Object Detection using Edge and Recognition Methods Using Shape/Color

PRAVEEN YADAV[1], Dr. MANOJ S. NAGMODE[2]
[1]*ME student, Department of Electronics & Communication, MITCOE, Pune*
[2]*Professor, Department of Electronics & Communication, MITCOE, Pune*

Abstract - Image processing is important for adding visual sense to device, decision making of the system with image processing became easier. By doing image processing on images finding objects presented in the image, tracking object and recognition of that object can be achieved. Object recognition is the process of finding an object in image, tracking of object in video sequence is to change the cursor position along with the object moves. Many algorithms and methods are available for object detection and object recognition. This paper presents a survey of techniques related to image processing. The aim of this paper is to review several moving object detection and object recognition methods. In this survey, sobel, canny, laplacian of guassian(log), prewitt and Roberts method is describe to detect object and recognition methods such as template matching, color based and shape based method is explained.

Keywords - *Object recognition, object detection, object tracking, sobel, prewitt, roberts, canny, laplacian of guassian,, template matching*.

I. INTRODUCTION

Image processing is the basic building block of computer vision. Processing on image or video to attain useful result is very challenging task. Generally image processing is distributed into three wide categories as object detection, tracking and recognition.

Object detection means detecting objects of a certain class (such as books, faces, or cars) in images. Object detection is used in computer vision, which includes image retrieval, threat detection and video surveillance. Detection of object is done using sobel, canny, laplacian of guassian(log), prewitt and Roberts method [1].

Object recognition is a procedure for pointing out an object in an image and say about its detail. Object recognition algorithms depend on matching, learning, or pattern recognition algorithms using shape-based or color-based techniques [2][3].

In this paper, Section II discusses about object detection of various edge detection techniques. Section III discusses about object recognition using template matching, shape based and other techniques. Our approach of recognize of object is explain in brief in section VI. The paper is concluded in section V.

II. OBJECT DETECTION

Various methods are available for detecting an object in an image such as Background subtraction based approach [4], Histogram-based methods and Edge detection based methods [5].

A. BACKGROUND SUBTRACTION BASED APPROACH

Background subtraction is necessary issue in visual surveillance and can extract moving objects for further analysis. However, a difficult issue in background subtraction is that the background is usually non-stationary, such as a waving tree or changing lights. To solve this problem, many previous studies have proposed corresponding pixel classification algorithms to classify the pixels as shadow, highlight, or foreground. Cucciara et al. [6] proposed a hue-saturation value color model to handle the shadow; this method defined shadows by the luminance and saturation values and used a predefined parameter for the hue variation. In [7] and [8], a red, green, and blue (RGB) color model was proposed to remove the shadow. however, one problem with this model was that there were too many parameters in the color model. All of these methods show good performance in managing the shadow issue; however, some disadvantages are apparent, such as a non-stationary background removal capability. Currently, the mainstream techniques of background subtraction can be roughly separated into three groups, including the mixture of Gaussian (MoG), the kernel density estimation (KDE), and the codebook (CB).

Among these, the MoG attracts the most attention With the block-based CB background model, the hierarchical method for foreground detection using the CB model (termed the hierarchical codebook (HCB) [9]) was employed to solve the dynamic background and to improve the processing speed by adopting high-mean and low-mean values of blocks; however, many additional issues were introduced. For example, fixed-size block-based processing that uses an identical threshold could result in false detection in the background subtraction. Among these, although a greater block size 16 is good to handle the dynamic background issue, some false subtractions (false negatives) can be observed over the vehicle (left) and

the pedestrian (right). For the smaller block of size 4 × 4, the foreground is well detected but the subtracted background is rather poor for the dynamic background, which is why the tradeoff block size 8 × 8 is adopted in HCB [9]. However, in some other sequences, a block of size 8 × 8 is not sufficiently large, which leads to noise, as is the case with a block of size 4 × 4 [Fig. 1(d)]. Conversely, for some sequences, the block of size 8 × 8 is not sufficiently small, which leads to false subtractions, as is the case with a block of size 16 × 16 [Fig. 1(b)].

Fig. 1: Block-based background subtraction results with *WATERSURFACE*. Column 1: Original images. Column 2: Block-based results of HCB .Column 3: Block-based results.[10]

To solve these issues, a multilayer block-based background model is proposed with three adaptive block-based layers for coarse detection and a pixel-layer (block of size 1 × 1) for further refinement. With this strategy, the reliability of the system is improved against the dynamic background problem, and the integrity of the foreground is well preserved. In the experiments, the proposed algorithm shows well performance in terms of various evaluation indices using the mean value of a block (as defined below) instead of using the high and low means in the HCB. Fig. 2 shows the conceptual flowchart of the proposed method, in which the right vertical axis denotes the time index (t). The flowchart can be separated into two parts: the first half ($1 \leq t \leq T$) , on the top, is for training the background model using four CBs, as introduced below, and the other half ($t>T$) is for background subtraction using the hierarchical conceptual algorithm. The FFRM, is adopted for adapting the background, is on the bottom-right corner. Moreover, as shown on the left of this figure, an illumination change procedure is also proposed to overcome the light condition changes. In this section, the first part ($1 \leq t \leq T$), known as the background construction, is introduced.

B. HISTOGRAM-BASED APPROCH

Speed and precision are crucial for object detection algorithms. In this paper, an object detection algorithm based on adaptive bandwidth mean shift and color histogram is proposed. The algorithm is capable of detecting objects precisely and rapidly. It is composed of both stages: a precise detection stage and a rough detection stage. In rough detection stage, thresholding and histogram back projection are applied for rough global localization and fast object identification. In precise detection stage, the position, size and orientation are derived in the adaptive bandwidth mean shift framework. In this approach two stage are rough detection stage and the precision stage.

The rough detection stage is a decent way to reach optimum quickly. The adaptive bandwidth (BW) mean shift approach is good for detecting the orientation, scale and position of objects precisely and quickly. In the rough detection stage, the back projection based mechanism is introduced to speed up the procedure. Then the input image is thresholded and filtered to a grayscale image, and then a blob approach called “adaptive blob growing” is executed on the whole grayscale image very quickly. Most of the information of original image is lost while converting it to grayscale image, and so the blob detection became much faster but the precision is lost. The precision of position, orientation and scale is then recovered at the later stage with the help of adaptive bandwidth O.

The adaptive bandwidth mean shift is an algorithm for seeking optimum locally. Thus the detection algorithm is very fast and that of without loss of precision. This approach is unlike from mean CAMSHIFT [11] and shift[12]. Mean shift repetition is executed directly on the back projected image to seek local optimum. But in this approach, back projection and blob detection procedure are used to locate the initial rough positions globally. A second stage is processed to filter the detection results, and the adaptive bandwidth mean shift is processed to the input image rather than back projected grayscale image. Compared with ABMSOD in paper [13], the rough stage of this algorithm is replacement of sliding-window method, and then the detection time is impressively reduced.

Fig. 2: Detection results of bottles and toy pandas of different scales and orientations.[14]

C. EDGE BASED APPROCH

In this section brief knowledge about edge based method is described. An Edge in an image is a change in the image intensity, usually deals with a discontinuity in image intensity or the first derivative of the image intensity.

The three steps for detection of edge are [1]:-

- Filtering of image
- Enhancement of image and
- Detection of object.

i. Filtering of image: Images may be distorted by noise such impulse noise and Gaussian noise. As there is a balance between edge strength and noise reduction, filtering is done.

ii. Enhancement: It highlight pixels where there is a change in intensity values and is done by computing the gradient magnitude.

iii. Detection: Many pixels in an image have a value for the gradient, and it is not necessary that all of these pixels are having edges. Therefore Thresholding is used to get the edge.

The different edge detection methods used are sobel, canny, laplacian of guassian(log), prewitt and Roberts method.

III. OBJECT RECOGNITION TECHNIQUES

A. TEMPLATE MATCHING

Template matching is a technique for finding object in an image which matched with a template image. In this technique template images for many different objects are stored already. When an image is given as input, input image is matched with the stored template to find the object in the original image. Template matching is used for recognition of characters, numbers and objects. It can be process on either color or gray level images. Template matching may either be pixel to pixel matching or feature based matching. In feature based matching the features (color and shape) of template image is compared to features of sub-images of the original image; to find whether the template of object is present in original image.

In [15], authors have proposed a morphological mathematical template matching approach for detection of object. The main focus of the paper is to track and detect the ground objects. The flying systems which have fixed camera in flying system were used to capture the images of ground for identifying the objects.

In [16], an approach for finding similarity between visual images, it uses matching of internal self-similarities. A template is to be compared to another image. Finding similarity across images can be complex process, the similarity between each image can easily determine with simple similarity measure, such as SSD (Sum of Square Differences), resulting in local self-similarity descriptors which are matched across images.

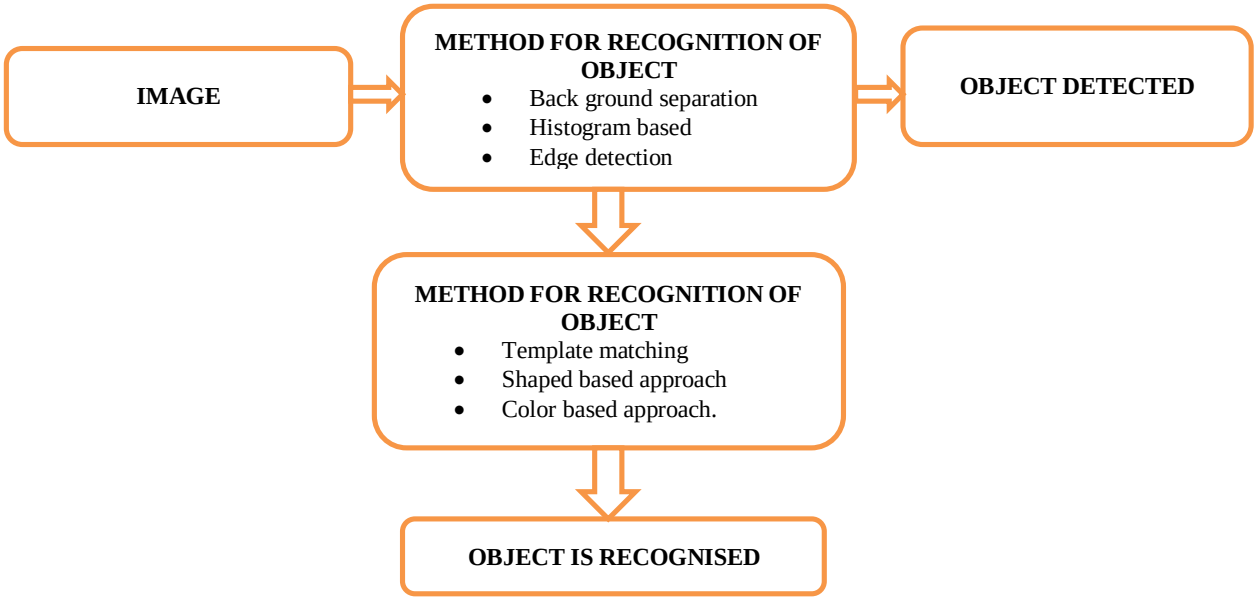
B. COLOR BASED

Color provides major information about object which can be used to recognize object. An efficient and simple object recognizes scheme is to match the images on the basis of color histograms. Color normalization is a concept in image processing concerned with artificial vision and recognition of object. An image have different color value depends on the illumination, which may differ depending on cameras, lighting conditions and other factors. Color normalization is process of discarding all these effect. The input image is converted to its histograms then object value is compared with its then on the basis on matching both input image value and object value, object is recognized.

Fahad Khan, et.al. [17] Proposed color attributes representation of image for object recognition. The color information of image is used in two methods for recognition of object, firstly part-based detection framework and secondly the Efficient Sub-window Search approach. The three main criteria for choosing an approach to use color as object recognition feature are Combination, photometric invariance and compactness.

In [18] the major aim is to recognition a multi-color object with change in illumination, object geometry and. In this image is normalized to *rgb color* so that hue *H* and saturation *S*, and proposed color models $c1c2c3$ and $l1l2l3$ are all not affected by changing the viewing direction, object geometry

and illumination. Further, it is shown that $l1l2l3$ and hue H are also unaffected to highlights. Finally, a change in power spectral distribution of the illumination is considered for new color constant color model $m1m2m3$.



Block Diagram. 1: DIFFERENT IMAGE PROCESSING METHODS.

Fig. 3: (a) Image template (b) Image against which it is compared (c) Detected object superimposed on gray-scale image

C. SHAPE BASED

Shape is important and unique features which are extensively used to recognize objects in images. The shape features are more reliable as compared to local features like SIFT because mostly all object categories are described by their shape then texture, such as car, horses and glass. Thus shape features are mostly used in place of local feature Berg, et.al. in [19], an algorithm is design to find similarity between feature points for object recognition is proposed. The step involve in shape matching is to give input as image with an object (shape) which is not known and compares it to a model. Then computation is done using aligning transformation to get similarity between original image and to the result after applying the aligning transformation In [20], a detection method based on shape of the object is proposed for clustering and extraction of edges using Gradient vector Girding (GVG) method that detect a direction graph of edges. The used method contains a series of pixel-level scan, and also computes much smaller second and third time algorithm on the results to fetch the connectedness.

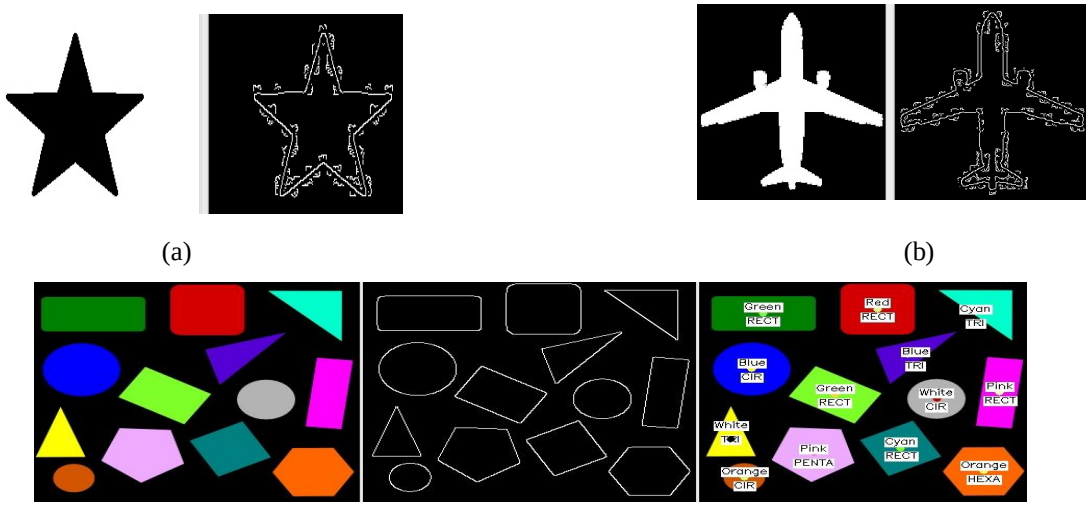
In [21] a method is presented by K.Schindler, D. Suter for detection of object class based on global shape and elastic matching of contours. An outline map which includes edge with closed point chains is formed by segmentation. A probabilistic measure for detection of similarity between two outline and then perform an suitable method to find closed outline in the image, which matched with a template image. The method only needs an outline of single object template. In this firstly a path is define to connect the edge point and then processing is done to get a minimum distance between them. The Authors mention techniques such as spline-based shape matching and chamfer matching for template matching and compares to elastic matching method

IV. OUR APPROCH

In our approach we selected edge based detection method and uses canny operator to find the edge of the object and then shape and color based characterization is done. In this original image firstly resize to 240*320, then image is converted to gray format from RGB after that canny operator is applied with filter value 5. That gives as edge of every object present in original image. Next step is to find contours of object which gives every value of edge pixel. Using contour we can identify shape and color of object. Final image contain no. of objects with label of their color and shape.

TABLE 2: COMPARATIVE STUDY OF OBJECT RECOGNITION METHODS [2]

Methods	Accuracy	Computational Time	Comments
Shape-Based	Moderate	Low	Simple pattern-matching approach can be applied with templates. It does not work well in non-static situations and it is not able to determine internal movements well.
Color-based	High	High	It creates a Gaussian Mixture Model to describe the color distribution within the sequence of images and to match it with stored data to recognize the object
Template-matching based	High	High	Provides improved quality with the expense of additional computation time.



(a) (b)

(c)

Fig.4: a) Canny Operator of star (b) Detected edge of airplane (c) Result of various shapes and color.

V. CONCLUSION

To analyze images high level of information is processed, so various methods for object detection and object recognition have been studied. In this paper we learn about background separation, histogram based approach and edge detection based methods. Further we describe technique used for recognition of object which include template matching, shaped based and color based approach. And use the edge detection and color/shape based method to recognition the object. As accuracy and computation time of color based recognition method is more than other methods. For detection of object edge based approach is used due to its simplicity and less computation time. The result shown are contain various different shape and color object so using those two method we can determine color and shape of object. Main drawback of background based approach is that if object present in first frame it will never get detected until it moves from their original position.

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Praveen Yadav pursuing M.E. degree in VLSI and Embedded Systems from MITCOE, Kothrud, Pune University. He received his B.E. in Electronics and Communication Engineering from Visveswaraya Technological University of Belgaum (2013)

Manoj S. Nagmode received Ph. D. in E&TC Engineering from Pune University, He received Master of Engineering in Electronics from Pune University and Received BE in Electronics from Pune University.