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# Contour Based Face Recognition Process

Md. Hasan Tareque[#1], Golam Dastoger Bashar[#2], Saria Islam[#3] and A. S. M Mahmudul Hasan[*4]

[#]*Department of Computer Science and Engineering, IBAIS University*
*Dhaka, Bangladesh*

[*]*Hamdard University Bangladesh*
*Narayangong, Bangladesh*

*Abstract*— **This paper describes a method for building "Contour Based Face Recognition Process" system so that it gives a user friendly environment to recognize face or image. We made an effort to emphasize all the relevant and crucial parts of face detecting algorithm. In this paper a contour matching based face recognition system is proposed, which uses "contour" for identification of faces. The advantage of using contour matching is that the structure of the face is strongly represented in its description along with its algorithmic and computational simplicity that makes it suitable for both hardware and software implementation.**

**As the process includes a huge work, it is so much time consuming and researchable. We could not complete it as whole but we tried to develop an algorithm that can find the contour of a human face and also develop the matching algorithm so it could recognize face more efficiently.**

**The outcome of our research in the field of "Contour Based Face Recognition Process" development provides data that can be used by researchers who entail information to work further in the development of face recognition.**

*Keywords*— **Contour Generation, Face Recognition, Histogram equalization, Matching Algorithm.**

## I. INTRODUCTION

Face recognition is a form of biometric identification. A biometrics is "Automated methods of recognizing an individual based on their unique physical or behavioural characteristics." [1] The process of facial recognition involves automated methods to determine identity, using facial features as essential elements of distinction. The automated methods of facial recognition, even though work very well, do not recognize subjects in the same manner as a human brain. The way we interact with other people is firmly based on our ability to recognize them. One of the main aspects of face identification is its robustness. Least obtrusive of all biometric measures a face recognition system would allow a user to be identified by simply walking past a surveillance camera .The research on face recognition has been actively going on in the recent years because face recognition spans numerous fields and disciplines. There is an increasing demand for security in commercial and law enforcement applications. The rapid development of face recognition is due to a combination of factors such as active development of algorithms, the availability of large databases of facial images, and a method for evaluating the performance of face recognition algorithms [2].

While humans quickly and easily recognize faces under variable situations or even after several years of separation, the problem of machine face recognition is still a highly challenging task in pattern recognition and computer vision [1]. A face is inherently a 3D object illuminated by a variety of lighting sources from different directions and surrounded by arbitrary background objects. Therefore the appearance of a face varies tremendously when projected onto a 2D image. Different pose angles also cause significant changes in 2D appearance. Robust face recognition requires the ability to recognize identity despite such variations in appearance that the face can have in a scene [3]. Simultaneously the system must be robust to typical image acquisition problems such as noise, video camera distortion, and image resolution. The recognition methods are categorized as follows which is based on intensity images.

Humans often use faces to recognize individuals and advancements in computing capability over the past few decades now enable similar recognitions automatically. Early face recognition algorithms used simple geometric models, but the recognition process has now matured into a science of sophisticated mathematical representations and matching processes. Major advancements and initiatives in the past ten to fifteen years have propelled face recognition technology into the spotlight [4]. Face recognition can be used for both verification and identification (open-set and closed-set).

## II. FACE RECOGNITION

A face recognition system is a computer-driven application for automatically identifying or verifying a person from still or video image [5]. It does that by comparing selected facial features in the live image and a facial database Face recognition technique tries to find a face within a large database, where the system returns a possible list of faces from the database. A face recognition system is a computer-driven application for automatically identifying or verifying a person from still or video image. It does that by comparing selected facial features in the live image and a facial database Face recognition technique tries to find a face within a large

database, where the system returns a possible list of faces from the database. And the images of various faces have been inserted into database as training data. We are trying to use these techniques in security purpose where password or finger print verification is not enough.

To build a system that can be used for human face identification based on the contour matching technique. Here the system will try to generate contours of the input image and also build a database of training image to match with input image. So that the system could identify the human face form a given input. After identifying the image the system could be used different sector like security system, banking system, voter identification, identify person from a video stream etc. For that a strong matching algorithm is required that will be fast and its implementation will be also easy. But building such an algorithm is not an easy task, so at first an easy matching algorithm is build so that could work in a small field, later the matching algorithm needs to be modified so it could work more efficiently.

The research on face recognition has been actively going on in the recent years because face recognition spans numerous fields and disciplines. There is an increasing demand for security in commercial and law enforcement applications. Facial recognition software has become an integral part of security around the world. Not highly favored in its early stages because of a lack of identifying correctly, but now with better technology of cameras' resolution the software is now able to more accurately calculate the nodal points of a person's face using the more integrated computers and software. While the high resolution cameras are not all that the software needs it also needs a faster and better equipped computer to compliment the software. With the better computer systems the program will be able to be more precise when transferring the nodal points into code where then it is compared to the database. Face recognition is an interesting and attractive field of research. It also has good future career opportunity.

## III. Face Recognization System

The system was divided into four (4) sub system. Each sub system has to perform well to get the final result accurate.

First the system has to take the input image from the user. It can be through a web camera, mobile phone or from the location the image is stored. Then it is required to show the system, the existing location where the images are stored.

Second the image was converted to gray scale. Then the image was stored in a pre-defined folder. Here different folder for different person was assigned so it made the system work efficiently.

Third system needed to do image processing. In this sub system Histogram equalization, Noise Elimination using Gaussian blurring and last making the image gray scale had to be done. For all this work, MATLAB predefined functions were used.

Fourth the system generated contours of the processed image. This is the trickiest part of the system because generating a contour of an image is not an easy task and needs a real hard work to get the right result.

Finally the system generated a matching algorithm that can recognize face, if the input image matches with database image, and also can give decision if input image not matched with database image.

The steps of face recognition are:

- Making image gray scale.
- Image Processing
  - Histogram Equalization
  - Noise Elimination
  - Make The Image Pure Black & White
- Contour Generation.
- Matching Algorithm.

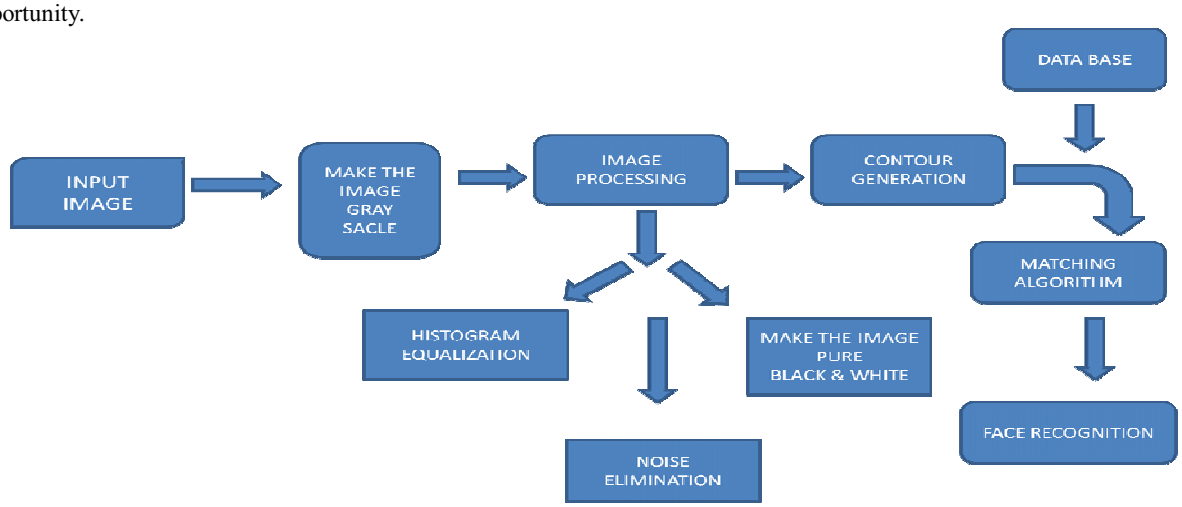


Fig. 1 Proposed System

*A. Making image gray scale*

Making the image gray scale it will help the process of Histogram Equalization. Because support many feature of Noise Elimination.

Fig. 2.1 Input image

Fig. 2.2 Gray Scale Image

*B. Image Processing*

The images are divided into two mutually exclusive sets:

- Training set is used to initialize and prepare the system to recognize arbitrary images and to fine tune the algorithm parameters.
- The test set is the set of images which is used to evaluate the performance of the system after training is completed.
- The images are preprocessed to improve the recognition performance.
- After the preprocessing stage, all the new images should have same dimension such as 223 x 271 pixels

It is important to use a training face database that includes different images of same subject because the system should be able to identify faces whether they are smiling, sad, wearing glasses, and not wearing glasses. Also the camera focus must be good so that face of the person can clearly visible. The recorded image used for database must be enlarging so that the system can give maximum correct output.

*C. Histogram Equalization*

Histogram equalization is performed which enhances the contrast of images by transforming the values in an intensity image so that the histogram of the output image approximately matches a specified histogram as shown in Fig 3.

Fig. 3 Image after Gaussian Blurring

*D. Noise Elimination*

This is used to remove any noise (if present) from the image. This is done using Gaussian blurring which is as shown in Fig 4.

Fig. 4 Image after Gaussian Blurring

*E. Make The Image Pure Black & White*

This is done because black & white giving a good and generates a close contour of the input image.

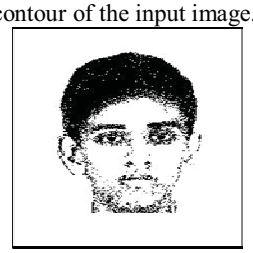

Fig. 5 Image after Black & White

*F. Contour Generation*

- This is the core of the system in which the contour of a face is generated from the image.
- The whole face is treated as a contour map, with the areas of constant gray level brightness (i.e. the plains) enclosed by the contour lines.
- Thus contour lines for a given face can be generated.
- The contour of a given image is as shown in Figure 3.6.

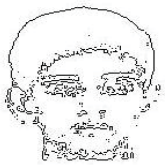

Fig. 6 Contour of a Given Image

*G. Matching Algorithm*

In general, it is quite difficult to extract facial area information using only simple techniques. In two face images of the same person, similar features can still be found in their contours. On the contrary, there are remarkable differences, not only in the shape but also in the size of the contours for images of different persons-

- Compare two images pixel by pixel.
- Compare total Generated contour length of two images.

- By the comparing two images pixel by pixel we get percentage of similarity. If the test values are more than some desired value than it returns matched.

If the contour length difference are bigger than some desired value than it returns unmatched.

## IV. RESULT

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If input image is same as registered image-

Fig. 7.1 Registered Image

Fig. 7.2 Input Image

Fig. 7.3 Registered Image and Input Image after Histogram Equalization

After filtering-

Fig. 8.1 Registered Image and Input Image after Filtering

Fig. 8.2 Contour of Registered Image

Fig. 8.3 Contour of Input Image

In this case face is recognized.

If the input image is different from the registered image-

Fig. 9.1 Registered Image

Fig. 9.2 Input Image

Fig. 9.3 Registered Image and Input Image after Histogram Equalization

After filtering-

Fig. 10.1 Registered Image and Input Image after Filtering

Fig. 10.2 Contour of Registered Image

Fig. 10.3 Contour of Input Image

In this case face is not recognized.

## V. CONCLUSIONS

Face recognition using contour matching has been proposed. The shape of the contours is affected by the tilting or panning of a face, though the effect due to these is not examined. It is an important problem and is left open for later study. Some pictures used in the experiments did have a degree of panning or tilt in them but the angles were quite small. The matching results obtained show that with a small degree of panning and tilting, the results are quite good. The further scope includes setting the threshold values automatically according to the characteristics of the image and experimentation with pictures with non-ideal faces or pictures taken by camera and the algorithm need to be tested for larger variation of database.

The proposed system of face recognition may be applied in identification systems, document control and access control. The face similarity meter was found to perform satisfactorily in adverse conditions of exposure, illumination and contrast variations, and face pose. Biometric technologies are found application in four broad application categories: surveillance, screening, enrollment identification, and identity verification. General security tasks, such as access control to buildings, can be accomplished by a face recognition system. Banking operations and credit card transactions could also be verified by matching the image encoded in the magnetic strip of the card with the person using the card at any time. Finally, a robust system could be used to index video-documents (video-mail messages, for example) and image archives indexed in such a way would be useful for criminal identification by the investigation department.

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