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Object Detection and Tracking in Real Time Video Based on Color

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Abstract:- In this paper we present a framework for efficient detection and tracking of an object in real time using color. A tracking algorithm is developed in order to analyze the motion of object is chaotic or not. Automatic tracking of object is done by several stages. These are image capturing, image processing, time series extraction and analysis. We proposed here Euclidian filter which has the advantages that it can be used in dynamic images. We convert the color image into gray, because it is easy to process the gray image in single color instead of multi colors. Gray images requires less time in processing. This also contains a discussion of the requirements of any searching task and presents a fast method for detecting the presence of known multi-colored objects in a scene.

Keywords:- Color-based detection, Euclidean filtering, gray scaling, contour tracking

I. INTRODUCTION

Visual object tracking is an active research topic in computer vision. Object tracking can be accomplished in many ways including by mechanical, acoustical, magnetic, inertial, or optical sensing, and by radio and microwaves, to mention a few. The ideal tracker should be tiny, self-contained, complete, accurate, fast, and immune to occlusions, robust, tenacious, wireless, and cheap. As of now such a tracker does not exist; trade-offs are necessary, and a method should be chosen based on the application in mind. The desired objects to be tracked then become much easier to detect. However, in certain instances (e.g., for an uncooperative object to be followed) this is not possible. Visual tracking is the task of following the positions of possibly multiple objects based on the inputs of one or many cameras. In the context of visual tracking, we can distinguish between the two tasks of detecting object based on color, and in locating and following an object.

Webcam is used to capture image continuously and computer processes the image and shows the path of object in monitor. Cameras are imaging devices which deliver an abundance of information of which only a fraction may be needed for a specific control task. The camera output needs to be preprocessed to extract the relevant information for the tracking problem, e.g., the position of an object to be followed.

Motion tracking of a moving object is done by simultaneously image capturing of it. Then the color of the object is to be identified. Other color is filtered by using Euclidean filter. Then this image is transformed to black and white image by converting from colored image to grayscale image. Therefore the position of moving object can be found. The position of the object in the x and y axis is stored in memory device and it is visualized in the computer monitor. The body of the object is covered by contour. Thus the automatic tracking of moving object is done. Preprocessing usually encompasses noise-suppression (e.g., image smoothing) and segmentation to delineate objects from their background and from each other.

II. RELATED SURVEY

We survey the techniques for tracking objects from object detection and method related to object tracking, specifically approaches that perform color-based tracking. An object required to be tracked before recognition, yet objects also compulsory to be detected before tracked. Tracking objects can be complex due to numerous issues. In fact, some of the issues are propagated from object detection. For example, the scene illumination changes, undesired moving objects, and shadows. R. Cucchiara et al. [3] proposed Sakbot system which is a robust and efficient detection techniques based on statistical and knowledge-based background up and use HSV color information for shadow suppression. The method capable to deal with luminance condition changes (e.g. lights, day hours and shadows), limited and high frequency camera motions (e.g. vibrations and wind), background changes (e.g. still objects) and various moving object’s speed.

Object tracking defined as the problem to estimate the trajectory of the object of interest moving in the scene. Conventional tracking process consists of establishment of correspondences of the image formation between consecutive frames based on features (e.g. color, position, shape, velocity) and involves matching between frame using pixels, points, lines or blobs based on their motion. In the early generation, Pfinder [4] is a well-known method, this method modeled pixel color disparity using multivariate Gaussian. S. J. McKenna et al. [5 and 6] then performed a tracking at three levels of abstraction (i.e. regions, people and groups) to tracked people through mutual occlusions as they form groups and separate from one another. Color information (i.e. color histogram and Gaussian mixture model) is used to disambiguate occlusions and to provide estimation of depth ordering and position during occlusion. T. Boult et al. [7] presented a system which monitoring non-cooperative and camouflaged targets, is suggested for visual surveillance domain especially controlled outdoor environment (e.g. parking lots and university campuses) with low contrasts targets moving in changing environments . Hydra [9] essentially is an extension of W4 which developed by University of Maryland. Yet, both approaches not using color cues for tracking. A. J. Lipton et al. [10], using shape and color information to detect and track multiple objects and vehicles in a cluttered scene and monitor activities over a large area and extended periods of time. However, these methods required complicated calculation or expensive computational power, thus we proposed object detection and tracking to identify objects appear in the scene based on color information.

III. PROPOSED METHODOLOGY

It is more suitable to explain the whole system with the help of a block diagram. The complete block diagram of the whole system is shown in Fig. 1.

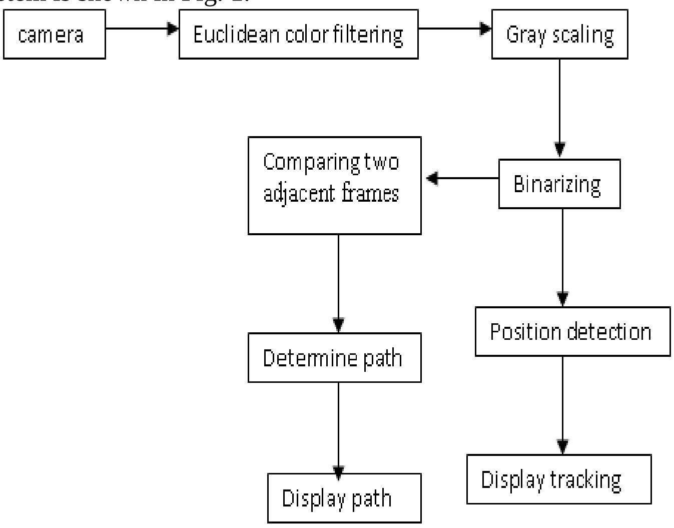

Fig 1 Block diagram of colored object tracking system

High resolution camera is attached with computer in the system such as webcam. Camera sends images to the computer simultaneously. At first Euclidean color filtering of each image is done. In this process the moving object body color is kept in image and other color is filtered. Therefore the body color of the moving object is given first to the system. Then gray scaling of the image is done we convert the color image into gray, because it is easy to process the gray image in single color instead of three colors. Gray images requires less time in processing. Finally binarizing of the image is performed. From these filtering processes, color image becomes fully black and white image. Now position detection becomes very easy. The moving object is covered by contour and displayed in the computer. Thus tracking of moving object is completed. The position at every instant is stored in computer memory for further processing. Two adjacent frames with respect to time are compared. Then the path of object is determined. The path of object is displayed in the screen. The full procedure is presented in Fig 2.

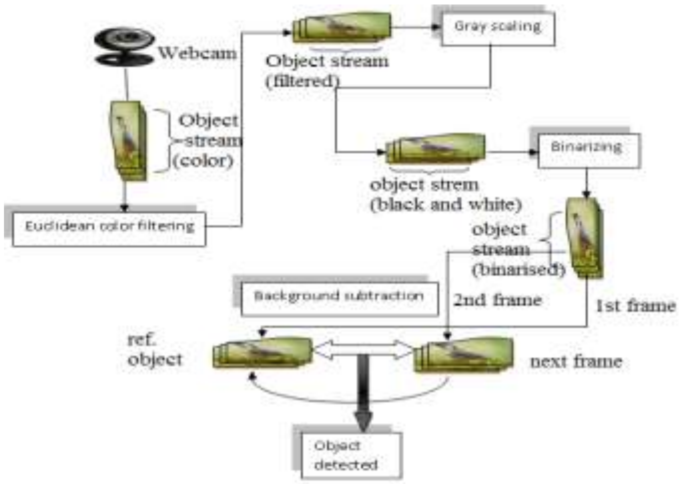

Fig 2 Procedure of the colored object tracking system.

Contour tracking: Computer Vision toolset usually provides some contour analysis tools, which can be used to extract contours from a binary image, to match a contour against a template contour, etc. Contour analysis can be helpful in reducing possible detection candidates when the target objects are simple shapes, such as rectangles, circles or ellipses.

An object after color analysis can be sent to contour extracting algorithm. Contour analysis is based on the binary image (mask image) output of color thresholding. Contour matching algorithms usually take as input two contours and output a real number indicating the extent to what they match. A threshold can be put on this number to rule out objects whose contours are too far away from the wanted contour. Contour algorithms do not use sliding window, thus is much faster than algorithms that are performed in a sliding window manner.

Detecting the presence of chaos in a dynamical system is an important problem that is solved by measuring the auto correlation, Hurst exponent, Lyapunov exponent, correlation dimension, complexity etc. Here to analyze the chaotic nature in motion of living beings, we have dealt only with Hurst exponent and Lyapunov exponent.

The Hurst exponent is a statistical measure used to classify time series. H=0.5 indicates a random series while H>0.5 indicates a trend reinforcing series. The larger the H value is the stronger trend. The Hurst exponent provides a measure for long term memory and fractality of a time series. Again, we have known that, H is directly related to fractal dimension (FD), such that FD=2-H.

The values of the Hurst exponent vary between 0 and 1, with higher values indicating a smoother trend, less volatility, and less roughness. To calculate the Hurst exponent, one must estimate the dependence of the rescaled range on the time span *n* of observation. A time series of full length *N* is divided into a number of shorter time series of length *n* = *N*, *N*/2, *N*/4… The average rescaled range is then calculated for each value of *n*. For a (partial) time series of length *n*, *X=X1, X2…Xn*, the rescaled range is calculated as follows:

The mean is calculated from (1).

$$m = \frac{1}{n}\sum_{i=1}^{n} X_i \quad (1)$$

Then a mean-adjusted series is created as represented in (2).

$$Y_t = X_t - m; t = 1,2,3, \ldots . n \quad (2)$$

The cumulative deviate series *Z* is then calculated from (3).

$$Z_t = \sum_{i=1}^{t} Y_t \;\; t = 1,2, \ldots , n \quad (3)$$

The range of *R* is computed from (4).

$$\text{R (n)} = \max (Z_1, Z_2, \ldots Z_n) - \min (Z_1, Z_2, \ldots Z_n)$$

The standard deviation S is computed from (5).

$$\text{S (n)} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(X_i - m)^2} \quad (5)$$

The rescaled range *R* (*n*) / *S* (*n*) and average over all the partial time series of length *n* is calculated from (6).

$$E\left[\frac{R(n)}{S(n)}\right] = Cn^H \tag{6}$$

The usual test for chaos is calculation of the largest Lyapunov exponent. A positive largest Lyapunov exponent indicates chaos. In case of real time object tracking, we have dealt with three kinds of fishes in our work.

IV. APPLICATION DOMAIN

Some of the applications of object tracking are:

- Automated video surveillieance: In these applications computer vision systems is designed to monitor the movements in an area, identify the moving objects based on color and report any doubtful situation.
- Robot Vision: In robot navigation, the steering system needs to identify different obstacles in the path to avoid collision. If the obstacles themselves are other moving objects then it calls for a real-time object tracking system. It is more accurate for robots tracking objects based on color rather than shapes.
- Animation: Object tracking algorithms using color features can also be extended for animation.

V. RESULT AND ANALYSIS

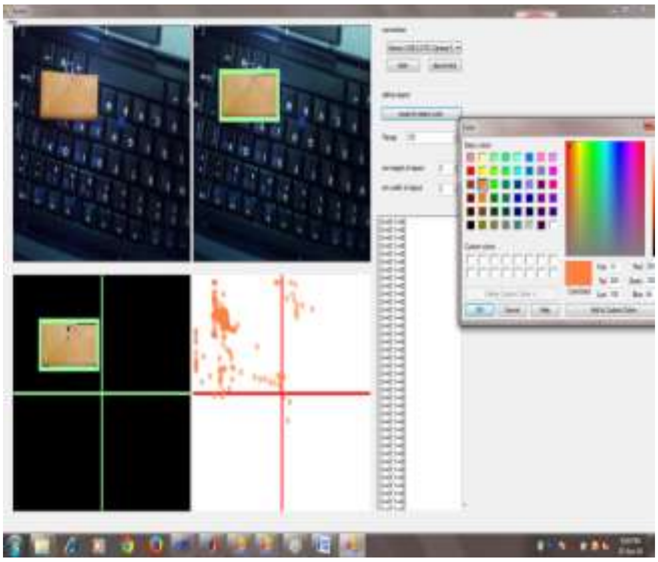

Fig 3 Detecting and tracking orange color object

In fig 3, 1st window shows system is connected with the webcam and capture image continuously. Window 2nd detected specified color as here given as color orange. Then In 3rd window passes through Euclidean filter and converting into grayscale and contour of an object detected. In 4th window the detected of a moving object path which is shown as same as detected color.

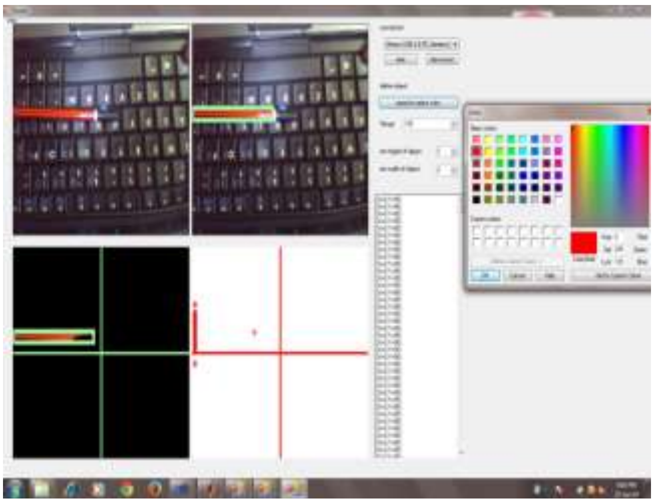

Fig 4 Detecting and tracking red color object

In fig 4, 1st window shows system is connected with the webcam and capture image continuously. Window 2nd detected specified color as here given as color green. Then In 3rd window passes through Euclidean filter and converting into grayscale and contour of an object detected. In 4th window the detected of a moving object path which is shown as same as detected color.

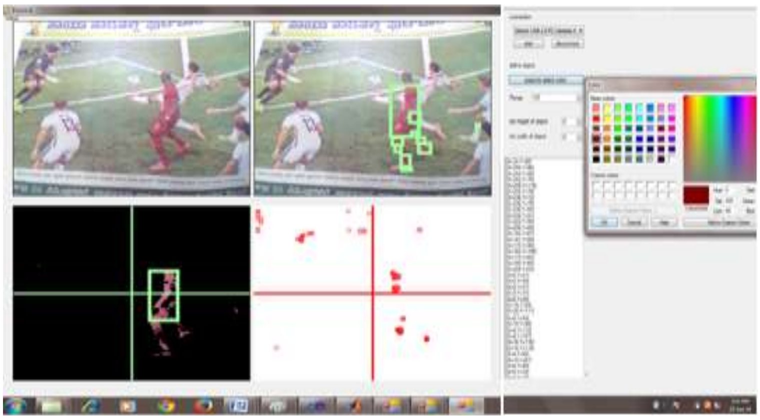

Fig 5 Detecting and tracking brown color object

In fig 5, 1st window shows system is connected with the webcam and capture image continuously. Window 2nd detected specified color as here given as player dress color brown. Then In 3rd window passes through Euclidean filter and converting into grayscale and contour of an object detected. In 4th window the detected of a moving object path which is shown as same as detected color.

VI. CONCLUSION

In this paper, an algorithm for real-time object detection based on color is proposed. The advantages of using color as feature to achieve object's similarity are robust against the complex, deformed and changeable shape. In addition, it is also scale and rotation invariant, as well as faster in terms of processing time. We used here Euclidian filter which has the advantage that it can be used in dynamic images in arbitrary dimensional space and has linear complexity. By experiments, we also find that the algorithm is very efficient. In the experiments performed both in indoor and outdoor environments, our approaches considerably reduce the detection delay and memory usage. As our algorithm is more efficient and do not rely on any special hardware, they are more appropriate for embedded systems or portable devices.

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