Face Detection based on Video

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Abstract— **Face detection is a very important system used by a variety of applications like face recognition systems, automatic lens adjustment, video surveillance systems etc. These systems need to primarily identify frontal face images and use them for further processing. Thus, face detection forms a primary basis for many systems. In our system, we propose an algorithm that detects faces by four modules.**

In the first module, we simple will detect moving objects by frame differencing technique of motion detection. In the next module, we will crop the image based on color. We will find a specific range of color of human skin and accordingly crop the image. In the third module, we will verify the symmetry of the cropped parts. A symmetry algorithm will be applied to verify the symmetry of the given part. Finally, we will detect the eye of the face by comparing the image with various eye templates. If during any of the four modules, a part of the image does not meet the threshold of the algorithm of the module, it is assumed that the part does not contain a face and the program rejects that part for further processing.

Keywords: **motion detection, skin, face geometry, flood fill, HSV**

I. INTRODUCTION

Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies. Face detection is used in biometrics, often as a part of (or together with) a facial recognition system. It is also used in video surveillance, human computer interface and image database management. Some recent digital cameras use face detection for autofocus.[4] Face detection is also useful for selecting regions of interest in photo slideshows that use a pan-and-scale Ken Burns effect.

Face detection is gaining the interest of marketers. A webcam can be integrated into a television and detect any face that walks by. The system then calculates the race, gender, and age range of the face. Once the information is collected, a series of advertisements can be played that is specific toward the detected race/gender/age.

In recent years, face recognition has attracted much attention and its research has rapidly expanded by not only engineers but also neuroscientists, since it has many potential applications in computer vision communication and automatic access control system. Face detection is an important part of face recognition as the first step of automatic face recognition. However, face detection is not straightforward because it has lots of variations of image appearance, such as pose variation (front, non-front), occlusion, image orientation, illuminating condition and facial expression.

In our system, we will attempt to detect faces by using four modules.

II. PROPOSED SYSTEM

Module 1: Motion Detection
In this module, the video is taken as a raw .avi file (or any other video format) and decompressed into its individual frames. The frames are then compared with each other to identify the moving object in contrast to the background. By this we will get a cropped part of image which is in motion.

Module 2: Face Skin Verification
In this module, the motion detected part of video is further processed to find a part that can be possibly a face based on colour.
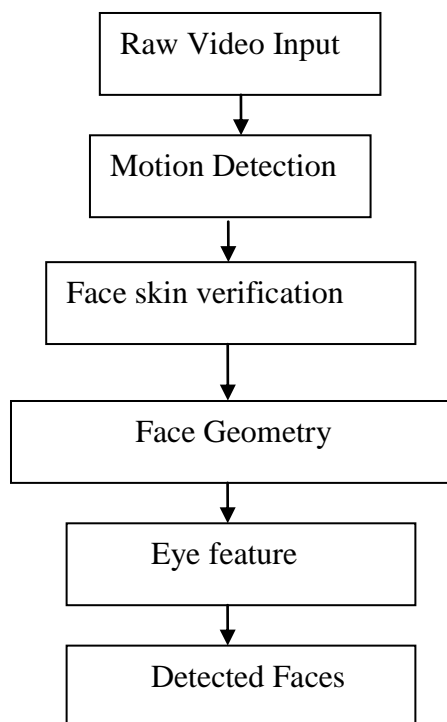
Module 3: Face geometry verification
In this part, the basic geometry of the detected region determined. If the length and breadth of the detected region is similar to face, the region is passed to the next module.

Module 4: Eye feature verification
In this part, the detected region is checked for typical face features such as its rotundity, position of eyes, nose and mouth. It is tried to match with a low resolution image of a typical face that is focused on its features. If the detected region matches by a certain threshold value, it is the most probable part of a region that represents a face.

If a part of the image taken from video stream passes all the modules, then the corresponding part is a face and will be detected by marking a rectangular frame around it.

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┌─────────────────────────┐
│    Raw Video Input      │
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            │
            ▼
┌─────────────────────────┐
│    Motion Detection     │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│  Face skin verification │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│      Face Geometry      │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│       Eye feature       │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│     Detected Faces      │
└─────────────────────────┘
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III. METHODOLOGY

1. *MOTION DETECTION:*

The basic requirement for any video-based surveillance systems is to detect the motion of an object. Without detecting the motion,it is not possible to extract the features of the object for recognition purposes. One of the techniques for motion detection that we have applied is FRAME DIFFERENCING.

Frame differencing is a technique where the computer checks the difference between two video frames. If the pixels have changed there was apparently something changing in the image (moving for example). Most techniques work with some blur and threshold, to distinct real movement from noise. Because frame could differ too when light conditions in a room change (and camera auto focus, brightness correction etc.).

Image segmentation is the fundamental approach for motion detection. Thresholding is the simplest method of image segmentation from a grayscale image. Here we are describing two existing methods and a proposed model method that realize moving object detection. One is simple differencing model method, second is shading modal method (existing) and third is proposed model method.

Simple Differencing Model Method work simply subtracting the current image and background image (that does not contain any moving object). The applied subtracting operation finds an absolute difference for each pixel, thus detecting moving objects (that have brighter or darker gray value), which usually differ from the background. If the difference is below a certain threshold, there is no change in the scene and the observed pixel is regarded as it belongs to the background.

ALGORITHM:

Step1: Convert video to corresponding image
Step 2: Convert to gray scale image
Step 3: threshold = 25
Step 3: For i from 0 to total number of frames − 1
Step 3.1: Calculate difference d = frame[i]-   frame[i+1]
Step 3.2: for each value in d
        Step 3.2.1: if d>threshold
                Step 3.2.1.1: output pixel = pixel value at frame i
        Step 3.2.2: otherwise
                Step 3.2.2.1: output pixel = 0
Step 3.3: Display output frame
Step 4: Stop

2. *FACE SKIN VERIFICATION*

In this module, we pass out the most probable area of the motion detected image that is a part of the human body. We basically check whether the particular pixel under consideration has an HSV value that lies within the skin tone. For this, we first find a suitable skin tone range that is specific to the race of people of the region where the system is going to be deployed. We then pass the image to the next module.

We have studied various skin colours and found an approximate range of HSV values that correspond to skin colour. The output after module 2 will be a a part of image that is in motion and that falls in the range of skin values. HSV model is used for greater flexibility in manipulation.

3. *FACE GEOMETRY VERIFICATION*

Human beings' faces have a typical face geometry. The ratio of length and breadth always lies in a fixed range. If we put a box around a face, the box is a rectangle having a length about 20% more than the breadth. This feature is checked from the skin detected output to verify the geometry of faces. First, the skin detected output is dilated to fill the gaps. Connected components are then found by the flood fill algorithm. Flood fill algorithm works by providing seed points in the image and expanding the seed point to find the bounded regions. The connected components are labelled for reference. The length and breadth of each connected component are calculated and the ratio is determined. This ratio is then checked with a particular threshold value. The ratio of a typical face is normally around 0.6 (breadth/length).

4. *EYE FEATURE VERIFICATION*

Every face has two eyes, one nose and a mouth. The positioning of these organs are also very typical. The eyes are always situated at 30% from the top of face. The nose is situated below the eyes and the mouth below the nose. As you can see from the example, we have almost detected the faces. Only the rightmost ladies hand and the bag are not faces. These regions are removed by the face feature verification.

In this, a low resolution image of a typical face is matched with the segmented regions. The amount of matches found is compared with a threshold. If it is above the threshold, then the detected region is the most probable face region in the video.

III. CONCLUSION

This paper has proposed an algorithm for detecting facial objects in a video file. The proposed facial detection system consists of first taking as input a video file from the user and detecting moving objects using frame differencing. The algorithm further, works only on the moving objects and not on the remaining still objects, thus narrowing down the scope to only the moving objects. The algorithm further narrows down the scope to only the moving objects that resemble the human skin tones by using face skin verification. The output of this stage is further processed by using face geometry verification and face feature verification. The output of this algorithm can be used as input to face recognition systems.

IV. SCOPE

The last decade has seen a significant development in information technology worldwide. As society gets advanced and sophisticated, so does technology. In the world which demands automation in every aspect, from booking a ticket to making VLICs, the part of a job where manpower is much needed has faded away.

Face detection can be used by face recognition algorithms which are used/will be used for numerous systems such as automatic video surveillance, automatic attendance system, automatic theft detection etc. Face detection is also used in digital cameras where the person clicking a photograph can adjust his lens based on the positions of faces in the picture. Face detection can also be used to calculate the headcount in an image.

V. REFERENCES

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