Real-Time Object Tracking Using Colour Feature

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Abstract-Video Tracking is the process of locating a moving object over time using a camera. The objective of video tracking is to associate target objects in consecutive video frames. The association can be especially difficult when the objects are moving fast relative to the frame rate. Another situation that increases the complexity of the problem is when the tracked object changes orientation over time. For these situations video tracking systems usually employ a motion model which describes how the image of the target might change for different possible motions of the object. In this paper an algorithm is proposed to track the real time moving objects in different frames of a video.

Keywords- Shape Features, Object tracking, Feature Extraction.

I.INTRODUCTION

Tracking can be defined as the problem of estimating the trajectory of an object in the image plane as it moves around a scene. The need for high power computers, the availability of high quality and inexpensive video cameras, and the increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms[1]. There are three key steps in video analysis, detection of interesting moving objects, tracking of such objects from frame to frame, and analysis of object tracks to recognize their behaviour [2]. In its simplest form, tracking can be defined as the problem of estimating trajectory of an object in the image plane as it moves around a scene. Our main aim is to track the real-time moving objects in different video frames with the help of a proposed algorithm. Median filtering is a non-linear operation often used in image processing to reduce noise. A median filter is more effective than convolution when the goal is simultaneously reduce noise and preserve edges.

II. OBJECTIVE

Our main aim is to track the real-time moving objects in different video frames with the help of a proposed algorithm. To perform video tracking an algorithm analyzes video frames and outputs the movement of targets between the frames. There are a variety of algorithms each having strength and weakness. Considering the intended use is important when choosing which algorithm to use. There are two major components of a visual tracking system, target representation and localization and filtering and data association.

Target representation and localization is mostly a bottom-up process. These methods give a variety of tools for identifying the moving object. Locating and tracking the target object successfully is dependent on the algorithm whereas filtering and data association is mostly a top down process which involves incorporating prior information about the scene or object dealing with object dynamics and evolution of different hypothesis.

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One of the most common problems encountered in object tracking is to find the region of interest (ROI). Region of interest is the region in which we locate the required object in different video frames. To locate the required object in different video frames, we have to first detect the motion of that object with the help of motion estimation features, such as Centroid, Boundingbox.

Another common problem which arises during the object tracking is that of light illumination and background which acts as a noise and is the main problem which arises during the tracking of the object which can be removed by filtering the noise.

Issues related to object tracking involves choosing good tracking algorithms, measuring their performance and understanding their impact on image analysis system. One of the main challenges in object tracking is that of noise, complex object shape/motion, partial and full object occlusions, scene illumination changes, real-time processing requirements. The tracking methodology discussed in this paper is focussed on locating and tracking an object on the basis of colour.

III. METHODOLOGY

Several general purpose algorithms have been developed for object tracking. Since there is no general solution to the object tracking problem, these techniques often have to be combined with domain knowledge in order to effectively solve an object tracking problem for a problem domain. Thus object tracking needs to be approached from a wide variety of perspectives.

As we have already seen that during the tracking of the object light illumination acts as noise. In general noise should be eliminated through processing, also we need that the time required for the processing of the image or frames should be as low as possible, as well as we need to see that the motion detection of the object should be proper, because if there is no proper motion detection we will not be able to detect and track the object.

In this paper we are confined to track the red colour objects. A dilemma within an object tracking research is the search for an effective measure of tracking quality. Different methods of tracking exist utilizing different characteristics e.g., shape, texture, or colour, etc. These methods perform differently depending on the application and are often compared only subjectively.

IV. TOOL USED

I choose MATLAB after deciding the various important tasks in my work. I decided that the platform on which I am going to develop my code will be MATLAB, because MATLAB is a high level technical language and interactive environment for algorithm development, data analysis, and numeric computation. Using the MATLAB product, we can solve technical computing problems faster than with traditional programming languages, such as C, C++, and FORTRAN.

We can use MATLAB in a wide range of applications, including signal and image processing, communications,

the MATLAB environment to solve particular classes of problems in these application areas. MATLAB provides a number of features for documenting and sharing our work, we can integrate our MATLAB code with other languages and applications, and distribute our MATLAB algorithms and applications.

In MATLAB various video acquisition and analysis functions are pre-defined in MATLAB that would make the development of my work much easier.

V. IMPLEMENTATION

The implementation of the proposed algorithm is done using MATLAB. The basic block diagram for the proposed algorithm is shown below:

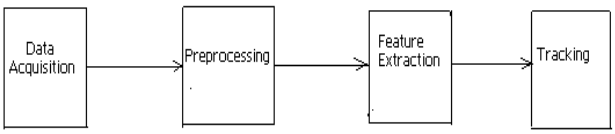

Figure 1: Basic block diagram for proposed algorithm

The basic block diagram consists of four blocks named as Data Acquisition, Pre-processing, Feature Extraction and Tracking. The functions of these blocks are as follows:

Data Acquisition: Data Acquisition means to obtain the video frames using the Image Processing Toolbox. The frames are acquired with the help of the default camera device present in/on your system.

Pre-processing: In pre-processing, first we convert the colour image into gray, because it is easy to process the gray image in single colour instead of three colours. Gray images requires less time in processing. Then we apply median filter to remove noise from images or frames obtained from the video. The image or frame filtered out with the help of the command 'medfilt2' present in the Image Processing Toolbox.

Feature Extraction: Selecting the right feature plays a critical role in tracking. The feature selection is closely related to the object representation. Various features required for tracking are colour, edges, optical flow, and texture. In the proposed algorithm, we track the required object using the colour feature, specifically red colour, thus we are focussed to track the red colour object/objects in the video.

Tracking: Tracking of the real-time objects is done on the basis of the region properties of the object such as Boundingbox, Area, Centroid, etc. Here Boundingbox property is used to track. Hence as the object moves different locations in the video, the Boundingbox also moves with it and therefore different values of region properties are obtained and hence the objective of object tracking is achieved.

VI. PROPOSED ALGORITHM

Several general purpose techniques and algorithms have been developed for object tracking. As we have already seen that during the tracking of the object light illumination acts as noise, also we need that the time required for the processing of the image should be as low as possible. To perform video tracking an algorithm analyzes video frames and outputs the movement of targets between the frames. There are a variety of algorithms each having strength and weakness. May, the proposed algorithm discussed in this paper will be helpful in developing better and efficient algorithms in the field of tracking. A basic flow chart diagram for the proposed algorithm is shown below

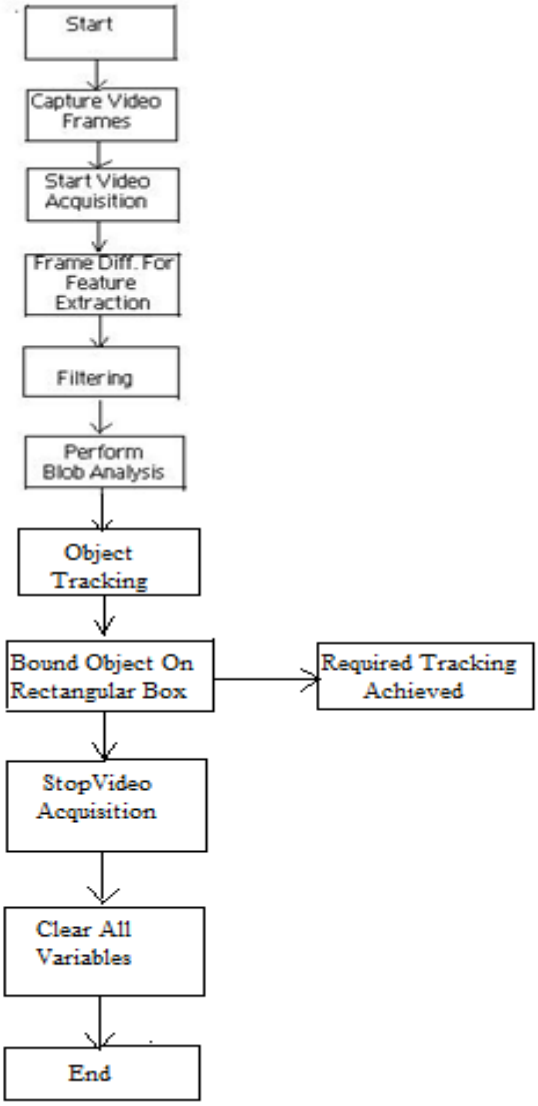

Figure 2: Flowchart diagram for proposed algorithm

The blocks present in the above flowchart are being explained below in the following steps:

Step1: Capture the video frames using the video input function.

Step2: Set the properties of video object.

Step3: Start the video acquisition.

Step4: Set a loop that starts after 50 frames of acquisition. This loop contains the following steps:

1 Get the snapshot of the current frame.
2 Now to track the red objects in real time we have to subtract the red component from the gray scale image to extract the red components in the image.
3 Use a median filter to filter out noise.
4 Convert the resulting gray scale image into a binary image.
5 Remove all those pixels which are less than 300 pixels.
6 Label all the connected components in the image to perform image blob analysis, here we get a set of properties for each labelled region.
7 Display the image.
8 Again a loop is used to bound the red objects in a rectangular box.

Step5: Stop the video acquisition.

Step6: Flush all the image data stored in the memory buffer.

Step7 Clear all the variables.

VII. RESULTS

I have worked on real-time object tracking, i.e., to track the object in video. The proposed algorithm explained above is applied on the video frames to achieve the required tracking. The results obtained are shown below:

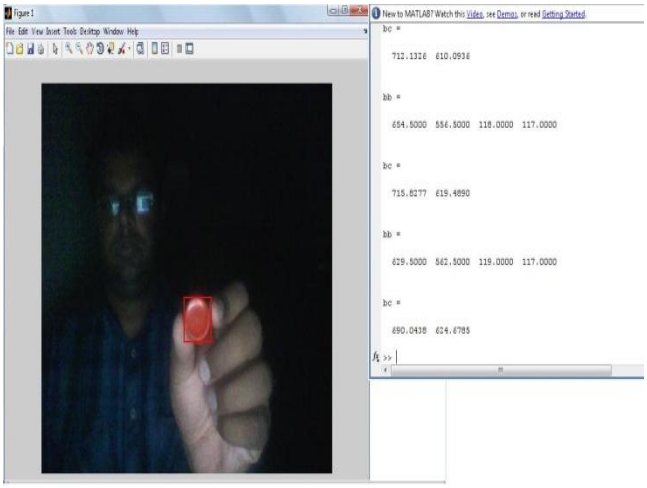

Figure 3: Object with required boundingbox present in centre position

The value of the boundingbox and the location of centroid at centre position are shown in the command window.

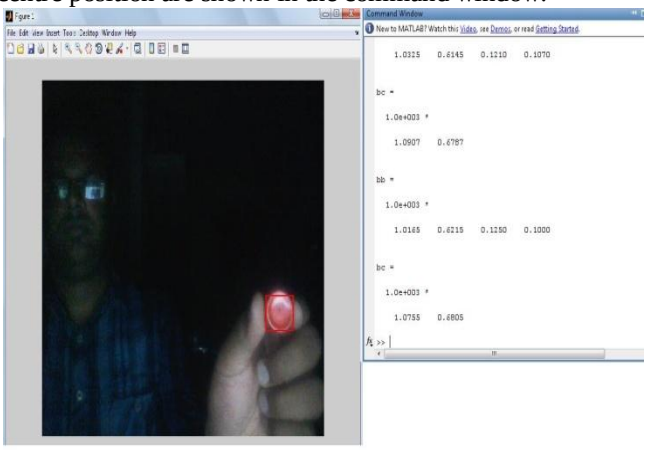

Figure 4: Object with required boundingbox moving towards right

The value of the boundingbox and the location of centroid at the right position are shown in the command window.

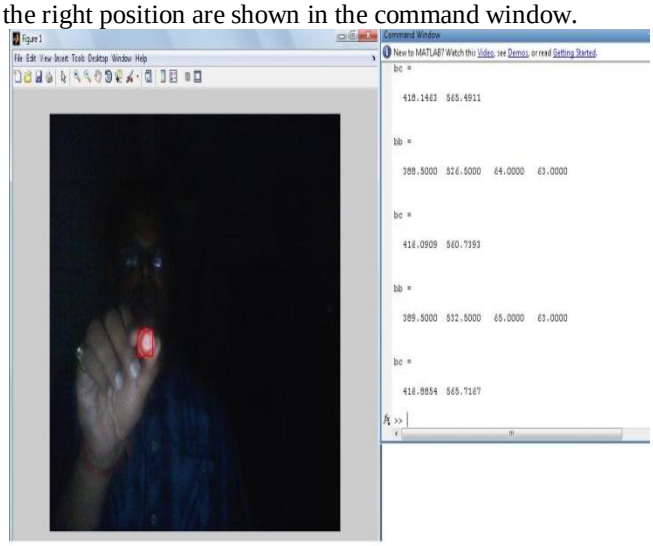

Figure 5: Object with required boundingbox moving towards left

The value of the boundingbox and the location of centroid at the left position are shown in the command window.

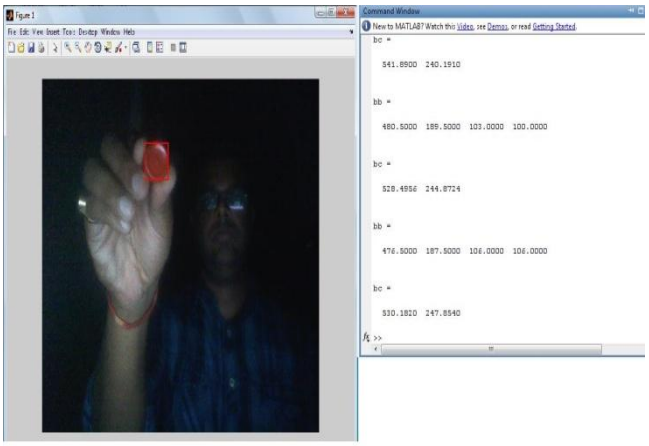

Figure 6: Object with required boundingbox moving vertically upwards

The value of the boundingbox and the location of centroid at vertically upwards position are shown in the command window.

The values of boundingbox and centroid for each location of the object are shown in the tabular form below:

Figure	Boundingbox	Centroid
3	629.5, 562.5, 119.0, 117.0	690.0438, 624.6785
4	1.0165, 0.6215, 0.1250, 0.1000	1.0755, 0.6805
5	389.5, 532.5, 65.0, 63.0	416.8854, 565.7167
6	476.5, 187.5, 106.0, 106.0	530.1820, 247.8540

VIII. 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 and report any doubtful situation [3]. The system needs to discriminate between natural entities and humans, which requires a good object tracking system.

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.

Traffic Monitoring: In some countries highway traffic is continuously monitored using cameras [4]. Any vehicle that breaks the traffic rules or is involved in other illegal act can be tracked down easily if the surveillance system is supported by an object tracking system.

Animation: Object tracking algorithms can also be extended for animation.

IX. FUTURE WORK

Significant progress has been made in object tracking during the last few years. Several robust trackers have been developed which can track objects in real-time in simple scenarios. However, it is clear that the assumptions used to make the tracking problem tractable, for example, smoothness of motion, minimal amount of occlusions, illumination constancy, high contrast with respect to

background, etc., are violated in many respective scenarios therefore limit the trackers usefulness in applications like automated surveillance, human computer interaction, video retrieval, traffic monitoring and vehicle navigation. Thus tracking and associated problems of feature selection, object representation, dynamic shape and motion estimation are very active areas of research and new solutions are continuously being proposed.

X. CONCLUSION

In this paper an algorithm is proposed to track the real-time objects on the basis of region properties such as Centroid, Boundingbox, etc, using the colour property of the object as a feature.

In the context, Median filtering is a non-linear operation often used in image processing to reduce noise during the real-time object tracking. A median filtering is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges.

May the contents discussed in this paper can give valuable insight into this important research topic and encourage new research.

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