REAL-TIME COLOR CLASSIFICATION OF OBJECTS FROM VIDEO STREAMS

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Abstract—Real-time Color identification and differentiating those colors of a moving object from a live video is a fundamental step in many real-time applications such as video surveillance, bio-metric identification process, etc., Object Detection is based on two parameters such as Objective and Subjective dimensions. Where the object consists of attributes like color, texture, shape, size and scale, however the subjectivity is guided by the observation of the image interpreters. Due to brightness and contrast sometimes webcam can hardly detect the expected color of the objects and because of the similarity of tracking, environment background color and the color of objects gets unexpected pixel value. This project will aim to implement object detection and color classification in MATLAB GUI. Where the objects will be detected and the color of the object will be classified in a real world scenario for both still and real-time image. This task includes image segmentation process for still image, where only the color and the count of objects will be recognized from a still image. However, for live video processing the region of the object as well as the color of the object will be recognized.

Keywords: Object detection; Color segmentation; Color classification; Real-time video; Still-image.

I. INTRODUCTION

Detecting objects and classifying the color of those objects is a rudimentary process in many real-time image processing vision systems. As the movement of objects increases, the process of finding objects and its identical colors in real-time can be performed easily [1]. As soon as the object has been recognized and color identification and classification in a video is detected, information of object analysis such as tracking details of objects, excavating properties of image and other video and image processing methods can be performed. Video capturing is performed through image acquisition toolbox. Image analysis and other operations are done by image processing toolbox.

This process is to show how an image is captured using a real-time video and how it is processed for color classification and image editing using MATLAB. Here, as the process is done in real-time, number of frames is considered as inputs in order to get the desired output. In color identification and classification process, primary colors are segmented from the input RGB frame. Each segmented colors are then identified by its pixel. Therefore, the real-time color recognition has two major processes, Color segmentation and Color recognition. This work mainly focuses on processing a still image as well as frames that are obtained from a video. The video is captured using a webcam connected to the laptop and is then processed. Snapshot of a frame is taken and the image processing concepts like thresholding, conversion of binary image, morphological operations are performed. Where, the output of processing the still image will result in displaying the number of objects it has been detected. In another approach of detecting colors from a real-time video, various objects with primary colors will be shown to the real-time video. Thus, by implementing concepts like bounding box, region props, the output will result in detecting the color and the pixel values which differ in x-y axis. Finally, image editing process will be done like adding brightness, cropping, rotation, resize. This gives an output displaying the basic image editing process and also displays the image with different primary color channels in order to show the color classification.

Primary color classification

MATLAB is a high level matrix language, where processing images are done easily by using accurate algorithms, which acts as a criterion for implementation. An image consist its details in the form of pixel values, which will be represented in matrix method; where, every inputs are considered as a matrix [2]. MATLAB offers toolbox for acquiring image and as well as for image processing, so the user can easily access input information which is nothing but, every pixel value from the image matrices and revise it through image processing toolbox.

Images are in three different forms or types, they are; Black and white or binary image, which consists of only zero and one. Where, one exemplifies white and zero exemplifies black. Commonly, images storage is of and its corresponding matrix is of two-dimension. Gray image are of two-dimensional matrix image, where the value of each pixel differs from the range 0 to 256, gray images are even similar to RGB images. However, for RGB image, there are three different matrices for three different components such as red, green and blue, and those three different components overlap in order to form an RGB image which is of three-dimension. This can be represented in matrix form as, 256x256x3. Hence, the matrix representation for different images is of different forms.

II. ALGORITHM

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Image acquisition toolbox is used to capture images into MATLAB and then the other operations like image analysis are performed using image processing toolbox.

Step 1: Camera is connected to MATLAB in order to get the preview of the Video and also to capture a snapshot of a frame [3].

Step 2: Snapshot of a frame is then converted into binary image. Firstly, gray conversion is done which is essential to convert an RGB image to gray scale image, having pixel values ranging from 0 to 255 and differs in its matrix representation.

Step 3: Then, the thresholding operation is performed to the binary image. Where, the thresholding operation is one of the easiest systems of image segmentation process. After the RGB image is converted into gray scale image. Multiband thresholding is applied where the output will result in binary image as RGB images will be threshold. A simple method is to give different threshold value for each component of an RGB image and re-combine them by applying AND logical operation. By doing so, the process of camera and its corresponding information's, which will be stored in system can be replicated excluding the perception of the users in accordance to colors.

Step 4: After thresholding operations are performed the binary image is obtained. Where, the binary image has only two possible values for each pixel. Naturally, the two colors used for a binary image are black and white.

Step 5: Morphological operations are performed on the obtained binary image. Morphological operations are based on the shape and structures of objects in image processing. Morphological operations are based on certain configuration. Those configurations if applied to an input image, the output image will also be expected to be of same configuration. The pixel value of the output image is nothing but the comparison of the neighboring pixels from the input image. As we select certain shape and size from neighboring image, we would be able to build certain morphological operation that which will be subtle to specific shape and size of input original image. There are two types of morphological operations:

Erosion: Used for removal of structures of certain shape and size, as required by the application. Which is been applied in this project. Where erosion can separate objects which are joined and cut-off partially displayed objects. Dilation: Used for filling the holes of certain shape and size of objects as required by the application. It is also used for repairing breaks and intrusions.

Step 6: After morphological operations are done, Color Segmentation process will be proceeded: The color which has to be identified and classified will be targeted from a set of colors that would be designed from different mishmash of colors organized in a vague structure. Different types of tests with a procedure will be performed on the input original image, where those test would detect the colors of objects and match with the target color and then classify the output as displayed below. These evaluations on colors can achieve invariants which would be based on color gradients that have derived from various lighting conditions for the target color pattern. However, the defined color gradients among the three color areas differ depending on illumination and noise, some characteristics of the gradient are highly liable which would create a nearly unique sign of the target color. These tests are based on the following gradient components: The red conduit gradient part through the red-green and red-blue margins and the green conduit gradient part through the red-green and green-blue margins with different color margins.

The gradients are appraised by calculating differences in RGB conduits between neighboring pixels. Color margins between neighboring areas are hardly severe in real images because of effects such as exploitation of colors, blurriness in movement of objects and when the pixels are interrupted. These gradient differences are designed through a distance of several pixels rather than between neighboring pixels [1]. This distance is then chosen to be as large as possible, consistent with the requirement that the samples used to compute the gradients all fit within the target region [1].

III. PROCEDURAL DIAGRAM

Swim lane in an activity diagram represents the flow of process. As per the diagram, once the user enters the valid password user will be redirected to main menu. If an invalid password is provided the access to the main menu is restricted.

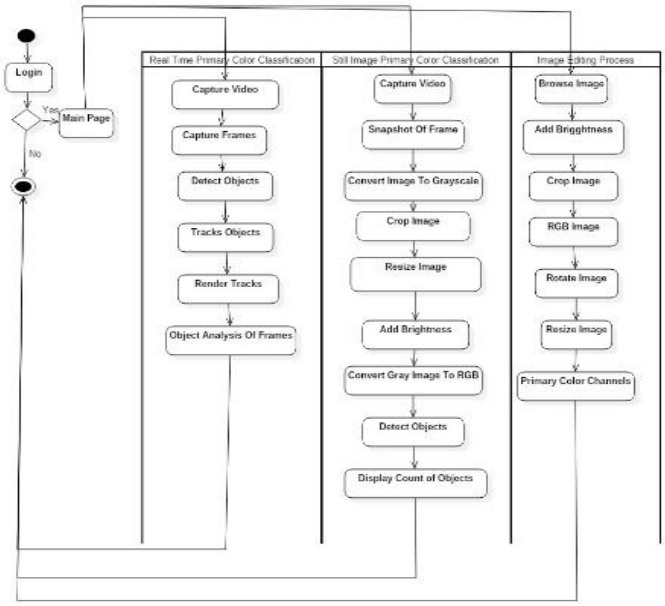

Fig 1: Activity Diagram

Main menu consists of three choices for the user such as Real-time primary classification, still image primary color classification process with the basic image editing process.

When the user selects real-time primary color classification, user will have to capture the video through the webcam. Where the application would detect an object from the live video and classify the primary color of that particular object when showed to the webcam. Once the object is detected its pixel value will be tracked along its X and Y axis. The count of detected pixel values will be displayed as the output.

When the user chooses the Still image primary color classification, User will have to capture a snapshot from a video stream. The snapshot will be analyzed by applying

few concepts like multi-band thresholding operation, morphological operation and color segmentation process. Where, the count of objects from the snapshot will be displayed as an output.

When the user chooses the Basic image editing process, User has an option to analyze any locally saved image. Once the image is analyzed, basic image editing techniques such as adding brightness to the image, cropping the image, converting the gray scale image to an RGB image, Rotating the image, Re-sizing the image and displaying the original image into three different primary color channels such as red, green and blue can be performed.

IV. RESULTS

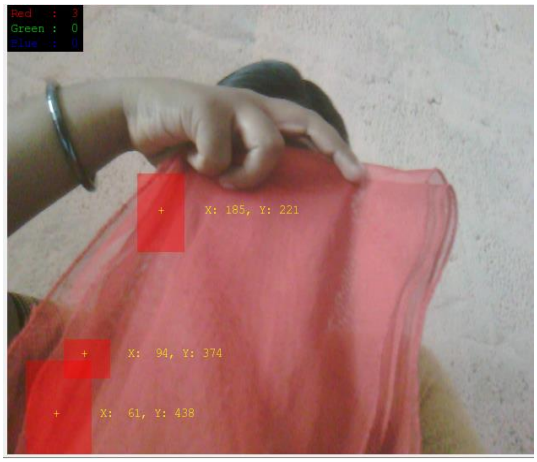

Fig 2: Real-Time Primary Color Classification Process

This GUI represents, when red color object is shown to the real-time camera it recognizes the object color and detects the pixel value of that red object at x-y axis.

Once video has been obtained, different methodologies can be performed to multiple-frames in order to get the required tasks done [4]. After the video has started from an image acquisition device it can be interfaced with the system, controlled by algorithm as specified, the next phase is GUI extraction which provides the segmented video of the moving object in the GUI video. Thus the flow of system deals with object detection and color classification of those frames by executing the process for object detection and color classification.

Fig 3: Real-Time Primary Color Classification Process

This GUI represents, when green color object is shown to the real-time camera it recognizes the object color and detects the pixel value of that green object at x-y axis.

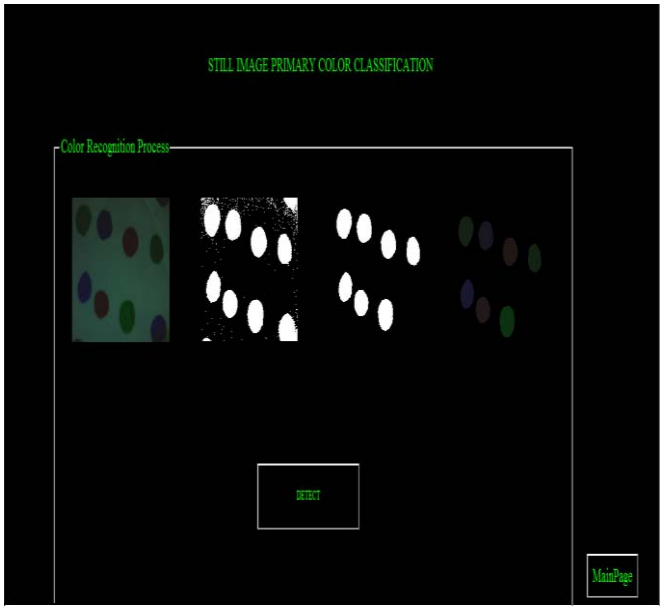

Fig 4: Still Image Primary Color Classification

This GUI represents four axes, first axes is the snapshot of a frame through video, second axes is a grayscale image to which thresholding operation is applied, in third axes it displays a binary image to which morphological operation is applied and finally in fourth axes it displays an image to which color segmentation is done [5].

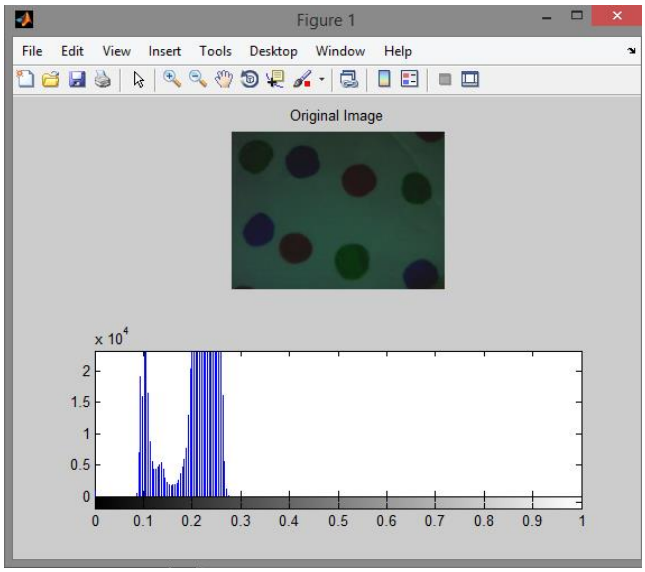

Fig 5: Still Image Primary Color Classification

This GUI displays the total number of objects it has been recognized from the snapshot taken from the video with its histogram, where the histogram represents the pixel value of each light and dark region in the image.

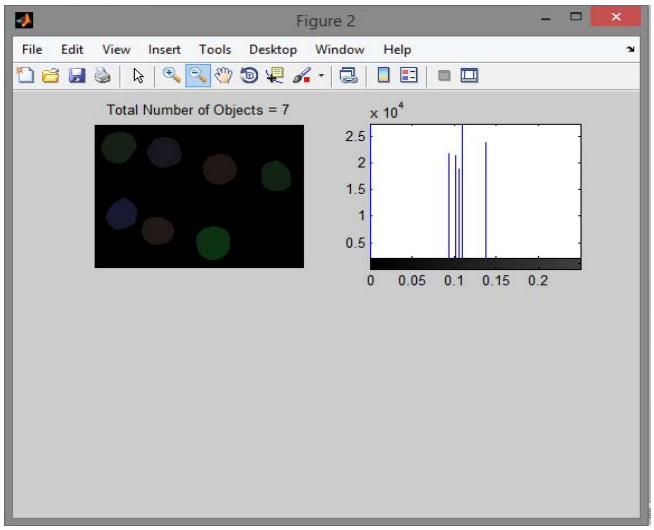

Fig 6: Still Image Primary Color Classification

This GUI represents total number of objects which has been obtained after all processing has been done to the original image. it also displays the histogram of this particular image which differs from the original image.

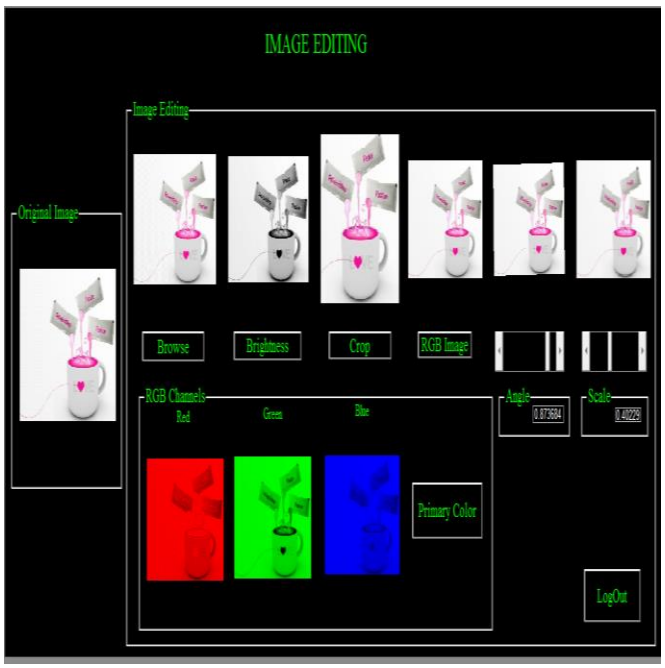

Fig 7: Image Editing Process

This GUI represents the primary color channels of red, green and blue of the original image.

CONCLUSION

Real-time color classifications of objects from video streams gain importance in wide range of industry, medical and gaming applications. This paper work can be enhanced for objects with blurred background, objects under different lighting conditions and movement of many objects.

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