Recognition of Human Face based upon Edge Detection Technique

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Abstract- *A significant change in intensity level in an image defines an edge. This paper is an effort to recognize face by detecting edges in human facial image. This method is based on the illumination spot created in the center of human eyes, in presence of some light source or natural light. Edge detector is responsible for creating the black spot in place of that illumination spot and arc in place of beginning of cornea. This portion of both human eyes acts as template and forms the basis for extracting other facial features so as to recognize the human face. Vertical distances can be calculated from these extracted features so as to recognize human face.*

Keywords- Edge detection, Illumination spot, facial features extraction, face recognition.

I. INTRODUCTION

Recognizing the human face even after long period is one of the most remarkable ability of human vision system. In area of computer vision automatic face recognition is still a complex and challenging task [1]. However research in automatic face recognition begins in early 1960, but the progress rate was not up to the mark.

Now a day's face recognition has gained attention as there are lots of security applications where face recognition is of utmost importance. These applications vary from automatic teller machines, border security, secured entry in various locations, passport offices up to identification of suspects in police databases. Unique face characteristic of humans is one of the biometric for identification and recognition purpose of human facial image.

II. EXISTING FACE RECOGNITION SYSTEMS

There exists several face recognition methods and can be categorized in many ways. Basically we can divide face recognition methods in three categories i.e. a) holistic template matching systems, b) geometrical local feature based systems and c) hybrid face recognition systems. Every category of face recognition system has certain advantages and disadvantages and appropriate system must be selected based upon specific task requirements.

Feature based approaches are robust to illumination conditions as compared with direct image methods. Various face recognition methods include Eigenfaces methods [2][3], Correlation method [4], Bunch Graph Matching method [5], Fisher faces method [6], Principle Component Analysis method [7] and Wavelets methods [8][9].

Elastic Bunch Graph Matching method requires a large image size but this method has good performance. This method gives appreciable results for less distortion invariant object recognition, if database size is moderate. For image classification the Correlation method is the simplest method in which test set is classified. Distances are being measured in the image space in this method. This technique has many limitations i.e. if the trained and test images are taken under varying lighting conditions, in that situation the corresponding points in the image may not be tightly clustered.

Another limitation is that it requires large storage and is computationally more expensive. Due to these limitations an alternative method for dimensionality reduction scheme is useful. The Principle Component Analysis method selects dimension reducing linear projections that maximize the scatter of all projected samples. Wavelet theory [10] finds its most suitable application in extracting multistage image information. This method still requires a suitable way to select a proper wavelet function for the purpose of feature extraction.

III. PROPOSED EDGE DETECTION TECHNIQUE FOR EXTRACTING FEATURES

The proposed face recognition technique is based upon the edge detection in the human image having the maximum face area. The illumination light spot in center of both human eyes in presence of some light source forms the basis for recognition of face. If the sample image is colored then it is to be converted to gray scale image for smooth running of edge detection algorithm. Edge detection algorithm is then run on the gray scale image with [3 x 3] convolution mask for marking the edges in the frontal facial human image, by removing all the other unwanted details from that image.

(a) (b) (c)

Figure 1: a) Input image, b) Output image with edge detection and c) Image with extracted features

Human facial features extraction has been shown in figure 1, where figure 1(a) is the input sample image provided to edge detection algorithm, figure 1(b) is the output image having edges only after removal of other unwanted details from the sample image by edge detection algorithm and figure 1(c) is the final image in which facial features like eyebrows, eyes, lips and chin have been extracted for the purpose of face recognition. The output image after applying the edge detection algorithm contains darkest as well as brightest intensity levels in both eyes portion only, hence making it convenient to mark template in both eyes region. Template is marked in both eyes region only because of having totally different intensity levels in this portion. Now other human facial features like eyebrows, lips and chin can be extracted from the eyes template. By setting a specific threshold and moving upwards eyebrows can be easily extracted. In a similar manner by moving downwards, lips and chin can be extracted from frontal human facial image. Both lips and chin features of human facial image will parallel as per the human face convention.

IV. FACE RECOGNITION PHASE

After applying the edge detection algorithm for extracting human facial features, human face has to be recognized on basis of those extracted features. Human face can be recognized by computing the vertical distance parameters between various extracted features. In this study horizontal distance h1 is computed between both eyes of human facial image. Vertical distance v1 is computed between both eyebrows and eyes of human facial image. Vertical distance v2 is computed between eyebrows and lips of human facial image. Vertical distance v3 is computed between eyebrows and chin of facial image. Vertical distance v4 is computed between eyes and lips of facial image. Vertical distance v5 is computed between eyes and chin of facial image. Vertical distance v6 is computed between lips and chin of facial image. Vertical distance v1 is the largest distance among other vertical distances and can be used as base parameter to compute other parameters like ka=v2/v1, kb=v3/v1, kc=v4/v1, kd=v5/v1 and ke=v6/v1. These parameters ka, kb, kc, kd and ke are combined to form the unique key K for every facial image for recognizing the human face.

V. CONCLUSION

In this study face recognition based upon edge detection techniques is proposed which works successfully for the frontal face human images. Lightning conditions are important for having higher success rates while using this technique. There must be enough light for capturing the bright illumination spot in the center of both eyes for having better accuracy during eyes template matching in the facial image. In case if most of the part of facial image is occluded i.e. a candidate with dark glasses, beard and moustaches then this technique is not so effective. Overall this proposed technique works successfully and has high success rate under the controlled lightning conditions.

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