

# Threshold Based Face Detection

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## ABSTRACT

Face detection is one of the significant applications of image processing and plays an important role in biometric systems. It is an interesting field of research that verifies the presence of faces and locates their positions in an image. This paper describes a face detection method based on image segmentation and threshold value. The experimental result of the proposed system gives an excellent result in terms of increased accuracy of face detection system both in still images and in video frames. It was tested using MATLAB with huge number of input images.

**Keywords:** Image segmentation, Morphological Operation, Threshold.

## 1. INTRODUCTION

Face recognition has been an active research area for the last four decade, the initial stage in face recognition system is to detect the face from an input image, the main objective of this stage is to find all the faces that appear in the image irrespective of its pose, aging, expression, illumination and disguise. It is very challenging task because of the variability in scale, orientation, location, facial expression, occlusion and lighting conditions. The human faces represent multidimensional, difficult, meaningful visual stimulant. Developing a computational model for face recognition is difficult [7].

## 2. RELATED WORK

Face detection is the first stage in face recognition with the purpose of localizing and extracting the face region from the background factors like pose, illumination, occlusion and the size of image makes difficult to detect or to recognize the face correctly. Yan, Kriegman and Ahuja presented a classifications that is well accepted [3]. classified methods are categorized into four types, they are Knowledge-based methods, Feature invariant approaches, Template matching, Appearance-based methods, each of these methods have its own limitations.

**a) Knowledge-based methods:** It comprises a set of rules that encode human knowledge of what constitutes a face and generally consist of relationships between facial features. This method is aimed at finding invariant features of a face with in a complex environment, thereby localizing the position of the face. Relationship among the features helpfully determines whether a human face appears in an image or not [8]. The advantage of this method is, it works well for face localization in uncluttered background and it is easy to come up with simple rules. The main drawback of this method is difficult to translate human knowledge into rules precisely, difficult to extend this approach to detect faces in different poses

**b) Feature-Invariant Methods:** This method aims to find structural features that exist even when the pose and lighting conditions vary, and then use these features to locate faces. This approach utilizes different positions, brightness and viewpoints to detect human faces. A statistical model is usually built up for describing the relations among facial features and the presence of the detected faces. Such face features, for instance are facial features, Texture and skin color [9]. The advantage of this method is using features are invariant to pose and orientation change. The main drawback of this method is, it is difficult to locate facial features due to several corruptions (illumination, noise, and occlusion) and to detect features in complex background.

**c) Template-Based Methods:** In these methods, standard patterns of a face are stored and the correlations between an input image and the stored patterns are used for detection. This method is used for finding facial features of an image which match based on the template and an input image. Shape template [10] and Active shape Model [11] are common examples of this method. This is simple method to implement. The drawback of this method is, templates need to be initialized near the face images and it is difficult to enumerate templates for various types of poses.

**d) Appearance based method:** In this methods, models (or templates) learned from a set of training images to capture the representative variability of facial appearance are used for face detection [12]. This method rely on techniques from statistical analysis and machine learning to find the relevant characteristics of face images. This method has demonstrated good empirical results. It extended to detect faces in different pose and orientation. Many approaches are proposed for classification. The major problem with these methods is that they require a very long computation time in the training phase.

Apart from these methods hybrid techniques are also used to combine one or more methods to improve the quality of face detection. Deepak Ghimire, et al. [4] proposed face detection by skin color image. It enhances the input image, segments the skin regions in color spaces RGB and YCbCr, and combines the edge image with the skin color image to separate between the skin regions and the background. The advantage of this method is the detection of faces in different illumination conditions, different sizes, different poses, and different expressions. Shady et al., [5] proposed a face detection method that allows to segment the skin region by applying a set of filtering operations and using a set of face features as chin point, nose point, nose bottom point, nose above point, neck point, and angle between (nose, nose above and nose bottom) points. This technique gives good results particularly in profile faces. Samir El Kaddouhi, et al., [6] proposed a face detection method based on the detection of skin regions, the application of geometric constrain (surface, ratio, eccentricity and similarity) and clustering corner points detected by Harris. The advantage of this method provides perfect face detection under all conditions (pose, expression or the presence of occlusion).

### 3. PROPOSED METHODOLOGY

In Face Recognition system, Face detection is the initial step, the main purpose of this step is to localize and extract the facial region from the background that will be fed into the face recognition system for identification. The processing steps of Our Proposed system consists the following steps

1. Image Acquisition(input)
2. Colour Segmentation
3. Image Segmentation
  - a. Morphological Operation
  - b. Edge detection
4. Face detection(output)

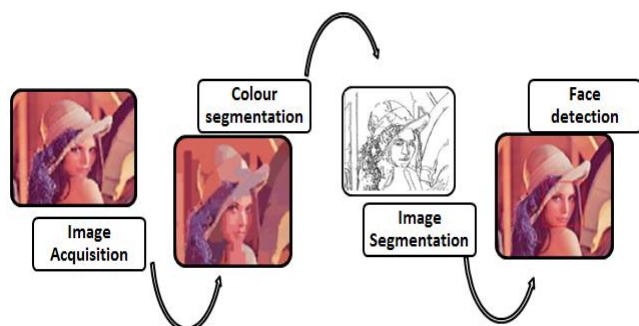


Fig1: Processing steps in face detection

### Image Acquisition

The first step of face detection is image acquisition typically from a physical scene. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images. The most usual method for image acquisition is by digital photography with a digital camera but other methods are also employed.

### Colour Segmentation

It is the process of dividing an image based on color such that each region is homogeneous. Clustering is used to segment the image according to color features. Clustering is a common step to get segmentation. K-means clustering algorithm is used for this segmentation among various segmentation methods. In the data space, clusters are regarded as regions of similar data points [1]. The steps involved in colour segmentation is as follows [2]

1. Read the Input image
2. Convert input image from RGB image to gray image.
3. Classify the colors in gray image using k-means clustering algorithm.
4. Label every pixel in the image using the results from k-means.
5. Create images that segment the image by color.

### Image Segmentation

The process of image segmentation is to divide the image into multiple segments. The main aim of this step is to analyze the image and represent

it easier. This step performs two sub tasks. The first sub task is morphological process; it is a collection of non-linear operations related to the shape of features in an image. The primary morphological operations are dilation and erosion. Dilation adds desirable segments to the boundaries of an object in an image, while erosion removes undesirable segments from an object boundary. We deal only with morphological operations for binary images. The result of this step is a set of segments extracted from the image. The filtering process has been done by the first sub task (morphological process).

The second sub task has been carried by the image segmentation is edge detection (canny edge detector) the objective of this step is to verify the presence of detected region based on the previous sub task. This step is used to detect faces in an image.

### Face Detection

The final step is to identify human faces in an image. For detecting faces in an image threshold value is used this approach helps to identify the faces from a background pixels. Thresholding allows to segment images into two regions, if the pixel value is greater than some threshold value helps to identify the faces in an image.

## 5. EXPERIMENTS AND RESULTS



Fig 2: Original image (Input)





Fig 3: Color segmentation image



Fig4: Image Segmentation



(a)



(b)

Fig 5: Morphological Operation (a) Eroded Image  
(b) Dilated Image

Fig 6: Face Detection (output)

## 6. CONCLUSION

Our proposed face detection method segments the image with great accuracy as compared to previous techniques. Thresholding based approach for image segmentation is effective to handle the acquired image under various conditions with reasonable accuracy and reliability. The proposed method has a high accuracy of detecting faces in the image.

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