International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 4 Issue 04, April-2015

Real time Face Recognition using Region- Based Segmentation Algorithm

Shemsa Selemani Ngambeki
College of Electronics Engineering
Tianjin University of Technology and Education
Tianjin, P.R China

Xuewen Ding, Michael D. Nachipyangu
College of Electronics Engineering
Tianjin University of Technology and Education
Tianjin, P.R China

***Abstract*----For the many years now, Face recognition has received a great deal of attention from both the market and research communities because of its many applications on various domains, but still remained very challenging in real time applications. A lot of face recognition algorithms, along with their modifications, have been developed during the past decades. In this paper, the real time face recognition is implemented on MatLab using region based segmentation technique called splitting and merging Algorithm. Also other region- based segmentation techniques are discussed in brief as well some applications of Face recognition**

Keywords-- Face recognition, Region based segmentation, Viola Jones face detector, MatLab

I. INTRODUCTION

Face recognition presents a challenging problem in the field of image processing, pattern recognition and computer visions. It is one of the most relevant applications of image analysis. It is a true challenge to build an automated system which equals human ability to recognize faces. Although humans are quite good at identifying known faces, but we are not very skilled when we must deal with a large amount of unknown faces. The computers, with an almost limitless memory and computational speed, should overcome human limitations. for many years, face recognition has drawn significant attention from the perspective of different applications. Despite the fact that there are more reliable biometric recognition techniques such as fingerprint and iris recognition, these techniques are intrusive and their success of these depends highly on user cooperation since the user must position her eye in front of the iris scanner for in iris recognition or put her finger in a finger

print device in finger print recognition. On the other hand, face recognition is non- intrusive since it based on images recorded by a distant camera, and can be very effective even if the user is not aware of the existence of the face recognition system. Many techniques have been implemented to perform face recognition task. In this paper we will focus on implementing region based segmentation technique called region splitting and merging algorithm for real time face recognition system.

II. FACE RECOGNITION

Face recognition technology is a kind of a biometric identification technology that identifies people based on their facial features. The technology uses a camera or webcam to acquire image or video stream containing human faces, automatically track the face in the image and then perform face recognition. Face recognition scenarios can be classified mainly into two types namely face verification (or authentication) and face identification (or recognition).

Face authentication (Am I who I say I am?) is a one –to-one match that compares a query face image with a template face image whose identity is being claimed. A good verification system verification rate (the rate at which a legitimate user are granted access) should be higher than false acceptance rate (the rate at which imposters are granted access).

Face identification (Who am I?) is a one- to- many matching process that compares a query face image against all the template images in a face database to determine the identity of the query face. The identification of the test image is done by locating the image in the database, whose image has the highest similarity with the test image. The identification process is a "closed" test, which means the sensor takes an observation of an individual that is known to be in the database. The test subject's features are compared to the other features in the database and a similarity score is found for each comparison.

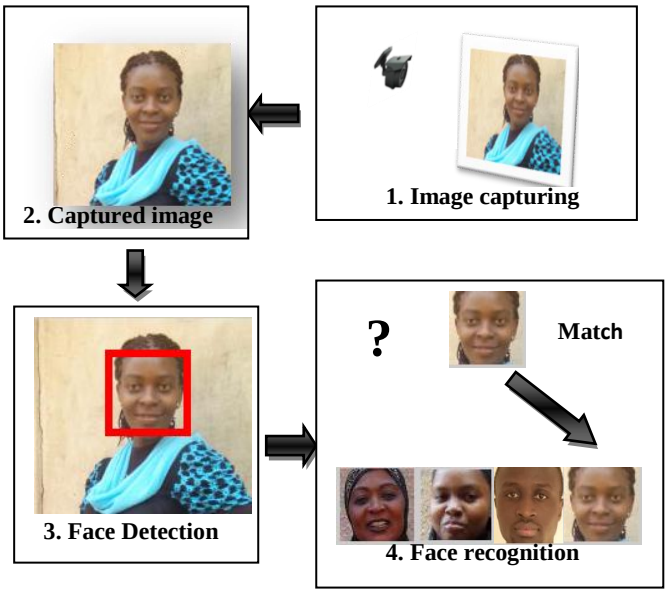


Fig 1. Face Detection and Recognition

The fig.1.above shows the face recognition procedure. A complete biometric face recognition system includes three main procedures namely: face detection, feature extraction and feature matching.

Face detection is the primary step in automated face recognition. It involves the extraction (localization) of face image from a large scene. Its reliability has a major influence on the performance and usability of the entire face recognition system. For a given single video or image , an ideal face detector should be able to identify and locate all the present faces regardless of their scale, orientation, positions, age and expression. Face detection can be performed based on several cues: skin color (for faces in color image and videos) motion (for faces in video) facial or head shape, facial appearance or a combination of these parameters. Many methods have been have been applied to this problem such as template-based techniques, motion detection, skin tone segmentation, principal component analysis, classification by neural networks and many more other algorithms.

The next procedure is feature extraction. At this stage face image extracted from the scene during face detection stage (detected face) will be processed. The image's facial features will be extracted and digitized. Features detected by the face recognition system include visual features, pixel statistics features, face image transformation ratio features and face image algebraic features. Many Algorithms have been employed to do this particular task.

Finally, the system does recognize the face. In an identification task, the system would report an identify from the data base. This phase involves comparison method, a classification algorithm and an accuracy measure.

III. REGION BASED SEGMENTATION TECHNIQUES

Image segmentation is one of the primary steps in image analysis for object identification. It involves the decomposition of an image into tessellations based on a certain criteria. It is one of the essential parts of both image processing and computer vision since it acts as a preprocessing step for pattern recognition and object detection. Segmentation is usually applied as an unsupervised learning method to detect region of interest with a certain characteristic and the constraint that the segmented regions should be homogeneous and without many holes inside. Equivalently, the similarity criteria should be uniform for pixel inside the same region and should vary among different regions. Existing segmentation algorithms can be categorized into region based segmentation, data clustering, edge based segmentation, JSEG and fast scanning algorithm. All of them expand each region pixel by pixel on their value or quantized value so that each cluster has high positional relation. The focus in this paper will be on the region based segmentation method.

Region-Based methods mainly rely on the assumption that the neighboring pixels within one region have similar value. The common procedures are to compare one pixel with its neighbors. If a similarity criterion is satisfied, the pixel can be set belong to cluster as one or more of its neighbors. Region growing method can be categorized into the following: Seeded region growing, the unseeded region growing, the Region splitting and merging and the Fast scanning algorithm. However in this paper we will discuss three of them, Seeded region growing, unseeded region growing and region splitting and merging.

A. Seeded region growing (SRG)

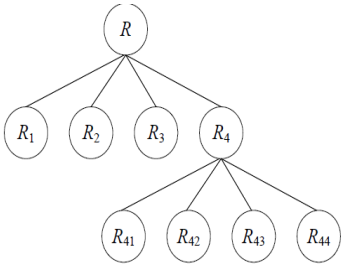
The seeded region growing (SRG) algorithm is one of the simplest region-based segmentation methods. it performs a segmentation of an image with examine the neighboring pixels of a set of points, known as seed points ,and determine whether the pixels could be classified in the cluster of seed point or not.

B. *Unseeded Region Growing*

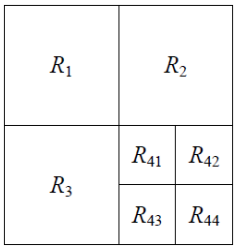
The unseeded region growing (URG) algorithm is a derivative of seeded region growing. Their distinction is that in URG there is no explicit seed selection is necessary. In the segmentation procedure, the seeds could be generated automatically. Therefore this method can perform fully automatic segmentation with the added benefit of robustness from being a region based segmentation.

C. *Region Splitting and Merging*

The main goal of region splitting and merging is to distinguish the homogeneity of the image. Its concept is based on quad trees, which means each node of trees has four descendants and the root of the tree corresponds to the entire image. Besides, each node represents the subdivision of a node into four descendant nodes. The instance is shown on the figure below.



2 (a)



2 (b)

Fig 2. 2(a) The structure of quadtree, where R represents the entire image region.2 (b) Corresponding partitioned image

The splitting and merging process have the following basics.

Let R represent the entire image region and decide a predicate P. The purpose is that if$P(R) = FALSE$, we divide the image R into quadrants. If P is FALSE for any quadrant, we subdivide that quadrant into sub-quadrants and so on. Until that, for any regionR_i , $P(R) = TRUE$. After the splitting process ,then the merging process is to merge two adjacent regions R_j and R_k if $P(R_j \cup R_k) = TRUE$.

The algorithm follows the following procedures :

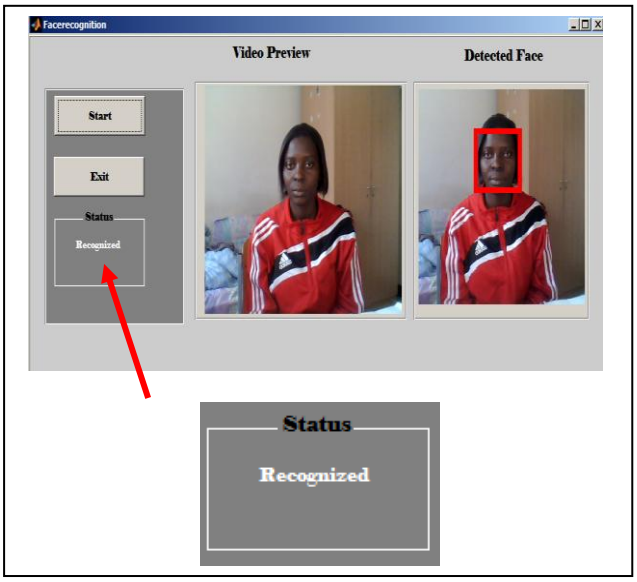
i. Splitting steps: For any region R_i, which $P(R_i) = FALSE$, we split it into four disjoint quadrants.

ii. Merging steps: When no further splitting is possible, merge any adjacent regions R_j and R_k for which$P(R_j \cup R_k) = TRUE$.

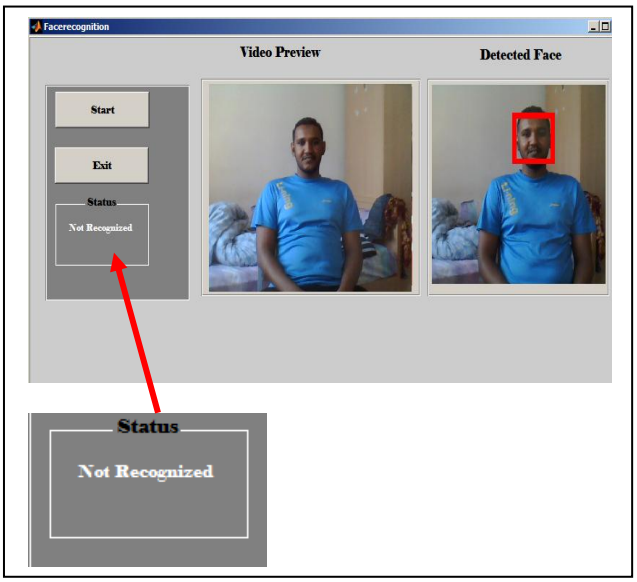
iii. Stop only if no further merging is possible.

IV. EXPERIMENTAL RESULTS AND DISCUSSION

On implementation of our real time face recognition system, the Viola Jones face detector is implemented for face detection process. The viola Jones face detector is a very useful method for real time object detection. Also for image segmentation the splitting and merging segmentation Algorithm is implemented, then feature extraction. Lastly the images were compared to those in our database for recognition. The Mat lab software was used implementation and the results are shown bellow



3 (a)



3(b)

Fig 3. 3(a)shows results when a person is recognized and 3(b) when not recognized

The experimental results shown above define two different cases when the person is identified and the case when the person is unidentified. The captured image undergoes face detection procedure then feature extraction and lastly the image is compared with the image in the database for recognition. If the person is recognized the status bar will display “recognized” and if the person is not the recognized status bar will display “not recognized”

V. CONCLUSION

In this paper, a real time face recognition system using region splitting and merging segmentation technique was successively implemented using Mat lab software and its performance was satisfactory. The real time face recognition system can play an important role in our daily life. This system can be applied in different areas, for example: security systems such as law enforcement and surveillance, and access control systems. Although the implemented system successively manage to identify people, but there is a challenge on designing a real time face recognition system such as light variation and quality of captured pictures. To reduce this problem, we recommend that the camera used for image capturing should of high quality so as to make the recognition performance of the system good.

VI. REFERENSES

(1) C. A. Hansen, “Face Recognition”, Institute for Computer Science University of Tromso, Norway.
(2) T. Kanade. Computer Recognition of Human Faces, 47, 1977
(3) R. Jafri, H. R. Arabnia, “A Survey of Face Recognition Techniques”, Journal of Information Processing
(4) W. Zhao, R. Chellappa, P. J. Phillips & A. Rosenfeld, “Face recognitions literature survey”, ACM Computing Surveys, Vol. 35, No. 4, December 2003.
(5) C. Gonzalez, R. E. Woods, S. liddins, "Digital Image processing Using MATLAB". Systems, Vol.5, No.2, June 2009.
(6) A. Tremeau, and N. Borel, "A Region Growing and Merging Algorithm to Color Segmentation," *Pattern Recognition*, vol. 30, no. 7, pp. 1191-1203, 1997
(7) R. M. Haralick and L. G. Shapiro, “Image segmentation techniques,” *Computer Vision Graphics Image Process.*, vol. 29, pp. 100–132, 1985.
(8) W. X. Kang, Q. Q. Yang, R. R. Liang, “The Comparative Research on Image Segmentation Algorithms”, IEEE Conference on ETCS, pp. 703-707, 2009
(9) Zhan, Y.; Wang, W. & Gao, W. A robust split-and merge text segmentation approach for images. In 8th International Conference on Pattern Recognition (ICPR .06), 2006.
(10) P. Viola and M. J. Jones, Robust real-time face detection, International Journal of Computer Vision, 57 (2004), pp. 137