ANN) is a data processing model inspired by the human biological nervous systems, like process information of human brain. This system is developed by highly interconnected neurons that pass the information from one neuron to other 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.

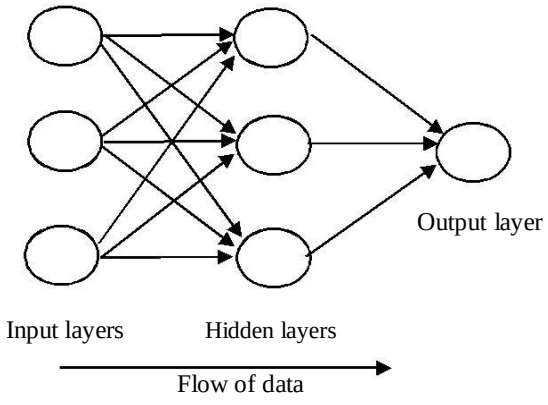

Figure 1: Artificial Neural Network

1.3 Neural Network

Correlation is used to determine the similarity between images. Correlation is a type of template matching which provide us the matching features of two images by calculate the intensity value at a particular pixel and mean intensity of whole image denoted as a letter with a straight line over it. It matches and compares images pixel by pixel and finally provides the matching percentage of those images. MATLAB use the following formula to find out correlation between two images.

$$a = a - mean2(a) \quad (1.2)$$

$$b = b - mean2(b) \quad (1.3)$$

$$r = \frac{sum(sum(a.*b))}{sqrt\left(sum(sum(a.*a)) * sum(sum(b.*b))\right)} \quad (1.4)$$

Where, a and b are matrices of same size, r is correlation between two images.

2. RELATED WORK

Brief review of literature is discussed as follows:
Chandan et al.[2] presented a technique of face recognition using Zernike Moments and SIFT algorithm. It provides good results as changing in age with the help of invariant features.
Renu et al.[3]this paper represented biometrics techniques such as Iris scan, retina scan and face recognition techniques There are lots of applications and solutions in biometrics technology used in security systems, which easy our life such as: improved security, It reduce the cost of admin to maintain the password. Rakesh et al. [3] this paper propose to label a Self-Organizing Map (SOM) to measure image similarity. To manage this goal feed Facial images associated to the regions of interest into the neural network. . Facial recognition is performed by a probabilistic decision rule in this system. At the end of the learning step, each neural unit is tuned to a particular Facial image prototype this scheme offers very promising results for face identification dealing with illumination variation and facial poses and expressions.
A.Nabatchian et al. [4] Presented the different moment invariant has been used to detect features from human face images for recognition application. In this recognition system a three layer perceptron neural Output layer network was used as the classifier. In this system the complete value of ρ and proper order of moment variants is used to optimize the performance of system.
Akinobu et al.[6] This paper proposes a classification-based face detection approach using Gabor filter features. Four Gabor filters are designed to detect facial features and the feature vector based on Gabor filters is applied to be the input of the classifier. The detection performances of different parts of Gabor representations have been investigated. Testing of this system is done on large number of images to find the

effectiveness of the proposed method.
Seyed Mehdi et al. [8] this study proposes a rotation and noise invariant FER system using an orthogonal invariant moment i.e. Zernike moments as a feature extractor and Naive Bayesian classifier. We can recognize seven different expressions by using this system.
Divyarajsinh N et al. [9] this paper describes the common methods like holistic matching method, feature extraction method and hybrid methods. Applications with examples are also described in this paper.
Hoda Marouf1 et al. [10] this paper introduce a system to find the identity of twins. The proposed method is based on the Pseudo-Zernike Moment (PZM) as a feature extractor to recognize a pair of identical twins.
Also, the location of face in an image is detected using the AdaBoost method and then the PZM is utilized to construct feature vector elements. Conclusion of literature: From literature I found Zernike moments and neural Network are better technique to fetch the features from image and match them respectively, this can provide us a good result for face recognition.

3. PROPOSED WORK

In this paper an algorithm is proposed which will be more effective to recognize the face of human. In this system Zernike moments and correlation is used to Extract the features for comparison. Zernike moments provide angle and amplitude of the image and correlation provide the similarity between two images. This data is stored as feature vector in dataset and further this data is used as the inputs of neural network to train and test the generated network. Feed forward neural network will provide us output according to the test image, It will provide identity of test image if the face matches with any image of dataset otherwise it will provide a message “image is not found”. This system provide high recognition rate.

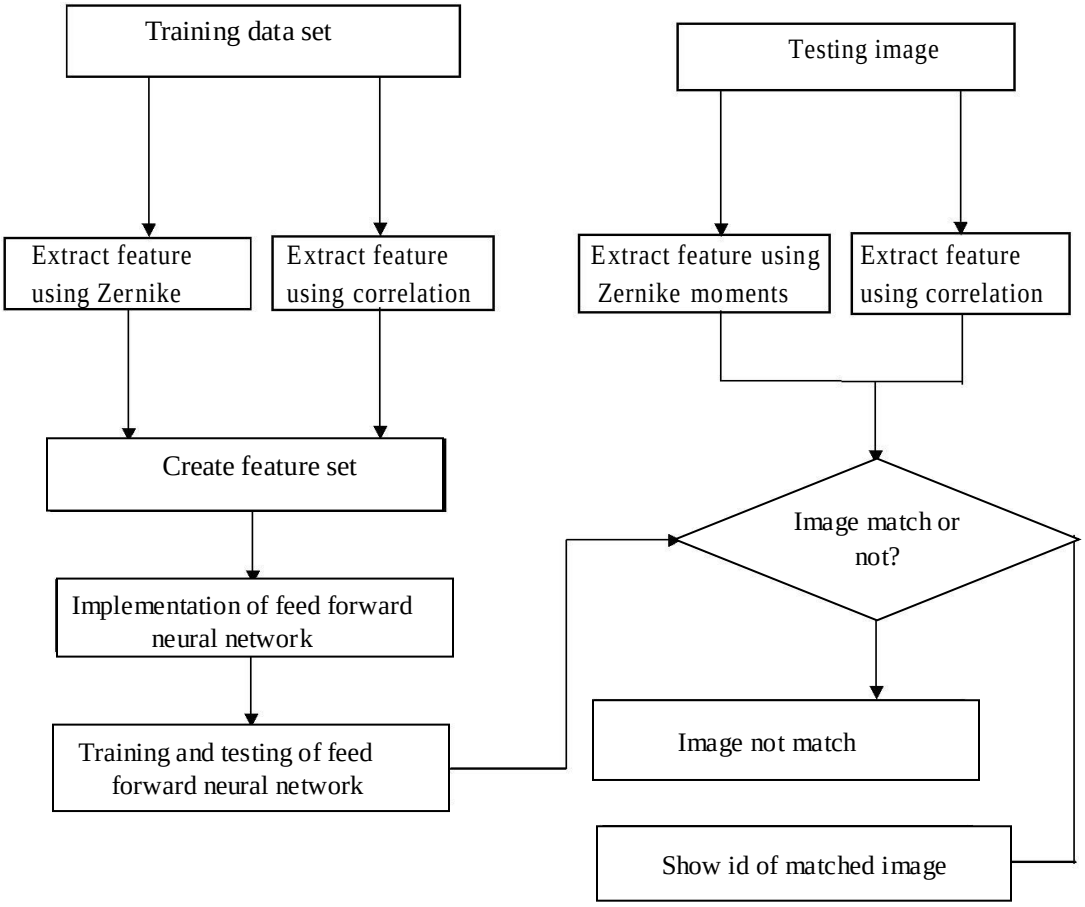

Figure 2: flow chart of proposed work

4. RESULT AND DISCUSSION

Proposed technique show better result as compare to existing techniques, when we apply it on a large dataset of images. This technique allows recognition against pose variations and at any angle between -90 degree to +90 degree and provide better recognition rate. System is tested using Face Pix Database that contains 90 different persons and every person's 74 images, and we observe Recognition rate 97%.

Table no. 4.1: Comparison of different algorithms

s.no.	Algorithm	Database	Performance rate	Advantage	Disadvantage
1	PCA	AR-Faces	70	Reduce Dimensionality	Class seperability remain same
2	LDA	AR-Faces	**88**	Reduce Dimensionality Increase class Severability	N/A
3	ICA	FERET	**89**	Exploits higher order Statistics	N/A
4	SVM	FERET	77-78	N/A	N/A
5	Z_NN	Face Pix Database	97	Pose variations and high performance Rate	

5. FUTURE WORK

Face recognition is wide area for research as today's requirement because this is very difficult task to recognize face against poses and light effects in real time application. Other algorithms for classification may be useful for better result for face recognition. Today's system are slow for human face recognition if they have large database, recognition time should be enhanced.

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