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Artificial Neural Network for Facial Feature Extraction System

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Abstract: This paper aims to develop face detection system using Artificial Neural Network (ANN). Face detection is one of the most important in security system. In this paper, an input image of face is acquired firstly by using a digital camera (model - Canon PowerShotA3100). The image is segmented by using threshold function and is needed to perform image processing techniques such as converting gray scale, noise removal image, edge image and changing to digited image. The important features of the image are needed to be extracted according to morphological features. A complete set of 12 features are used for the classification of final outcomes. Feature vectors obtained from feature extraction are used as input to neural networks. The system trains the Neural Network using Back-propagation algorithm. MATLAB 2009a programming language is used to implement this system.

Keywords: Entropy, Variance , Neural Network, Homogeneity

1. INTRODUCTION

Developing detection and recognition algorithms become a very fascinating study due to its applications within the field of business, security system, person authentication, robotics, advertising, and enforcement. As a result of the development within the effectiveness of information technology distinctive researchers from all over the world have proposed a number of algorithms and techniques which make immense possibilities for outreach into nonstandard areas such as nanotechnology, criminal identification and many more by taking advantages of the growing application of computer vision [1]. Face features, an important means of biometric is a rapidly growing domain in pattern recognition. Usually, face recognition systems accomplish the task through face detection, facial feature extraction and face recognition. Facial features which make a face distinct play a vital role in identifying a person. Face recognition is influenced by many complications such as the differences of facial expression, the light directions of imaging, and the variety of posture, size and angle. Even to the same people, the images taken in different surroundings may be dissimilar. Facial feature extraction has become an important issue in recognition of human faces.

Although it is clear that people are good at face recognition, it is not at all obvious how faces are encoded or decoded by the human brain. Developing a computational model of face recognition is quite difficult, because faces are complex, multi-dimensional visual stimuli. Therefore, facial feacture recognition is a very high level computer vision task, in which many early vision techniques can be involved. The main purpose of this paper is to implement for face recognition system applying MATLAB image processing functions.

The proposed scheme of the present research is to provide a system for feature extraction for face decection for image processing systems. Various methods have been proposed by different researchers. But this thesis described accurate image preprocessing using color conversion methods and median filter method. Many researchers have focused on the extraction of the features. Different morphological features have been used, and some methods have been carried out with color features. Majumdar and Jayas developed classification models by combining two or three feature sets (morphological, color and textural) to classify individual kernels. Mallat developed wavelet technique, is used in textural image analysis to make object classification more precise.[6] Vertical and horizontal centre points are extracted from Paliwal, J., Borhan, M.S. and Jayas developed for an inexpensive machine-vision system (MVS) to identify and classify cereal face, a flatbed scanner was used and its performance was evaluated. Images of bulk samples and individual grain kernels of barley, Canada Western Amber Durum (CWAD) wheat, Canada Western Red Spring (CWRS) wheat, oats, and rye were acquired and classification was done using a four layer back-propagation neural network. Classification accuracies in excess of 99% were obtained using a set of 10 color and textural features for bulk samples. For single kernel images, a set of at least 30 features (morphological, color, and textural) was required to achieve similar classification accuracies. Classification accuracies for single kernel samples varied between 96 and 99%.[5]. Majumdar and Jayas also proposed that texture can be defined as the distribution of color in an image with respect to the spatial coordinates. It can be qualitatively evaluated as having one or more of the properties of fineness, coarseness, smoothness, granulation, randomness, or irregular. Two objects, in their digital image form, can be comprised of same number of pixels and exactly same color histograms but if the distribution of color is dissimilar, they can have totally different appearance. These two objects, if classified using simple color features, would be classified as similar objects. Haralick presented that there have been many statistical and structural approaches to the measurement and characterization of image texture: autocorrelation functions, autoregressive models, optical transforms, digital transforms, structural elements, spatial gray tone co-occurrence probabilities, gray level run lengths, and sum and differences histograms. [7]

systems are still largely in use; major areas of application of offline signature verification systems include: authentication of bank cheques, attendance register monitoring and visa application [8], and [9].

2. PROPOSED SYSTEM

This section describes system design of the proposed system. A typical face recognition system generally consists of the basic characteristics. These are image acquisition, preprocessing, feature extraction and face . The first stage deals with collection of face followed by pre-processing and feature extraction process as the second and third stage respectively. The fourth stage describes the training process. And the final stage describes the face recognition process between the test. The architecture of the proposed system composed of four main steps. This paper is to implement for face detection system applying MATLAB image processing functions.

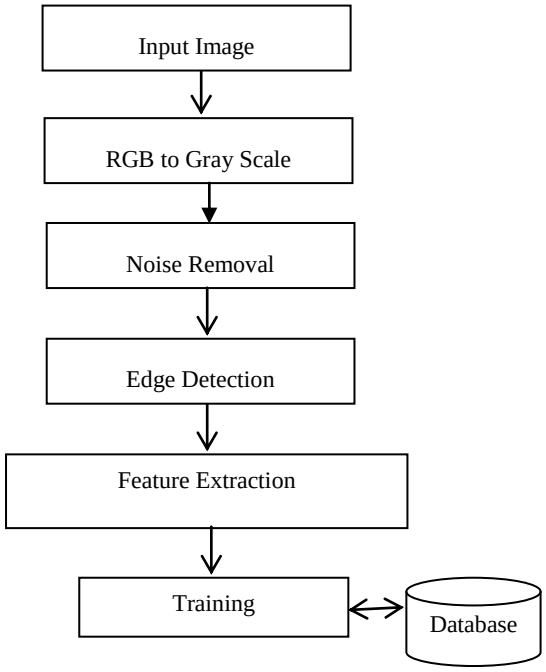

Figure. 1 System Design of the Proposed Process

2.1 Image Acquisition

The input images can be acquired through the scanner or camera. Using a conventional analogue camera and scanner method is clearly not appropriate for verification system. It is due to the procedure to follow need a lot of time or on other words, its time consuming. It is also tedious and impractical. Using a video camera with frame grabber is the one that has been applied in the real life system as everything can be automated through the computer and it suitable for the real time processing. But that method is expensive. Using a digital camera is more convenient, cost effective and reliable. The proposed system uses a high resolution digital camera. Pre-processing is an important and diverse set of image pre-processing for next stage of image processing based application. The input image All the collected input images were scanned and stored in a digital format. There will be some amount of noise in the input. Median filter was used to remove the noises present in the input images.

Fig. 1 Input Image

2.2 Image Pre-processing

2.2.1 Grey Scale Image

A grayscale or grey scale digital image is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort, also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest. The range of pixel values is from 0 to 255. These images can provide some sorts of noise [3].

Figure. 3 Grey Scale Image

2.2.2 Noise Removal Image

There are many methods to reduce noise. Dirt on camera or scanner lens, imperfections in the scanner lighting, etc introduces noises in the scanned signature images. A filtering function is used to removal the noises in the image. Filtering function works like a majority function that replaces each pixel by its majority function. Median filter is used to reduce salt-pepper noise and Gauss noise respectively. The easiest way to create such a median filter is to copy the 9 pixel values in memory cells and sort them by ascending gray value. They only differ by the position in the list from which the gray value is picked out and written back to the center pixel. The filter operation which selects the medium value is called the median filter [1]. A noise reduction filter is applied to the binary scanned image. The goal is to eliminate single white pixels on black background and single black pixels on white back ground. In order to accomplish this, the image is appled a 3 x 3 mask with a simple decision rule: if the number of the 8-neighbors of a pixel that have the same color with the central pixel is less than two, the color is reversed of the central pixel. Comparing and selecting characterize the class of operations to combine neighboring pixels. Such a filter is called a rank-value filter. The preprocessing task of rank value filters is the removal of disturbances or noise in an image. The median filter sorts the values of the neighboring pixels in an ascending order and returns the value in the center of the value list. The main problem is a fast algorithm to sort the pixel values correctly. The median is usually taken from a template centered on the point of interest. The median has a well-known ability to remove salt and pepper noise [2].

Figure. 3 Filter Image

2.2.3 Edge Image

The Sobel operator is the most popular edge detection operator among edge detection techniques. This is because it gives the better performance than other contemporaneous edge detection operators, such as the Prewitt operator. The Sobel templates can be involved by operating on a matrix of dimension equal to the window size, from which edge magnitude and gradient are calculated. The Sobel operator performs a two dimensional spatial gradient measurement on an image and so emphasizes regions of high spatial gradient that correspond to edges. Typically it is used to find the approximate absolute gradient magnitude at each point in an input grayscale image.

Figure. 3 Edge Image

2.2.4 Dilated Image

Grayscale dilation with a flat disk shaped structuring element will generally brighten the image. Bright regions surrounded by dark regions grow in size, and dark regions surrounded by bright regions shrink in size. Small dark spots in images will disappear as they are `filled in' to the surrounding intensity value. Small bright spots will become larger spots. The effect is most marked at places in the image where the intensity changes rapidly and regions of fairly uniform intensity will be largely unchanged except at their edges. Figure 4 shows a vertical cross-section through a graylevel image and the effect of dilation using a disk shaped structuring element.

Figure. 3 Dilated Image

3. FEATURE EXTRACTION

In feature extraction, a mathematical representation called a biometric template or biometric reference is generated, which is stored in the database and will form the basis of any recognition task. Facial recognition algorithms differ in the way. Feature extraction involves simplifying the amount of resources required to describe a large set of data accurately. The features can be derived directly from the results of the preprocessing operations. Although there are many types of features, morphological features or shape features are used for this system. Among the shape features, different features from a pre-processed face image are extracted for this system. These proposed features are as follows: Mean Subtraction, Entropy, Variance, Smoothness, Kurtosis, Skweness, Contract, Correlation, Energy and Homageneity. The data is fairly simple and makes the calculation of covariance matrix. This is not the subtraction of the overall mean from each of image values as for covariance, it needs at least two dimensions of data. It is in fact the subtraction of the mean of each row from each element in that row.

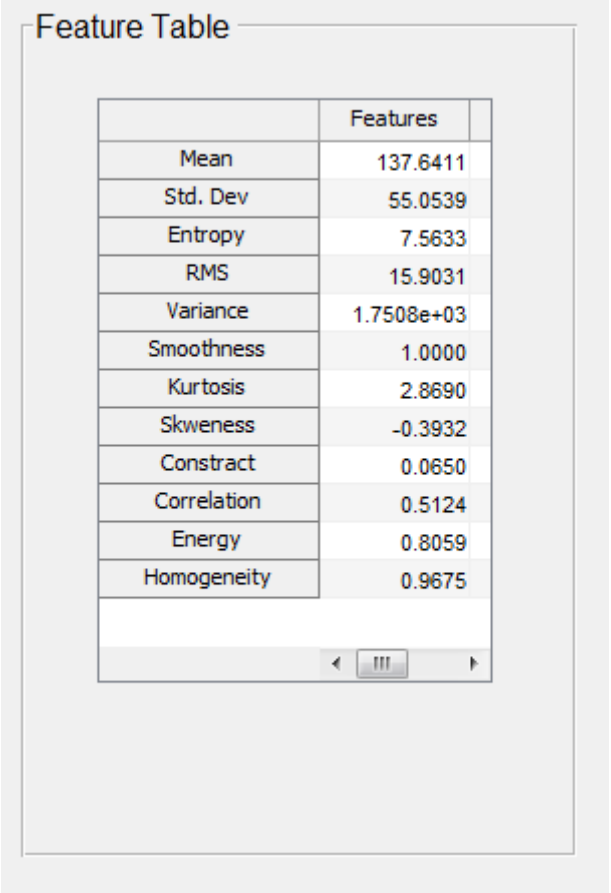

Figure. 4 Feature Extraction

4. TRAINING

The basic elements and structure of Artificial Neural Network (ANN) are insufficient to make a useful learning machine. The key to automated learning is being able to assess the learning algorithm can be eventually guided toward a satisfactory solution. Training and testing data sets for a classification system are usually determined from known process generation mechanisms or by a consensus of expert opinion. Either way there is a known data standard against which to evaluate the system's performance. After training, the test set of known categories is passed through the ANN classification system and it is possible to get the percentage of correct and incorrect classifications. An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data

classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. The network is composed of a large number of highly interconnected processing elements (neurons) working in parallel to solve a specific problem. [10]

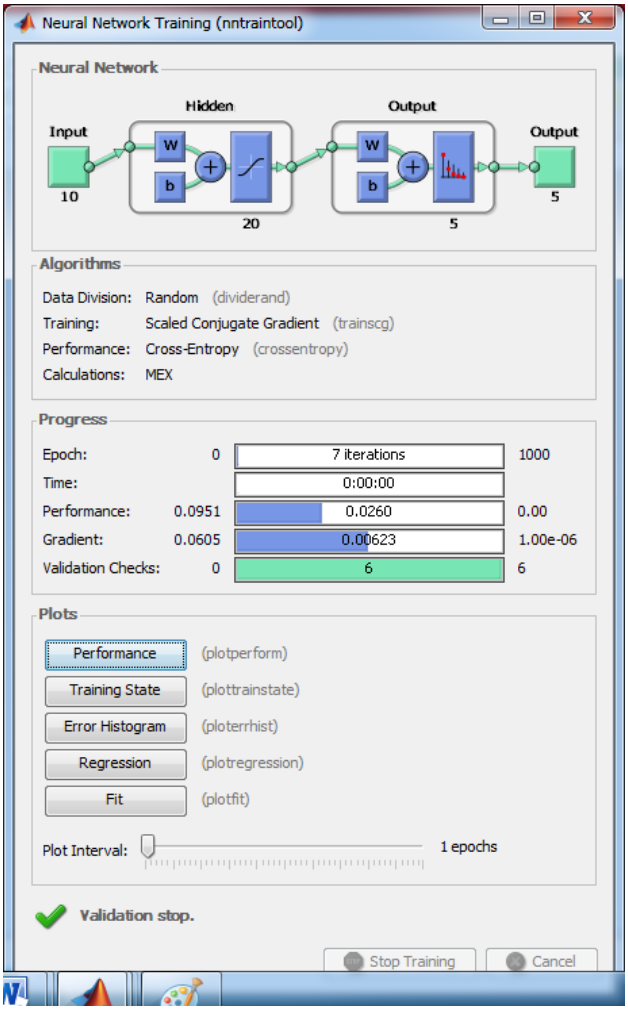

Figure. 5 Training Neural Networks

4.1.1 Edge Image

This is the result of output windows form for facial feature extraction system. The output result shows the .

	Image 1	Image 2	Image 3	Image 4	Image 5
Mean	147.9979	123.7593	82.6312	60.6728	78.9876
Std.Dev	81.4966	92.0016	94.1296	66.7431	76.4326
Entropy	7.6517	6.9345	6.1677	7.0162	8.3076
RMS	15.0234	13.8163	11.7042	13.0495	14.2567
Variance	4.6908e+03	6.1917e+03	1.3338e+03	13.0481e+03	14.0671e+03
Smoothness	1.0000	1.0000	1.2000	1.6500	1.5000
Kurtosis	2.0450	1.5473	1.8844	2.9926	2.8006
Skwenes s	-0.5163	-0.0429	0.7016	1.0746	1.0067
Construct	0.0946	0.1700	0.1781	0.1127	0.2109
Correlation	0.3112	0.2147	0.2838	0.3657	0.4000
Energy	0.7769	0.6425	0.6049	0.7223	0.8006
Homogeneity	0.9527	0.9150	0.9109	0.9436	0.8967

Figure. 6 Training Results

5. CONCLUSION

This paper described the basic approaches, techniques, and applications of artificial neural networks as a start of the development of comprehensive recognition systems. The system provides other capabilities such as integrated graphics and interpretive environment which MATLAB offers. Face recognition system which used by principal component analysis is to recognize the face which is registered in database. The system can recognize the face which is registered. This system used the eigen value to detect the person face and recognize. The proposed facial feature extraction system is reliable and provides high accuracy.

6. ACKNOWLEDGMENTS

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7. REFERENCES

[1] Y. C. Chan, C. C. Chang, K. M. Wang, G. C. Lee, Video-Based Face Recognition Using a Probabilistic Graphical Model, *Conf. on Machine Vision Applications*, 2009

[2] L. S. Balasuriya and Dr. N. D. Kodikara. "Frontal View Human Face Detection and Recognition", 2006

[3] A. Volkan , *Face Recognition using Eigenfaces and Neural Networks*, December 2003

[4] Anonymous: *SQL (Structure Query Language)*, 2007, http://en.wikipedia.org/wiki/SQL.html

[5] Bringer J., Chabanne H., Cohen G., Kindarji B. and Zemor G.: Optimal iris fuzzy sketches in Biometrics: Theory, Applications, and Systems, (2007).

[6] D. Bolme, R. Beveridge, M. Teixeira, and B. Draper, "The CSU Face Identification Evaluation System," *International Conf. on Vision System*, pp.304-311, 2003

[7] Dr.S.Vijayarani, Mrs.M.Vinupriya :Performance Analysis of Canny and Sobel Edge Detection Algorithms in Image Mining, in International Journal of Research in Computer and Communication Engineering, vol.1, Issue 8, October 2013

[8] Kefen FAN, Qingqi Pei, Wei MO, Xinhu Zhao, and Qifeng Sun, "An Efficient Automatic Iris Image Acquisition and Preprocessing System", Proceeding of the 2006 IEEE International Conference on Mechatronic and Automation, Jun 25-28 ,2006 Luoyan, China,pp 1779-1784.

[9] Parteek Verma, Maheedhar dubey, Aomak Basu, Praveen Verma "Hough Transform Method for Iris Recognition- A Biometric Approach", International Journal of Engineering and Innovative Technology (IJIT), ISO 9001:2008 Certified ISSN: 2277-3754, volue 1, Issue 6, Jun 2012.

[10] Rechu V. Blanz and T. Vetter, "Face recognition base on fitting a 3D morphable model," 2003