Efficient Color Tracking from Images and Real time Video

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Abstract— Recent trends in technology aim to build highly interactive and easy to use applications using non conventional interaction devices such as Web Cam, Projector, Data Gloves etc. Among them Web Cam can be used for development of variety of applications such as Virtual Mouse, Image Grabber etc. these applications are tracking various gestures of human hand by some means, and using them programmatically. The aim of this paper is to present fundamentals of tracking colors from an image and video, so that using those colors as markers, user may be able to track fingers in a real time video.

Keywords- Color detection, Finger tracking, Finger tracking using Computer vision, Color detection in real time video, Color identification using Computer vision.

I. INTRODUCTION

As we all know human beings are using their natural postures and gestures to convey different information to others, if we can operate a Computer using the same technique, than it would be easier to operate. From this thought and with the advancement in the technologies and computing capabilities the researchers developed techniques to track human hand / fingers using a webcam to establish an interaction mechanism between user and a Computer and the technique of tracking the movement of fingers occurring in front of a webcam is called Finger tracking.

There are number of approaches used for finger tracking, some are using bare hand, some are wearing markers on finger tips, some are using gloves with markers pasted on its fingers and some are using specialized hardware to detect positions of fingers.

This paper is organized around efficient techniques to detect specific colors from an image as well as from real time video.

II. BASIC IMAGE PROCESSING OPERATIONS

First have a look at some basic image processing operations, which will be required in order to track colors from images and real time video.

A. Segmentation

Segmentation is the process that subdivides an image into a number of uniformly homogeneous regions [1]. Each homogeneous region is a constituent part or object in the entire scene.

B. Image Subtraction

Image Subtraction is an operation where one image is subtracted from the other image. It is generally used to remove constant noise effect, to identify moving region [2] as well as to identify various colors from an image or frame [3][4].

C. Thresholding

Thresholding is a technique to convert a colorful image into grayscale or binary image [5]. It is used generally identify certain colored area or object from an image [5][6]. In this operation each pixel value is compared with the fixed threshold value, if it is greater than fixed threshold value than pixel value will be set to 255 (white) otherwise it will be set to 0 (black) [5]. Therefore at the end we get binary image from a colorful image.

D. Noise Reduction

Noise Reduction is a process to reduce the effect of noise (unnecessary components) from an image or video [1]. It is used to improve the visibility quality of an image or a video [7][8].

E. Occlusion

Occlusion [6] is a condition where important parts of an image are made hidden by means of some noise or behind any object.

III. COLOR TRACKING ALGORITHMS

Our aim is to track colors from images as well as from the real time video. In order to track the color from a real time video we need to first detect the colors from images.

A. Tracking Colors from Image

To efficiently track colors from images we need to identify the sequence of basic image processing operations. From the various experiments carried out, my concluded algorithm is,

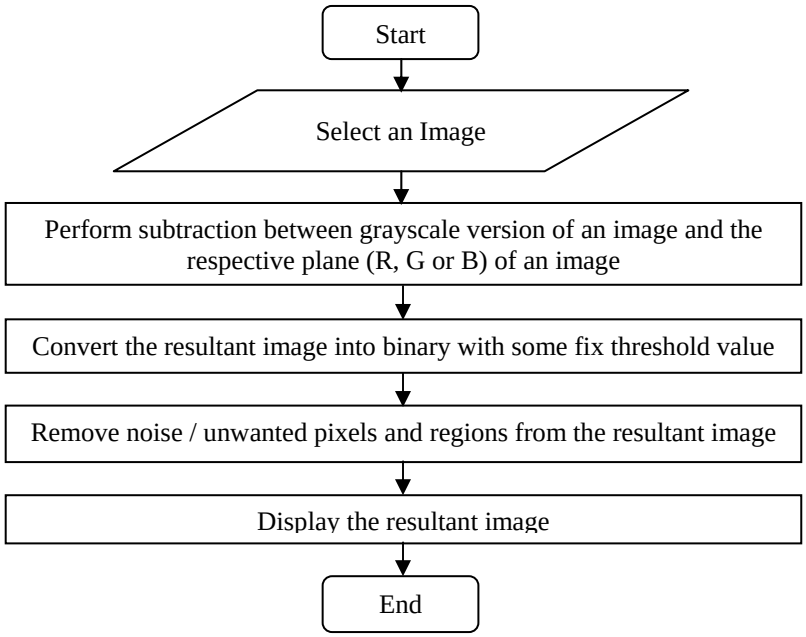

Figure 1. Algorith to detect colors from an Image.

This algorithm has been implemented in the Matlab R2010a version. It provides the facility to read Red, Green or Blue planes of an RGB image separately.

B. Tracking Colors from Real time video

In order to track the colors from a real time video, first we will have to separate frames of a video, then we will have to identify the number of frames can be processed within a second, and accordingly we will have to capture one by one frames and process each frame for continuous color tracking. We will use the above mentioned algorithm for each frame. After many experiments, my concluded algorithm to track colors from a real time video can be represented using a flowchart shown in Figure 2.

Using this algorithms variety of shades of Red, Green, Blue, and Yellow were tracked successfully under different lighting and background conditions. Also this algorithm can be used to track any object having the colors specified here. It is tested with many objects such as Color Sketch pens, Color Balls, Fingertips with markers etc. it can also track multiple objects having similar color together.

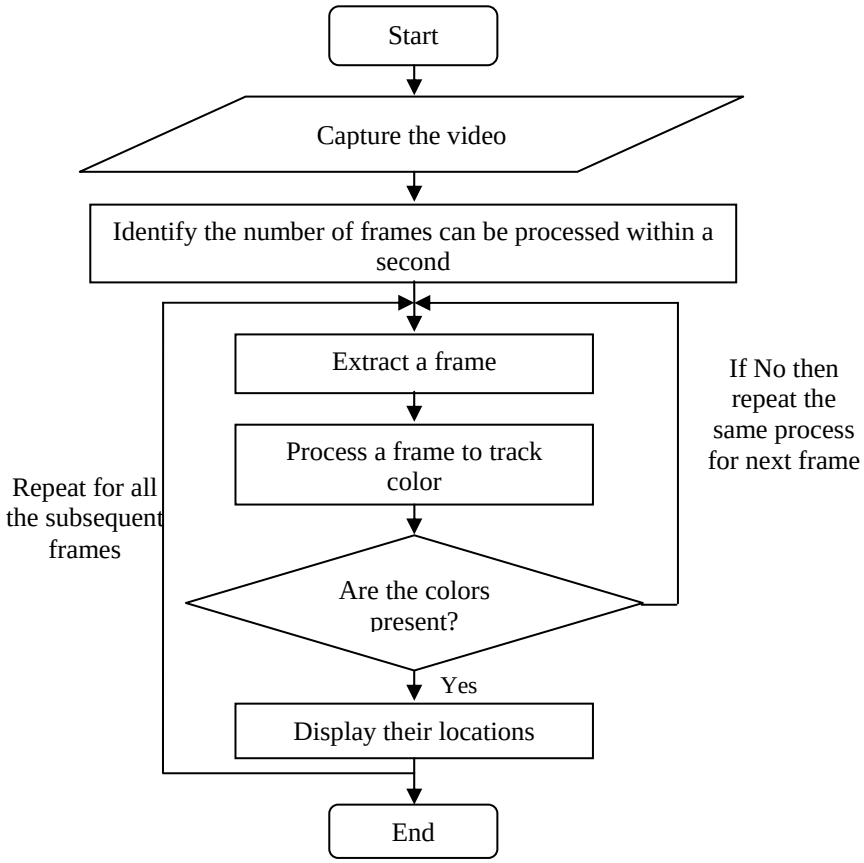

Figure 2. Algorith to detect colors from Real time Video.

IV. EXPERIMENTAL RESULTS

After implementing this algorithm, the algorithm is tested in static as well as differing lighting and background conditions to track four colors Red, Green, Blue and Yellow. Here are some results.

a. Results of Color Tracking from an Image

We carried out experiments to track four above mentioned colors separately from an image. Then we tried to track all four colors together and we got the expected results.

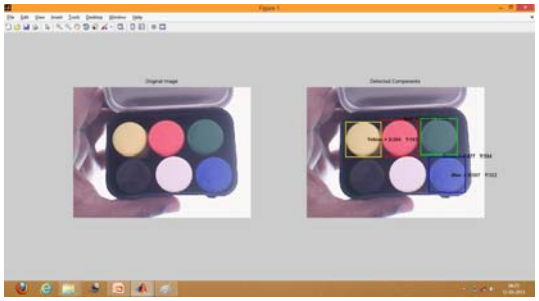

Figure 3. Detection of colors from an Image.

b. Results of Color Tracking from Real time video

Similarly the algorithm to track colors from real time video is tested under various environments and surprisingly we succeeded to track all the four colors with different shades. Here are some sample outputs, detecting colors of markers pasted on fingertips. The following images show the obtained results after implementing this algorithm.

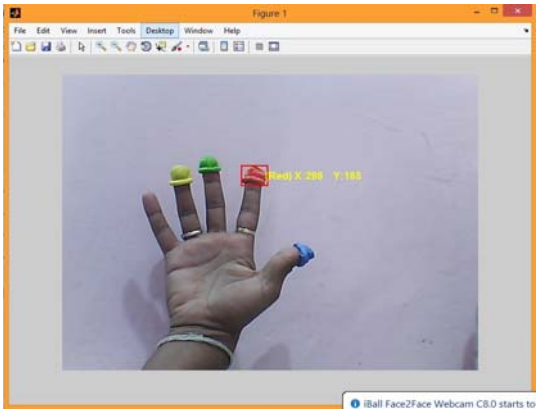

Figure 4. Detection of Red color from Real time video

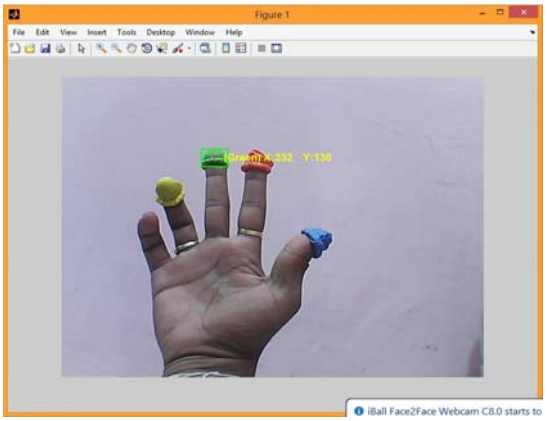

Figure 5. Detection of Green color from Real time video

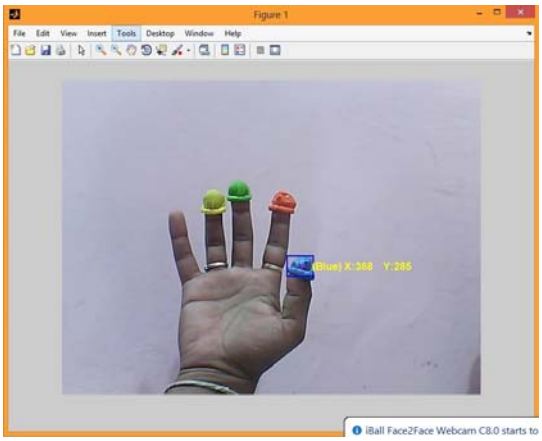

Figure 6. Detection of Blue color from Real time video

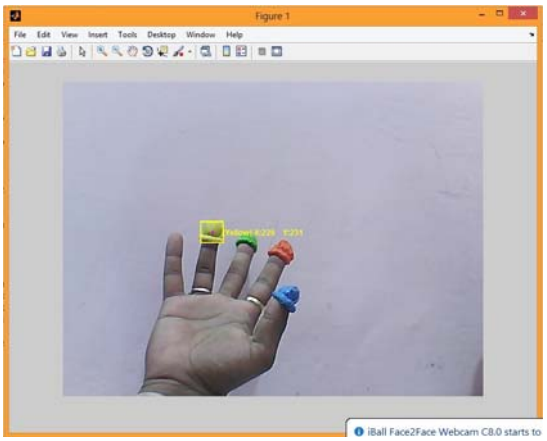

Figure 7. Detection of Yellow color from Real time video

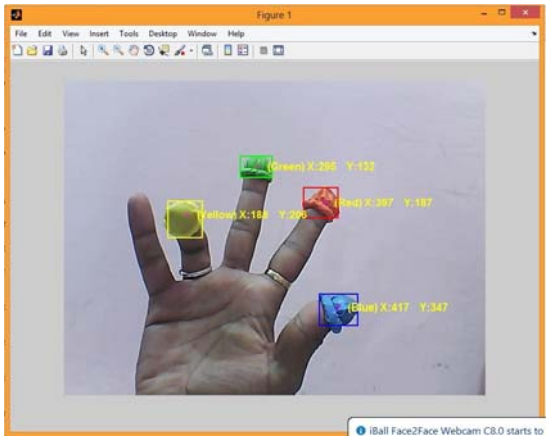

Figure 8. Detection of All colors together from Real time video

V. CONCLUSION

After performing experiments on many images and in differing lighting and background conditions, we can conclude that the above mentioned algorithms are robust enough to track the specified colors from various images as well as real time videos in any condition. In static lighting and background conditions we achieved 100% accuracy in tracking the colors, while in differing lighting and background conditions the accuracy is 94%. Also this algorithm processed 17 frames / second for tracking a single color and 11 frames / second to track all four colors together.

This algorithm can be used to develop variety of applications such as Virtual mouse, Virtual keyboard, Image grabber, Computer controlling applications, Robot controlling applications etc. and the robustness and efficiency of this algorithm can make computer vision a more stronger contender of interacting with a Computer system.

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