Training Free Face Recognition and Cropping using Skin Identification Algorithm

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Abstract - Face recognition system is an automatic process of detection of faces in images captured by the cameras in the artificial intelligence systems. Various methodologies have been adopted for face detection. Face recognition techniques are working on the various devices like surveillance systems, mobile, home door locking systems and many security systems for authentication purposes. In this paper the face is recognized in the image given as input it can be captured by any camera. The image is than processed with the skin detection algorithm and the face area is cropped and extracted out. The good thing about this proposed methodology is this algorithm does not need any training kind of thing which is free from taking recognition time. Such methodology be very useful in the situations where training for fresh images not available.

Keywords - Face Recognition, Training Free, Face Cropping, Skin Identification and Artificial Intelligence.

I. INTRODUCTION

Face recognition has recently received a blooming attention and interest from the scientific community as well as from the general public. The interest from the general public is mostly due to the recent events of terror around the world, which has increased the demand for useful security systems. Facial recognition applications are far from limited to security systems as described above. To construct these different applications, precise and robust automated facial recognition methods and techniques are needed. However, these techniques and methods are currently not available or only available in highly complex, expensive setups. The topic of this thesis is to help solving the difficult task of robust face recognition in a simple setup. Such a solution would be of great scientific importance and would be useful to the public in general.

The face is our primary focus of attention in social life playing an important role in conveying identity and emotions. We can recognize a number of faces learned throughout our lifespan and identify faces at a glance even after years of separation. This skill is quite robust despite of large variations in visual stimulus due to changing condition, aging and distractions such as beard, glasses or changes in hairstyle.

Computational models of face recognition are interesting because they can contribute not only to theoretical knowledge but also to practical applications. Computers that detect and recognize faces could be applied to a wide variety of tasks including criminal identification, security system, image and film processing, identity verification, tagging purposes and human-computer interaction. Unfortunately, developing a computational model of face detection and recognition is quite difficult because faces are complex, multidimensional and meaningful visual stimuli.

Face detection is used in many places now a days especially the websites hosting images like picassa, photobucket and facebook. The automatically tagging feature adds a new dimension to sharing pictures among the people who are in the picture and also gives the idea to other people about who the person is in the image. In our project, we have studied and implemented a pretty simple but very effective face detection algorithm which takes human skin colour into account.

Our aim, which we believe we have reached, was to develop a method of face recognition that is fast, robust, reasonably simple and accurate with a relatively simple and easy to understand algorithms and techniques. The examples provided in this thesis are real-time and taken from our own surroundings.

II. FACE RECOGNITION TASKS

The three primary face recognition tasks are:

• Verification (authentication) - Am I who I say I am? (one to one search)

• Identification (recognition) - Who am I? (one to many search)

• Watch list - Are you looking for me? (one to few search)

Different schemes are to be applied to test the three tasks described above.

Which scheme to use depends on the nature of the application.

A face recognition system would allow user to be identified by simply walking past a surveillance camera. Human beings often recognize one another by unique facial characteristics. One of the newest biometric technologies, automatic facial recognition, is based on this phenomenon. Facial recognition is the most successful form of human surveillance. Facial recognition technology, is being used to improve human efficiency when recognizing faces, is one of the fastest growing fields in the biometric industry. Interest in facial recognition is being fueled by the availability and low cost of video hardware, the ever-increasing number of video cameras being placed in the workspace, and the noninvasive aspect of facial recognition systems.

Although facial recognition is still in the research and development phase, several commercial systems are currently available and research organizations, such as Harvard University and the MIT Media Lab, are working on the development of more accurate and reliable systems.

We have focused our research toward developing a sort of unsupervised pattern recognition scheme that does not depend on excessive geometry and computations like deformable templates. Eigenfaces approach seemed to be an adequate method to be used in face recognition due to its simplicity, speed and learning capability.

III. PROPOSED METHODOLOGY

Facial recognition is a visual pattern recognition task. The three-dimensional human face, which is subject to varying illumination, pose, expression etc. has to be recognized. This recognition can be performed on a variety of input data sources.

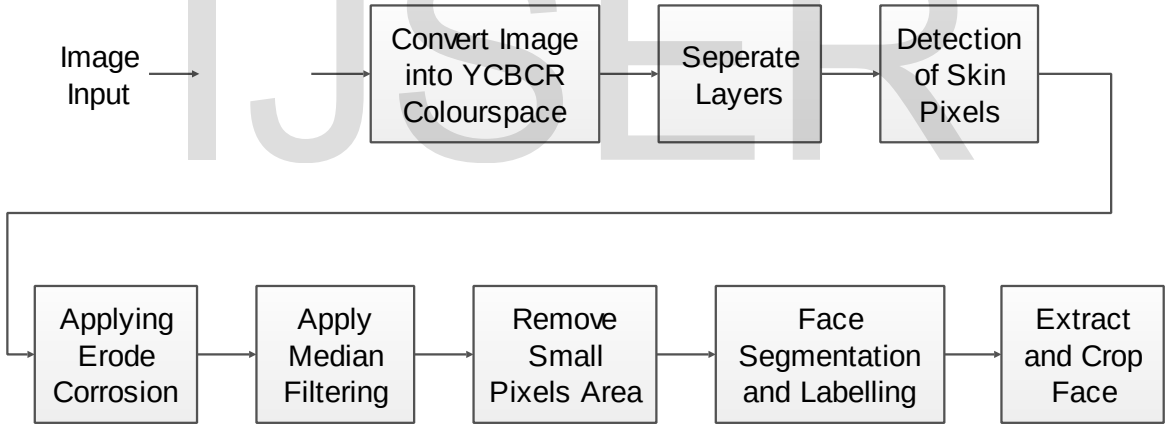


Fig. 3.1 Block Diagram of Proposed Methodology

The aim of face detection is localization of the face in a image. The aim of the face preprocessing step is to normalize the coarse face detection, so that a robust feature extraction can be achieved. The variation of facial appearance of different individuals, which can be very small.

- The non-linear manifold on which face images reside.
- The problem of having a high-dimensional input space and only a small number of samples.

When looking at the photometric information of a face, face recognition mostly rely on analysis of a subspace, since faces in images reside in a sub manifold of the image space. This can be illustrated using the skin detection algorithm.

The proposed skin detection based training free face recognition algorithm is given below in the fig. 3.1. The main blocks are conversion of RGB image into YCBCR colour space. Separation of layers to detect skin area. After

that skin area is detected and the image is passed through median filtering. The results of this step is like binary image. The binary image is having blocks of pixels and the small groups of 500 pixels are removed and rest of the blocks are labelled each label is considered for skin area of face, and the pixel indexes are extracted and face area is cut down from original image according to indexes found.

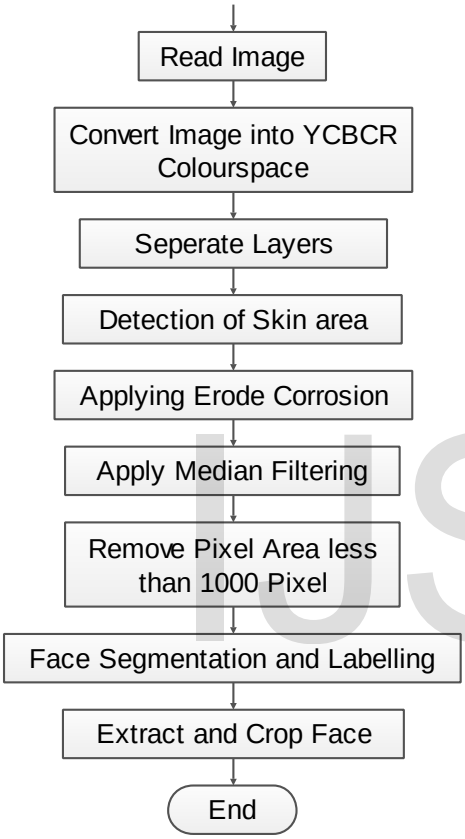


Fig. 3.2 Flow Chart of Proposed Methodology

The above explained proposed face recognition algorithm is implemented on the simulation tool and the flow of the algorithm is explained with the help of flow chart in the below Fig. 3.2. The main steps are as follows:

a. *Start the simulation*
b. *Read Image after browsing*
c. *Convert RGB image into YCBCR colour space for better skin area detection*
d. *Separate the layer Y, CB and CR where in the layers CB and CR having better skin properties*
e. *Now set parameters of skin like colour intensities and put rest of the pixels zero or null*
f. *Apply Erode corrosion for removing pixels like ball having pixel are 2x2*
g. *Now delete those group of pixels which has 500 pixels or less*
h. *Now label rest of the pixel groups and find out the pixel indexes of those groups*
i. *Crop the original image as per pixel indexes found*
j. *The extracted pixels are face*
k. *End of simulation*

IV. Simulation Results

The face recognition algorithm mentioned in the previous section is evaluated and the results are found. The whole algorithm has major steps of face recognition and the outputs after each step is given in the table below. The respective steps with the outputs with recognition time is also given in the table. The comparison of the proposed methodology with the existing learning free techniques are also compared and the accuracy is also compared which is higher than the previous methods. The comparison is shown in the Table I.

From the above mentioned results (in Table II) it can be say that the recognition of face with face cropping time is about 0.72 seconds on an average which is very fast. The images are taken of different dimensions which shows the adaptive nature of the algorithm. The multiple face images are also considered in this algorithm, i.e. multiple face in a single image is also recognized and cropped.

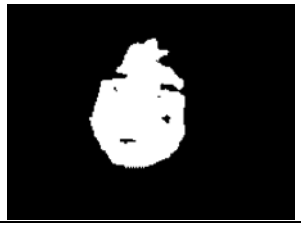
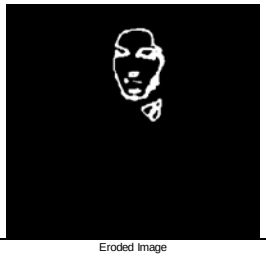
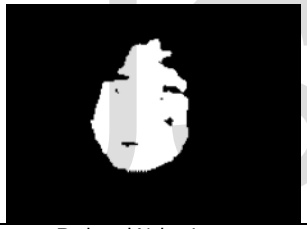
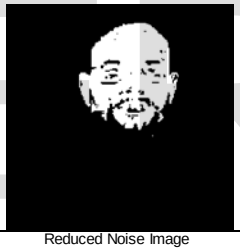
TABLE I: RESULTS AND PERFORMANCE COMPARISON OF PROPOSED METHODOLOGY

Parameters	**Viola Jones Method**	**Scanning Based Learning Free (Base Paper)**	**Proposed Work**
No. of distinct Input Images	59	59	**114**
No. of images detected faces	19	58	**113**
Success rate	32.20%	98.3%	**99.11%**

No. of images accurately cropped face	19	54	**113**

Accuracy rate	32.20%	91.5%	**99.11%**

TABLE II: OUTPUTS OF THE PROPOSED ALGORITHMS AT VARIOUS STAGES

Results after Main stages	**Kalam**	**Modi**	**Player**
Original Input Image	Original Image 	Original Image 	Original Image 
Extraction of Skin Area	Skin Like Area 	Skin Like Area 	Skin Like Area 
After Applying Erode Corrosion Operation	Eroded Image 	Eroded Image 	Eroded Image 
Reduced Noise	Reduced Noise Image 	Reduced Noise Image 	Reduced Noise Image 
Removing Pixels less than 1000 pixels	After Removing group of the pixels less than 1000 	After Removing group of the pixels less than 1000 	After Removing group of the pixels less than 1000 

Detected and Cropped Faces	Face Detected 	Face Detected 	Face Detected 
Recognition Time	0.4215 Seconds	0.4063 Seconds	0.4285 Seconds
Size of Image	200x151	200x204	300x281

V. Conclusion and Future Scope

From the results it is clear that the above proposed methodology is completely free from training database, means it can be applicable in various systems where face area need to be extracted out. The technique having advantage of extraction of multiple faces in a given image. The proposed algorithm has 99% accuracy and take very less time to execute. After comparison from the existing work on face recognition based on training free technique, proposed technique is quite better than in accuracy and speed.

In future the advancement in the skin detection algorithm with the integration of other feature of eyes, nose, mouth and chin makes this technique more accurate and robust with high speed detection and recognition of faces in a given image with multiple face detection technology in a single attempt.

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