FACE RECOGNITION USING GABOR WAVELET TRANSFORM AND FEED FORWARD NEURAL NETWORK

[1]Swati Singh, [2]Ranjeeta Singh

[1,2]Department of Electronics and Communication Engineering, Galgotias University (India)

ABSTRACT

In recent years, an explosion in research on pattern recognition systems using neural network methods has been observed. Face Recognition (FR) is a specialized pattern recognition task for several applications such as security: access to limited areas, banking: identity confirmation and identification of wanted people at airports. Biometric techniques deals with identifying individual with the help of their biological data. Face plays an important role in conveying identity and emotion. People can recognize thousands of faces learned throughout their lifetime and identify familiar faces at a glance even after every years of separating. In this paper we will explain about the tasks involved in face recognition and outline a complete Face Recognition System (FRS) based on Gabor transform and Feed Forward Neural system (FFNN). Face recognition system includes two stages: training and testing series. We use Gabor wavelet transform for function extraction and then Feed Forward Neural Network as a classifier.

Gabor transform is used to extract features at grid points and graph matching for the proper positioning of the grid. Neural Network is used for the purpose of classification because it is a mathematical model which solves the problem of a group of highly connected neurons to realize compositions of non linear functions. Experimentation is carried out on Face Recognition System (FRS) by using Yale Face Database and Olivetti Research Laboratory (ORL) database.

Keywords: Face Recognition, Gabor Wavelet Transform, Feed Forward Neural Network.

I INTRODUCTION

The modern information age encounters human kind with various complications that are not available to the same level in the past days. The main complications are the organization of group and its security. In the perspective of enhanced versatility and world population, security and organization have become important social issues. Within this environment of improved significance for security and organization, recognition and verification methods, have designed a Key technological innovation in various areas.

Machine recognition is an effective research area including several professions such as image managing, design recognition, computer perspective and Neurological systems. FR technology has numerous professional and police officers programs which range from a set relevant of handled framework images such as passports, credit cards, Image ID's, driver's certificate, and mug images to real-time relevant of tracking video pictures [1].

Except personal conversation recognition, these methods need the client to remember a protection security password, to get into a PIN rule, to bring a logo, or in common, need a personal action in the course of recognition or confirmation. Additionally, all the means described above (Keys, badges, protection security passwords, PIN codes) are susceptible to being missing or ignored, while hand marks and retina assessments experience from low client acceptance [2].

Thus we need to analyze novel methods of recognition and confirmation using encounter recognition methods. Francis Galton in 1888 was the first who recommended the method of determining activities [3,4].

The aim of this research is to analyze different ways to be used for encounter identification, in particular the use of wavelets. Wavelets are statistical features that cut data into different regularity elements, and then research each element with a quality printed with its range

Face recognition is becoming an active research area spanning several disciplines such as image processing, pattern recognition, computer vision, neural networks, cognitive science, neuroscience, psychology and physiology [5].

Face recognition from still and video images has been an active research area due to both of its scientific challenge and wide range of potential applications. Within the past two decades, numerous face recognition algorithms have been proposed. Humans can identify and detect faces in a scene with some effort, building an automated system that accomplishes such as objective is very challenging. The challenges mainly come from the large variations in the visual stimulas due to illumination conditions, viewing directions or poses, facial expressions, aging and disguises such as facial hair, glasses, or cosmetics [6].

There are many other types of identification such as password, PIN or token systems. For example, a store that wishes to recognize some customers or a house that has to identify people that live there. For these application, face as well as voice verification are very desirable. FR technology became available to allow verification of "true" individual identity. This technology is based in a field called "biometrics". Biometric access control are automated methods of verifying or recognizing the identity of a living person on the basis of physiological characteristics. Among the various biometric ID methods, the physiological methods (face, fingerprint, DNA) [7].

The input of a face recognition system is always an image or video stream. The standard biometric measures identify power are False Rejection Rate (FRR) and False Acceptance Rate (FAR). FRR (Type 1 Error) and FAR (Type 2 Error) are inversely proportional measurements. Generally, automatic face recognition systems are comprised of three steps: Face detection, Feature extraction and Face recognition.

Face detection is defined as the process of extracting faces from scenes. So, the system positively identifies a certain image region as a face. Face detection procedure has many applications like face tracking, pose estimation or compression. The next step is feature extraction involves obtaining relevant facial features from the data. These features could be certain face regions, variations, angles or measures, which can be human relevant (e.g. eyes spacing) or not [8]. In face recognition systems, it is clear that the evaluation and benchmarking of the algorithms is crucial. The important facts which can be learned from evaluations are:

- Large set of test images are essential for adequate evaluation
- Sample should be statistically similar to the images that arise in the application being considered.
- Most useful form of evaluation is that based as closely as possible on a specific application.
- The accuracy, samples, speed and hardware, and human interface are extremely required for face recognition system.

Whether a face recognition system is better or not is measured by using two basic methods. There are two primary tasks of Face recognition:

Verification (one-to-one matching): Verifying an individual on the basis of any identity among the image.

Identification (one-to-many): If an image of an unknown individual is given, then we determine the person's identity by comparing that image with a database of images of known individual.

II FACE DETECTION

Face detection is the first step and major problem in face recognition systems. The main purpose of face detection is to locate and extract the face region from the background. It has several applications such as content-based image retrieval, intelligent human-computer interfaces, crowd surveillance, video conferencing and video coding [9].

The main function of face detection is to determine (1) whether human faces appear in a given image, and (2) where these faces are located at. The output of this step is patches containing each face in input image. Face-alignment is performed to justify the scales and orientations of the patches to make the system easy to design. Face detection is used for region of interest detection, retargeting, video and image classification, etc. Face detection deals with several challenges and are usually present in images captured in uncontrolled environments, such as surveillance video systems. These challenges can be attributed to several factors such as:

- **Pose variation**: Pose variation happens due to subject's movements or camera's angle.
- **Feature occlusion:** The presence of elements like beards, glasses or hats introduces high variability
- **Facial expression.** Facial features also vary greatly because of different facial gestures.
- **Imaging conditions.** Different cameras and ambient conditions can affect the quality of an image, affecting the appearance of a face.

In face detection technique some systems detect and locate faces at same time, but some systems first perform detection and then locate the faces. Face detection is a two class problem where we have to decide if there is a face or not in a picture. Face detection detects facial features and ignores anything else.

2.1 Methods of face detection

Face detection methods are divided into four categories and are classified as: Knowledge based methods, Feature-invariant methods, Template matching methods and Appearance based methods.

Knowledge based method: These are rule-based techniques. They try to catch our information of encounters, and convert them into a set of guidelines. For example, an experience usually has two symmetrical sight, and the eye place is deeper than the face. Face functions could be the range between sight or along with strength distinction between the eye place and the reduced area. The big issue with these techniques is the issues in developing an appropriate set of guidelines. A remedy is to develop ordered knowledge-based techniques to get over these issues. However, this strategy alone is very restricted. It's incapable to discover many encounters in a complicated picture.

These techniques show themselves effective with simple information. But, what happens if a man is dressed in glasses? There are other functions that can deal with that problem. For example, there are techniques that identify face-like designs or along with of skin. It is very important to choose the best shade design to identify encounters.

Template matching method: Design related techniques try to determine an experience as a operate. For example, an experience can be separated into eyes, experience shape, nasal area and oral cavity. Also an experience design can be built by sides. But these techniques are restricted to encounters that are front and unoccluded. An experience can also be showed as a figure. Other layouts use the regards between experience areas in terms of lighting and night. These conventional styles are as opposed to feedback pictures to identify encounters. This strategy is simple to apply, but it's insufficient for experience recognition. It cannot achieve great results with modifications in cause, range and shape. However, deformable layouts have been suggested to deal with these problems.

Appearance based method: In common, appearance-based methods depend on methods from statistical research and device learning to find the appropriate features of experience pictures. Some appearance-based methods work in a probabilistic system. A picture or operate vector is a unique varying with some possibility of that belong to a experience or not. Another strategy is to determine a discriminate operate between experience and non-face sessions.

III FEATURE EXTRACTION

After the face detection step, human face patches are extracted from images. Directly using the face patch for face recognition have some disadvantages such as large pixel size (first each patch contains approx 1000 pixels) due to which the system becomes robust and some other problems as pose variation, feature occlusion, facial expression

and imaging conditions also comes. After this step, a face patch is usually transformed into a vector with fixed dimension or a set of fiducial points and their corresponding location.

Feature extraction involves obtaining relevant facial features from the data. These features could be certain face regions, variations, angles or measures, which can be human relevant (e.g. eyes spacing) or not. Approaches that are used for Feature Extraction are: Local feature and Global feature. Global and local features play different roles in face perception, and both of them contain information for face recognition system.

- **Local feature**- Eyes, Nose, Mouth information
- **Global feature**- Extract feature from whole image

Feature extraction involves several steps: dimensionality reduction, feature extraction and feature selection. We can make a distinction between feature extraction and feature selection. Feature extraction extracts features based on transformations or combinations of the original data. It transforms data in order to select a proper subspace in the original function space. On the other hand, function selection criteria choose the best part of the feedback function set.

IV FACE RECOGNITION

After formulizing the reflection of each experience, the last step is to identify the details of these encounters. For each person, several pictures are taken and their functions are produced and saved in the data source. Then when a feedback experience picture comes in, we execute experience recognition and function removal, and evaluate its function to each experience category saved in the data source. There are two common programs of experience identification, one is known as identification and another one is known as confirmation. Face identification means given an experience picture, we want the program to tell who he/she is or the most potential identification; while in experience confirmation, given an experience picture and a think of the identification, we want the system to tell real or incorrect about the think.

- Holistic method
- Feature based method
- Hybrid method

V RESULT AND DISCUSSION

The implementation results of the detection algorithms based on neural network are studied. Experiments are conducted by ORL dataset for our proposed Gabor wavelet faces with feed forward neural network. The ORL dataset consists of 140 frontal faces in which the size of each image is 18×27 pixels. After the extraction of faces through wavelet, feed forward neural network is used as a classifier and the described database is used for training.

After training of the datasets elapsed time we get is 13.982878 seconds. The result obtained in proposed system is given as:

Step1: Feature extraction using Gabor filter.

Step 2: Face detection in the image using the output vectors from the filter.

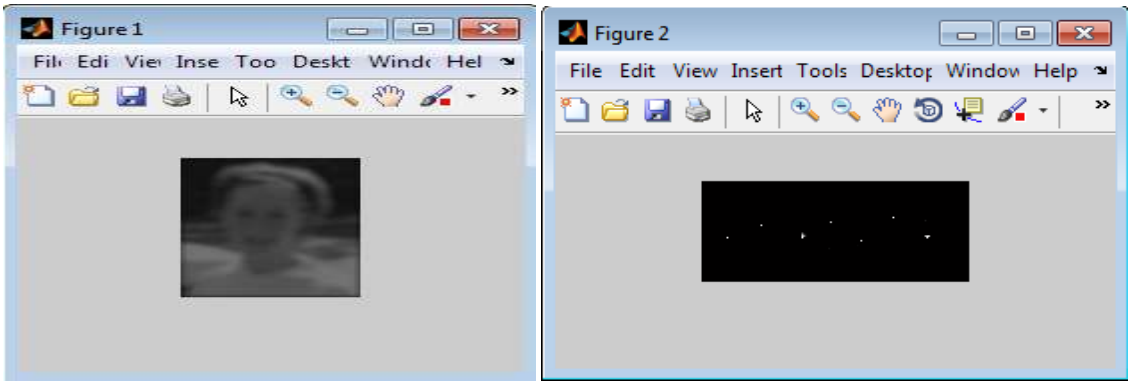
Step 3: Create image database for training the neural network.

Step 4: Initialize the network.

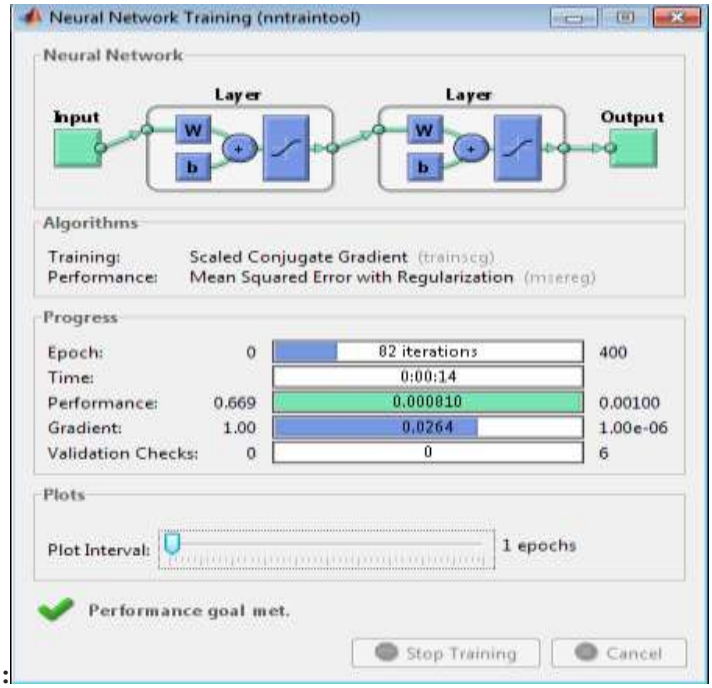
Step 5: Train the network using feature vectors obtained from the Gabor filter.

Step 6: Test on photo.

First section **Second section**

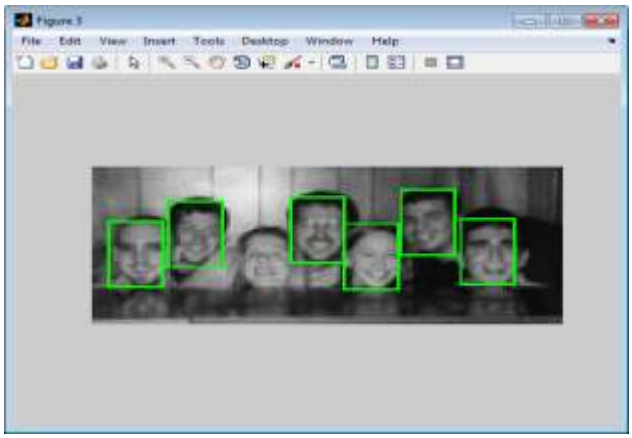


Third section



:

Final result



VI CONCLUSION

Face detection has been an attractive field of research for both neuroscientists and computer vision scientists. Humans identify a large number of faces and neuroscientists are interested in understanding the perceptual and cognitive mechanisms at the base of face detection process. Since 1988, many algorithms have been proposed as a solution to automatic face detection. Although none of them could reach the human detection performance. Although by using 2D Gabor wavelet transform, the local information is extracted from the nodes of a predefined graph, leaving some details on a face which is useful in detection task. In this paper, an approach to face recognition using Gabor wavelet transform and feed forward neural network is presented. Here we use Gabor wavelet for feature extraction and neural network for classification. The main problem which comes is that when the number of training non-face photos is high, the number of output neurons reduces. The faces which are not detected by the system is due to the lag of training data sets in neural scheme, and will be reduced by training more number of face image to the neural network. Dimension reduction supports to reduce the execution time and also reduce the memory space.

Neural Network is especially used in pattern recognition, in which patterns with large datasets can be recognized. It selects appropriate learning rules, transfer functions, data processing methods and specially how neurons are connected within the network.

In short face recognition evolved preprocessing of input image, extraction of feature and at last comparison is done for matching. Feature extraction involves the mining of useful amount of information required to describe a large set of data accurately.

In future, algorithm can be modified by using different wavelet transform methods to detect the change in orientation between the test image and database images.

REFERENCE

[1] Chellappa, Rama, Charles L. Wilson, and Saad Sirobey. "Human and machine recognition of faces: A survey." *Proceedings of the IEEE* 83.5 (1995): 705-741.

[2] Kepenekci, Burcu, "*Face Recognition Using Gabor Wavelet Transform*," MSc. Thesis, the Middle East Technical University, September 2001.

[3] F.Gaton, "Personal identification and description-1 nature 21," pp. 173-177, june 1888.

[4] Sir Francis Galton, "Personl identification and description-2 nature," pp. 201-203, 28 June 1888.

[5] Jingli Zhou, Shengsheng Yu Yongzhong Lu, "A Survey Of Face Detection, Extraction and Recognition," *Computing and Informatics*, vol. 22, pp. 163-195, 2003.

[6] Yu Su Shinguang Shan Xilin chen and wen gao, "hierarchical ensemble of global and local classifiers for face recognition," *IEEE*, 2007.

[7] Shang-Hung Lin, "An introduction to face recognition technology," *Informing Science special issue on multimedia informing technologies-part 2*, vol. 3, No. 1, 2000.

BIBLIOGRAPHY \l 1033

[8] Davood Sarikhanimoghadam and Hamid Dehghani Hossein Sahoolizadeh, "Face detection using Gabor wavelets and Neural Networks," *World Academy of Science Engineering and Technology*, vol. 2, pp. 9-20, 2008.

BIBLIOGRAPHY \l 1033

[9] T.Guhan N.Revathy, "Face Recognition system system using Back propagation Artificial Neural Networks," *International Journal of Advanced Engineering Technology*, vol. 3, no. I, pp. 321-324, January-March 2012.