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Moving Object Detection and Tracking Using Matlab

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Abstract: *Object tracking is the process of locating moving objects in the consecutive video frames. Real time object tracking is a challenging problem in the field of computer vision, motion-based recognition, automated surveillance, traffic monitoring, augmented reality and object based video compression etc. Performance at higher level is greatly depends on accurate performance of object detection. Various platforms are being used for designing and implementation of object detection algorithm. It includes C programming, MATLAB and Simulink, open cv etc. Among these, MATLAB programming is most popular due to its extensive features. These features include data processing using matrix, set of toolboxes and Simulink blocks covering all technology fields, easy programming. This project presents the implementation of object detection and tracking using MATLAB.*

Key Word*: Object detection, HSV model, noise removal, object tracking.*

I. Introduction

The proliferation of high powered 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. 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 behavior. In its simplest form, tracking can be defined as the problem of estimating the trajectory of an object in the image plane as it moves around a scene. In other words, a tracker assigns consistent labels to the tracked objects in different frames of a video.

Detecting of object has become a very active research area in computer vision community due to the vast number of applications with many applications traffic monitoring, human activity surveillance, people counting and other financial applications. In all these applications extraction of moving objects from the video sequence is the key procedure. Since the camera is not in motion here. In this work we considered the single object tracking. The motivation behind this work is to develop software for tracking which has the major application in security, surveillance and vision analysis.

II. Literature Survey

N. Otsu (1979) [1] in his paper proposed a technique to pick out a threshold mechanically from a grey level bar graph has been derived from the point of view of discriminant analysis. This directly deals with the matter of evaluating the goodness of thresholds. Associate optimum threshold (or set of thresholds) is chosen by the discriminant criterion; specifically, by maximizing the discriminant measure alphabetic character (or resultant the measure of disjunction of the categories in grey levels). G.Wyszecki et al (1982) [2] proposed a research work that describes regarding the color science ideas and strategies. The RGB show is used here to acknowledge the shading within the image. The RGB show could be a shading model that joins red, inexperienced associated blue lights in numerous approaches to create an assortment of hues. Brownrigg, D. R. K (1984) [3] in his paper mentioned regarding the actual cases of filters and needs. The notion of a lowest weighted median filter, of a taxonomic group that act identically is introduced. J.Kittler et al (1986) [4] in his paper proposed a research work that provides the efficient answer for the matter of minimum error thresholding that comes below the idea of object and picture element level grey values being ordinarily distributed. This is applicable for mutithreshold choice. R. C. Gonzalez.,et al (1992) [5] in this paper Digital Image process discusses Image segmentation subdivides a picture into its constituent regions or objects. The amount of

segmentation depends on the matter to be solved. Non-trivial image segmentation is one among the foremost tough tasks in image process. The accuracy of the segmentation determines the final word success or failure of a computerized analysis program. N. R. Pal., et al (1992) [6] in his paper mentioned the constraints of a number of the prevailing threshold choice techniques. The approximate minimum error thresholding algorithmic rule of Kittler and Illingworth has been changed considering a Poisson distribution for the gray level rather than the normally used distribution. The modified technique is found to be far better from the purpose of view of each convergence and segmental output. J.L. Vincent(1993) [7] in his paper describes regarding the morophological reconstruction. The quality parallel and ordered approaches to reconstruction are concisely recalled; their common disadvantage is their inefficiency on standard computers. to boost this case, a brand new algorithmic rule is introduced, that relies on the notion of regional maxima and makes use of breadth initial image scanning's enforced via a queue of pixels. Solihin, Y.,et al (2000) [8] in his paper discuss the advantages of a multi-stage thresholding approach that thresholds gray scale images stage-by-stage. The ability to use numerous data from the image to help the assignment of a intensity level is central to the multi-stage approach. Therefore it's better suited to pictures that have consistent characteristics as encountered in specific applications. R. S. Berns(2002) [9] in his paper describes that MATLAB takes every answer as a network, that makes it the foremost usually used image making ready stage. Photos will speak to grey scale, RGB, HSV, and alternative shading models.

III. Methodology

The picture consists of many pixels. The every picture element corresponds to a code. The total of those codes provides a whole image. After analyzing the code, the code may be used for the definition of Colors, and therefore the Colors of those definitions are used for the picture element markers used to determine the Colors within the image.

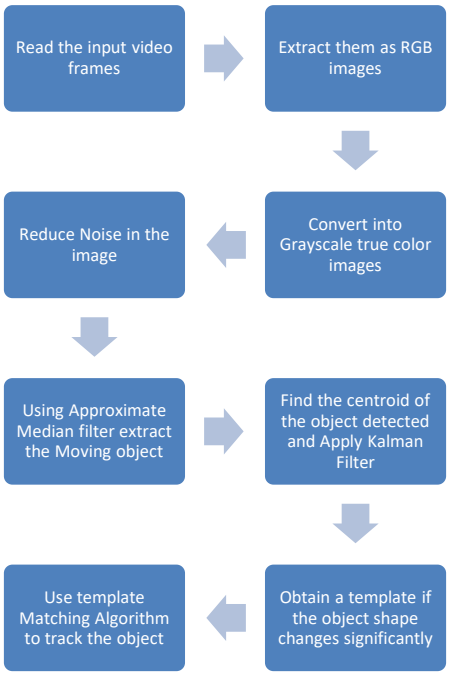

Figure 1 Block Diagram of the implementation and evaluation

First we process the color and texture feature in separate ways. First, we eliminate the incompatible pixel using color based object detection, and then we do texture matching to find the object position.

Color recognition

To understand the basics of camera vision it is necessary to know how a computer sees an image. A computer can only work with numbers, so when an image is imported on a computer, the computer sees it as a lot of numbers. For each pixel in the image, the computer uses a code and all those codes together form the total image. For image processing, it is required to understand the way a computer encodes an image. There is more than one way to encode a picture by using different color spaces.

RGB-space

In the RGB color space, each color is described as a combination of three main colors, namely Red, Green and Blue. This color space can be visualized as a 3d matrix with the main colors set out on the axis. The values for the main colors vary from 0 to 1. Each color is coded with three values, a value for red, blue and green. In this color space, an imported image on a computer is thus transformed into 3 matrices with values per pixel for the representing main color.

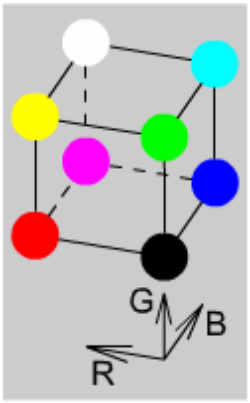

Figure 2: RGB color space model.

HSV Color Space

HSV color space is for separating luminance component with chrominance component. The luminance component lies in V(intensity value) and the chrominance component lies in H(Hue) and S(Saturation). In HSV model, Hue defines the kind of color like red, yellow, green, blue, or the combination between those colors. Hue value is between 0-360. Saturation gives a measure of the degree by which a pure color is diluted by white light, and value show the intensity of light-dark color. HSV color model is shown in Figure3 . HSV color space is more similar to human eye perception about color and more ideal model to be used in color-based image and video processing algorithm.

V = max(R; G; B) ---------- (1)

where, H €[0_; 360_], S€ [0; 1] and V€ [0; 1].

Noise Reduction

Digital images captured or features extracted from images are usually contaminated by a variety of different noise sources. These noise sources can be categorized into two groups. In the first group, the noise is random and is not coherent with the object of interest. For example, white noise produced by the image sensor. In the second group, irrelevant background objects may share common features with the object of interest. This type of background noise is eliminated. Objects with H and S values falling within the hysteresis band appear in the binary image resulting in detection errors. Hence, noise filtering will be essential for any localization algorithm to succeed.

Median Filter:

Median filter is a standard nonlinear order-statistic filter. It is generally employed in the preprocessing stage to improve the effectiveness of object recognition algorithms. The median filter is typically used in images corrupted by impulse noise (salt-and-pepper noise). For example, given a pixel under consideration, it is surrounded by 8 other pixels. These 9 pixels are ranked and then the pixel under consideration is replaced by the median value. Although this example uses integers, our images are only binary valued. As the replaced value is the median, it is not significantly affected by a single outlier but also forces the distinctive centre pixel to be more like its neighbour. An alternative method uses the mean instead of the median, but the filtered binary image using the mean is poorer than that obtained from the median.

IV. Conclusion

A robust and efficient automated single object tracking system is presented in this paper. The system has been implemented using an algorithm based on Approximate Median Filter, Kalman filter and dynamic template matching.

The algorithm has experimentally been shown to be quite accurate and effective in detecting a single moving object even under bad lighting conditions or occlusions. Such an automated object tracking system can be used in applications where accurate tracking is required but good lighting conditions cannot be provided. The video tracking system is furthermore very much applicable to areas like video conferencing and surveillance. Future work focuses on tracking multiple objects at the same time as well as on improving tracker accuracy during camera motion. The algorithms can be implemented on hardware equipment. These algorithms can be further extended for the use in real-time applications and object classifications

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