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Design an Algorithm for Face Recognition Using Zernike Moments and Neural Network

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ABSTRACT
Biometrics is a term used for measurement of human body by using different characteristics. Face recognition is also a characteristic of biometrics which is widely used at different places for security and authentication purpose. Extraction of global feature and find efficient match is good approach to find research goal in face recognition. This can be done by using Zernike Moments and Feed Forward Neural Network with Back Propagation. These both methods are efficient and effective. Global features are extracted by Zernike Moments are Amplitude and Angle of the face image. We also use correlation to find the similarity between images this makes our system more efficient. Neural network is used for pattern recognition in this system when all features are gathered. This algorithm will provide good recognition rate against in different poses and face angles on images

General Terms
Face Recognition Algorithms, Security, Pseudo code, Authentication.

Keywords
Biometrics, Zernike Moments, Z_ NN, Neural Networks, Face recognition

1. INTRODUCTION

Face is the unique identity of every person by which we can recognize each other, this is the most commonly used 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 putting restriction on an unauthorized person. This technology is used to stop crimes like fake identification, driver's fake licenses etc. 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. This technology is improving day by day by for business purposes and to fin d out criminals, now days this technology is used for attendance purpose at educational institute and industries. A human face has more than 180 nodal points [1] are lies for face recognition. We can extract two types of features that are local and global [2], local features are extracted as a view of face image like difference between eyes, width of nose, shape of cheeks etc. an d Global features are those which we can find out from overall image like amplitude, histogram etc. many approaches are implemented for feature extraction but not all are perfect as real world applications and i n different poses, But Zernike Moments is more effective to extract global features which are invariant in rotating and reconstructing images. Face recognition is divided in two approaches first is image processing and other is artificial intelligence used for pattern recognition or classification. Image processing contains feature extraction and edge detection methods, techniques used for this are Zernike Moments, SIFT, Correlation etc. Artificial intelligence is used for pattern recognition and classification. Neural network is used in proposed algorithm which takes feature vector set as input and matches the results with target value.

1.1 Zernike Moments
Zernike Moments is feature extraction method used for face recognition, by using this method. This method works on unit circle which is generated over the face in image and find out the origin of that circle to check the angle of that face in particular image and amplitude. This method provides better re cognition rate because features are invariant in case of image rotation. It is mapping of orthogonal polynomial that are complex. In Region of interest Zernike Moments are used to represent the representation depends on the translation and scaling of the moments. Zernike moments have rotational invariance, and can be made scale and translational invariant, making t hem suitable for many applications. Zernike moments are accurate descriptors even with relatively few data points. Reconstruction of Zernike moments can be used to determine the amount of moments necessary to make an accurate descriptor. We can calculate the Zernike moments using following

equation [7].

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

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

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 amplitude and angle of given images which is helpful for us to recognize the right image.

1.2 Neural Network

Neural networks simulation seems to be a recent development. This field was in use before the arrival of computers, and has survived a minimum of one major natural event and a number of other eras. Many important advances are boosted by the employment of cheap laptop emulations. Following associate degree initial amount of enthusiasm, the sphere survived a amount of frustration and discredit. Throughout this era once funding and skilled support was minimal, necessary advances were created by comparatively few researchers. These pioneers were able to develop convincing technology that surpassed the constraints known by Minsky and Papert. Minsky and Papert, revealed a book in 1969 during which they summed up a general feeling of frustration against neural networks among researchers, and was so accepted by most while not more analysis. Currently, the neural network field enjoys a revivification of interest and a corresponding increase in funding. 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.

2. RELATED WORK

There are many techniques are implementing to solve the problems in face recognition systems are discussed as below:

A new methodology provide by chandan singh et. al [7] using ZM and SIFT algorithm which will provide better result against poses of face images. In this approach local invariant features are extracted by SIFT algorithm and Global features are extracted by Zernike Moments. This system provide better recognition rate by combing two techniques rather than used alone. Seyed Mehdi Lajevardi [8] A fully automatic system is developed by using ZM and NB classifiers. It provides a good recognition under seven different expressions, light conditions, pose variations and noise. Simon X. Liao and Miroslaw Pawlak [11]. This paper Discuss about Integrals and the Geometric Errors that can determine the accuracy of Zernike Moments (ZM). Conclusion of this study is geometric error has more involvement to find out the accuracy of the ZM. Hayet Boughrara [13] Proposed A new constructive algorithm that is implemented for face recognition by using ZM and Gabor features for feature extraction and a Multi Layer Perceptron is used for training purpose. This system will start with one hidden layer and layers can be increased if the Mean Square Error is not reduced. Rakesh Rathi [19] Propose to a label a Self Organizing Map to measure the similarities of the images. In this system all images are feed to neural network for training and at the end all images are converted into particular prototype of facial image and probabilistic decision rule will recognize test image.

3. PROPOSED ALGORITHM

Proposed algorithm is based on Zernike Moments and Neural network for face recognition is givan in pseudo code as follwing.

Table no 1 Proposed Algorithm

Algorithm Pseudo Code

Initialize Tset-I (i-1,2,3 …….n)
for (Tset-i =1, Tset-<=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
}

In this algorithm we have to perform following steps for recognition:

***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 will be the effective and efficient algorithm which will provide us a high recognition rate.

4. CONCLUSION

Face recognition is most important technique of biometrics which contains many local and global features for recognition in case of security. This technique is more helpful in case of security and authentication as compared to password using or other biometrics techniques because in this technique no one has to remember any password or activity to remind the system. Also no one can copy your face as password or signature. The proposed work is based on face recognition system which will be helpful against poses and different angles of system. In this system two methods are used for feature extraction which is Zernike Moments (ZMs) and Cross Correlation (CC), which are used to collect global features of image. Zernike Moments extract an angle and amplitude of images and Cross Correlation find similarities of images.

5. FUTURE WORK

Many techniques have been discussed in literature survey which provide good recognition rate for recognition but these all fail at many times in pose variation, light effects, makeup, age variation etc. Future work can be done to improve the qualities of recognition system. Researchers also can improve the time taken by system for recognition. Today's systems also fail in low resolution images and system should be real time than images used for recognition. Recognition system can become more attractive and accurate if they work in real time environment and take minimum time for recognition. Future scope of research is never ending documentary for any research topic because technology is never ending process for change and easy life, it is improving day by day by different researchers according to their ideas.

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