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Content Based Image Retrieval for Brain Scan Images

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Abstract— **Face is our primary focus of attention for conveying identity. Human face detection by computer systems has become a major field of interest. Detection of faces in a digital image has gained much importance in the last decade, with application in many fields. Automating the process to a computer requires the use of various image processing techniques. This paper presents a new face detection method which combines the morphological operations and the Template Matching Method. First we convert the input image into binary image with adjustments in the dynamic threshold value. After that background minimization through the morphological operations is done and then connected component analysis is performed on the resultant image. Then correlation of the connected components and threshold value of template is done which finally identifies the face region in the image. The template threshold is obtained by converting the RGB images in the database into YCbCr model and finding covariance between the mean values of Cb and Cr.**

Keywords- Connected Components, Opening, Template matching, YCbCr model.

I. INTRODUCTION

Computer vision is one out of many areas that wants to understand the process of human functionality and copy that process with intension to complement human life with intelligent machines. Face detection and localization is usually the first step in many biometric applications like, face recognition, video surveillance, human computer interface etc. Face detection in general terms is defined as to isolate human faces from their background and exactly locate their position in an image. Different algorithms based on the approaches, like Knowledge based [11], template matching [5, 6], neural networks [7], Eigen face decomposition [8], support vector machine [9], pattern recognition [9] etc. are effectively applied in detection of faces. Each algorithm has its own advantages and disadvantage in terms of accuracy, speed, complexity based on the prior information and knowledge. The present paper uses a mixed approach that is, morphological operations followed by template matching. The color based approached usually take care of either RGB or HSI [9,10], but in this algorithm we take covariance value of mean values of Cb and Cr values students in education for detecting the growth of tumors, and for research purposes.

II. MORPHOLOGICAL OPERATIONS

Here operations are applied to minimize the background. Operations result in a binary image same as the size of original image in which background gets blackened and skin regions get whitened. However some regions similar to skin also appear white: pseudo color pixels like clothes, floors, building etc. The goal of the connected component algorithm is to analyze the connection property of skin regions and identify the face, which are described by rectangular boxes. Ideally each face is a connected region separated from each other. However, in some circumstances, two or even three faces can be connected by ears or high luminance hairs. In addition, pseudo-skin pixels are scattered and generate hundreds of connected components, which costs unnecessary computations if they are identified as face candidates. However, the connection is thin compared to the inside regions of the face and it can be broken by image morphology operations. After color segmentation the left over noise in the background can be smoothened using morphological processing. It is necessary to remove the unwanted specs in order to speed future processing. Hence the open (erode followed by dilate) operation was performed using a structuring element. It was observed that the open operation has resulted in huge reduction in the number of small noisy specs. Erode shrinks the selected area and expands the background, whereas dilate operation does the reverse of this. In particular, one row direction and one column direction image erosion operations are applied so that more pixels are eroded in column directions. This is based on the observations that faces are usually connected more horizontal. In addition, within a face, connections between the parts above and below the eyes are fragile and it is desired not to erode this connection. As erosion operation act similar to median filter, and can remove pseudo-skin pixels because of their scattered and weak connection property. Between first and second level erosions, holes are filled so that later erosions only happen at edges of the connected components and will not cause regions inside face to fall apart

III. CONNECTED COMPONENT ANALYSIS

Connected component analysis is a method used to find homogenous regions in an image – in this case a binary image. Black pixels are considered to be background pixels and so any white pixels indicate foreground pixels (the objects the program is interested in). The essential idea behind connected component. analysis is to connect all the

pixels that touch other white (foreground pixels) together in order to form a region. So instead of foreground pixels, there are now foreground regions.

The fundamental method is relatively simple, although there are many ways of implementing it. The image, in this case the background subtraction image of the input image with noise reduction completed, is searched through pixel by pixel, from top left corner to bottom right and any white pixel is labeled (i.e. given a unique number). The label is either a new label if none of the surrounding pixels (that have already been passed) are labeled or else one of the surrounding pixel's labels. If there is more than one distinct label around the pixel, an "equivalence" is noted between them. After all the pixels have been thus labeled, all the equivalent labels are relabeled so those connected pixels have the same label and so become the same connected component or region.

IV. TEMPLATE MATCHING

Template matching methods [9] that find the similarity between the input images and the template images (training images). Template matching method can use the correlation between the input images and stored standard patterns in the whole face features, to determine the presence of a whole face features. This method can be used for both face detection and face locations. The advantages of this method are that it is very simple to implement the algorithm, and it is easily to determine the face locations such as nose, eyes, mouth etc. based on the correlation values. It can be applied on the various variations of the images such as pose, scale, and shape. Sub-templates, Multi-resolutions, and Multi-scales have been proposed to achieve the shape and the scale invariance.

In the proposed algorithm when an image with connected regions is obtained operations are applied on it to obtain an image with connected skin regions only. This is done by the method of template matching. The template threshold value calculated is used here to obtain the skin regions. Thus after doing connected component analysis we obtain an image with connected skin regions as white region and the rest region is black in color.

After this, it uses the fact that the ratio of height to width for a face is usually about 1. So in the proposed algorithm the next step is to calculate the ratio of height to width of the connected regions. If the ratio is below 1.8, it is considered as face.

A. Calculation of threshold value

The algorithm takes the advantage of face color correlation to limit face search to areas of an input image that have at least the correct color components. In the literature [9,10] there are many color based face detection algorithm, but the proposed algorithm uses the two color spaces only namely, HSI and YCbCr. The bounding ranges calculated for the values of H, Y, Cb and Cr were used to generate the binary images.

1) YCbCr color space

YCbCr space segments the image into a luminosity component and chrominance components. The main advantage is that influence of luminosity can be removed during processing an image. Using the reference images different plots for Y, Cb and Cr values for face and non-face pixels were plotted and studied to find the range of Y, Cb and Cr values for face pixels.

To classify each image pixel as a face or non-face from the correlation result, we need to choose a good threshold value. This is a difficult choice and risk degrading into playing with a heuristics and losing performance on general images. Fixing a hard threshold is difficult as the correlation result must be properly normalized to remove the effects of image size. This problem will be compounded when we try to combine the results from different resolutions in the multi-resolution extension. Moreover this is greatly dependent on the degree of clutter in the image and lighting intensities. In fact, we are not even sure that there is going to be a face in any general image, thus we cannot be tempted to use correlation maxima as the sole criteria. We decided to use the mean value of Cb,Cr and covariance between mean values of Cb and Cr as the correlation threshold value. Thus the threshold is adaptive and adjusts to different images, lighting conditions, degree of clutter etc. Each face is equally likely to exceed the threshold while background will be suppressed as low correlation relative to the mean correlation.

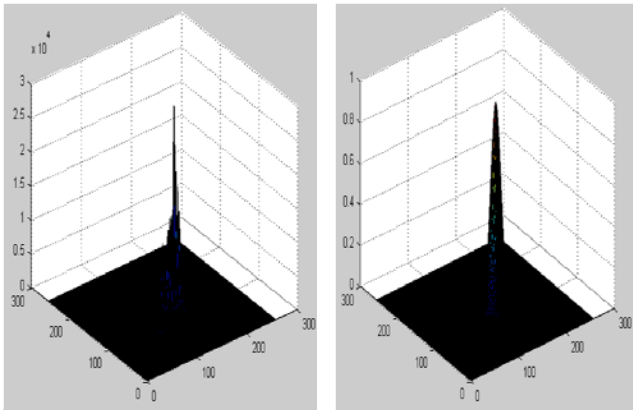

Fig1: Plotting mean values of Cb and Cr component of training samples and covariance between Cb and Cr suggesting threshold value for template

V. DESIGN AND APPROACH

The basic principle behind this is to find connected skin regions and then determine whether face is present or not in those connected regions

The steps to be followed are as under:

- **Step1**- An input image is taken and converted to grayscale image and then to binary image.

- **Step2**-Morphological operations like opening and closing are applied on binary image to minimize the background of the image.
- **Step3**-Then connected component analysis is done on the resultant image to find out the connected regions of skin color.
- **Step4**-Finally, correlation between the template threshold and width and height ratio of connected regions is done to obtain the face region. The value less than threshold value will be considered as the face region and the image will appear with a rectangle around it.

The block diagram of the proposed methodology is as under:

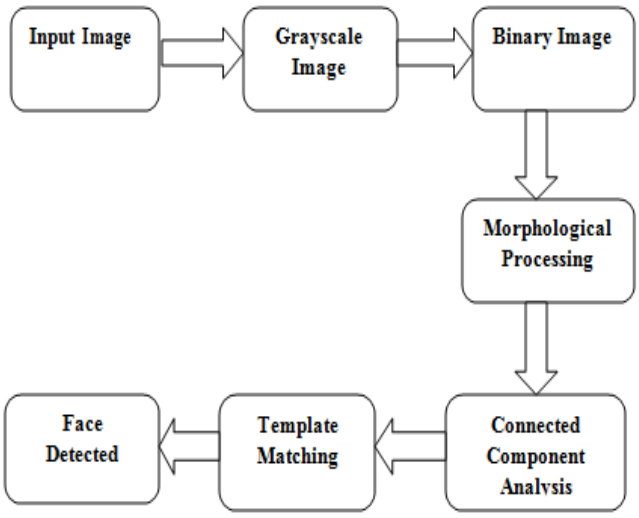

Fig2: **Block Diagram**

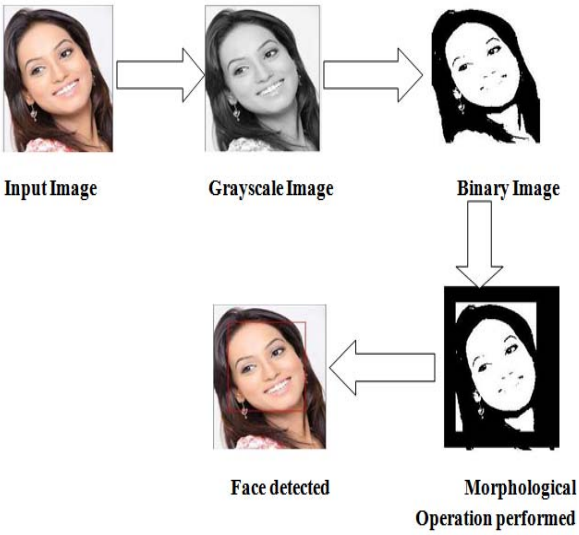

Fig4: **Experiments and Results**

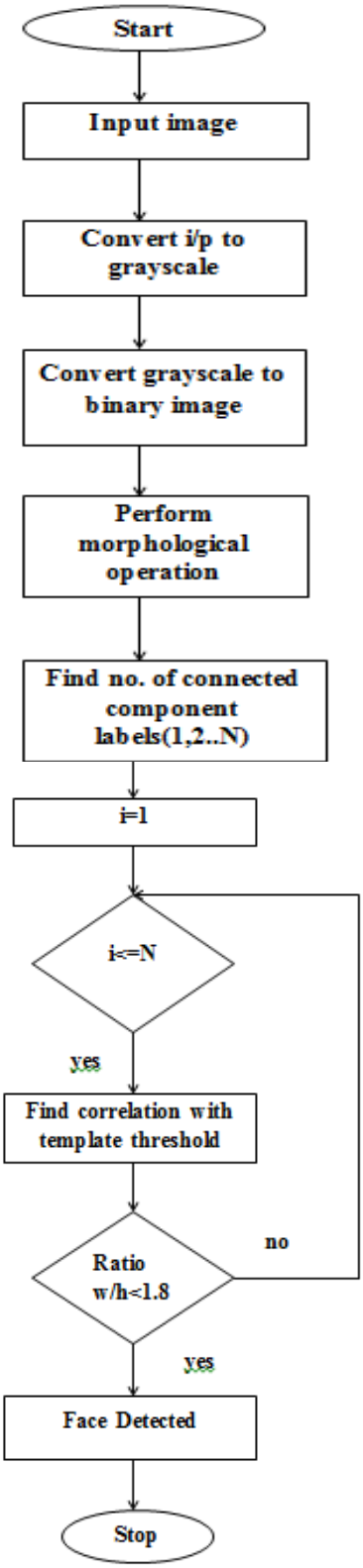

Fig3: **Flowchart for Algorithm**

VI. FUTURE WORKS

The proposed methodology works on the frontal view of the image and also can be applied to the image having single face in it. So future works can be a modification in the approach for multiple face detection.

VII. CONCLUSION

The above algorithm was implemented in MATLAB on more than 50 such test images which were given as an input to the algorithm directly. The efficiency of the face detection was found to be near about 86.7%.

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