Contour-based Target Detection in Real-time Videos

Jose Anand[1], K. Sivachandar[2], M. Mohamed Yaseen[2]

[1]Associate Professor, [2]Assistant Professor, & Department of ECE, KCG College of Technology, Chennai, Tamil Nadu, India

Abstract — **Moving object target detection has a significant interest in image analysis. Frames are extracted from the real-time video, and from this image the required target is detected. This paper presents a contour-based object tracking using the spatial information. The image is applied for multiple segmentations to partition the image into simpler segments. Then automatic identification is done using the contour information on the image with a target object template available in the database. The similarities are updated with spatial relationships and target is detected. Result shows the effectiveness of the contour-based target detection model.**

Keywords—**contour information, multiple segmentation, spatial information, target detection.**

I. INTRODUCTION

The efficiency of target detection is one of the most challenging tasks. The real-time implementation involves processing data online and gives timely analysis. These real-time processing increases the applications in image processing fields such as internet communications, web browsing, telemedicine, etc [2]. In real-time the video that are captured with cameras are processed to obtain frames or images. Image processing is a signal processing unit in which the input is an image such as photograph and the output may be either an image or set of parameters related to the image [9]. The local information and features of the shape provides more information for some classes of objects [5] [13].

Many researches are going on to detect the target such as motor bikes, cars, and other vehicles. The other method is defined by the shape, which is represented by contour features [8]. For real-time processing of target detection, high spatial resolution can be used to abundant spatial and contextual information. The existing object tracking method such as constellation models and deformable shape models are not efficient [1] [4]. Contour-based feature learning and location-sensitive classifier for object detection with a discriminative set of features from a collection of contour fragments is presented in [13]. An automatic target detection model using contour representation and spatial concepts was proposed in [14] [18].

The rest of the paper is organized as follows. Section 2 reviews about the related literature on target detection in different applications and section 3 describes about contour-based target detection model used in the real-time. Section 4 details the experimental setup and analysis the simulation results in which the required target is detected. Finally conclusion is given in section 5.

II. RELATED WORK

In this section, we review the prior work on the various target detection models implemented in images. Lei et al [7] presented a high temporal resolution remote sensing imaging model for moving target detection with bionics compound eye. The system introduced an elementary mathematical model for developing compound eye equipment and introducing the electronic image stabilization. The equipment is a multi-channel ray system and each ray system has an aperture of compound eye. The video is captured by loading the camera on a moving carrier.

Dimitris et al [3] presented a review of target detection algorithms for hyperspectral imaging applications. This uses adaptive algorithms to deal with the unknown backgrounds. This requires a signal processing component to expertise the areas of array processing, radar, and detection. Performance assessments state that the approach gives a good detection with less false-alarm.

Huabo et al [6] described the imaging mechanism for the compound eyes and described the process of multi-resolution imaging. An image filter with variable resolution is discussed and proposed a method for moving object detection using variable resolution double-level contours. Texture gradient computation is performed for contour segmentation in high resolution image acquired by single eye.

Chein et al [2] presented a Linearly Constrained Minimum Variance (LCMV) beamforming approach to real time processing algorithms for target detection and classification in hyperspectral imagery. The target is passed through a Finite Impulse Response (FIR) filter using a set of linear constraints and minimizes the variance resulting from unknown signal sources. Two LCMV-based target detectors named, Constrained Energy Minimization (CEM) and Target Constrained Interference Minimization Filter (TCIMF) are used. Classification is implemented by QR-decomposition and processed by line-by-line in real time.

Ulisses et al [15] proposed a method for automatic target detection and tracking in Forward-Looking InfraRed (FLIR) image sequences. Morphological operators are used to extract and track targets, and to remove undesirable clutter. The design is based on spatial intraframe and temporal interframe information. The system is suitable for pipelined implementation.

Subash et al [14] presented a novel method to detect geospatial targets in high resolution remote sensing images by using a class of target templates with multiple viewpoints. The target is modeled by a collection of target models with multiple viewpoints. The contour informations are obtained and seed regions are identified using target templates.

Patnaik et al [11] discussed the target detection using resilient propagation-based neural network paradigm. This uses pre-processing to extract features and is fed as input to the resilient propagation neural network. The resilient propagation algorithm is implemented in ADSP-21062 assembly language.

Veeralakshmi et al [16] proposed an edge detection technique for detecting the correct boundary of objects in an image. The method can detect the boundaries of object using the information from intensity gradient using the vector image model and texture gradient using the edge map model. Padmapriya et al [9] proposed a method to detect boundary in medical image using magnitude, direction, edge map and density of the edges bounded to the object and to crop the detected object and enlarge the image. The blur effect of the enlarged image is removed and a high resolution image is produced from the low resolution image.

Santhosh et al [12] proposed an external force for active contours called Vector Field Convolution (VFC), to address problems related to limited capture range, noise sensitivity, and poor convergence to concavities. VFC is obtained by convolving the edge map generated from the image with the user defined vector field kernel. Mixed VFC is used to alleviate the leakage problem caused by choosing inappropriate parameters.

Dinesh et al [10] projected the important place of segmentation of images in extracting information for decision making. The study reviewed the research on various research methodologies applied for image segmentation and aims to provide a simple guide to the researcher for those carried out their research study in the image segmentation.

III. CONTOUR-BASED TARGET DETECTION MODEL

From the real-time video, a frame is captured based on the requirement. This image is decomposed into three stages as shown in figure 1. Initially the captured image is multiple segmented to extract the candidate regions. Then contour information is obtained using the shape descriptor. Finally, the contour information is compared with the target template to obtain the target.

Multiple segmentation is obtained by varying one parameter of the segmentation algorithm. K-means clustering is used to partition the image into multiple segments. K-means is faster than hierarchical clustering algorithms and produce tighter clusters than other clustering [14]. Then the segmented regions are mentioned using contour information. For this shape descriptor is used and is expected to be robust.

The shape descriptor has properties like translation, scaling, rotation, and slight shape variation [17]. The noise present in the segmented image is removed using median filter. The edges of the target images are obtained using canny edge detection method [14].

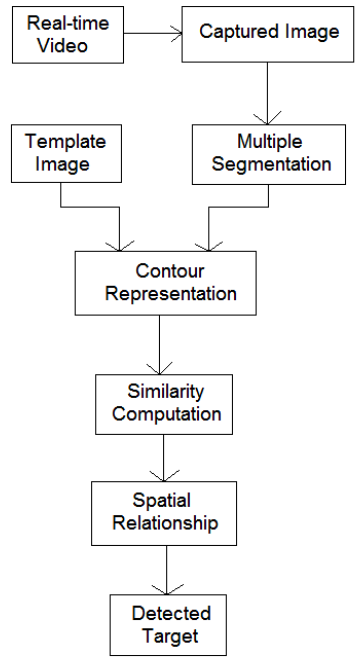

FIGURE 1 TARGET DETECTION PROCESS

After obtaining the contour information, the similarity segments are computed to get the target seed regions. The similarity of two points is resulted as the distance between their descriptors. The distance between two histograms is defined by,

$$Dist_{(p,q)} = X^{2}_{(hp,hq)} = - \qquad \underline{\qquad\qquad} \qquad (1)$$

where, K is the number of Shape Context (SC) bins, *hp(k)* and *hq(k)* are the normalized shape descriptors at points p and q respectively. The match cost matrix between two contours P and Q is defined by,

$$Dist(P,Q) = \begin{bmatrix} dist(p1,q1) & dist(p1,q2) & \cdots & dist(p1,qN_q) \\ dist(p2,q1) & dist(p2,q2) & \cdots & dist(p2,qN) \\ \vdots & & \vdots & \vdots \\ dist(pNp,q1) & dist(pNp,q2) & \ldots & dist(pNp,qNq) \end{bmatrix} \qquad (2)$$

Matching cost is used to calculate the similarity between segment P and template Q. After the segmentation the seed regions are identified using spatial relationships. This computes the indexes of eight neighbors of all the contour points and is evaluated using Euclidean distance. The target seed regions are identified by matching the regions with the reference model.

IV. RESULTS

Analysis of contour-based target detection approach has been carried on an Intel Core 2 Duo CPU system with 2.10 GHz on a 32-bit Windows 7 Ultimate Operating System using MATLAB. The image which is extracted from the real-time video is shown in figure 2.

FIGURE 2 FRAME CAPTURED FROM REAL-TIME VIDEO

The frame contains background information along with two targets. The two targets cannot be defined in a standard template as the objects are overlapping. The image is subjugated using multiple segmentation in order to detect the seed region. The output or multiple segmentation is shown in figure 3. When the image is segmented the information of target is distributed unequally and all the segmented images are compared with the overlapping information to identify the target object.

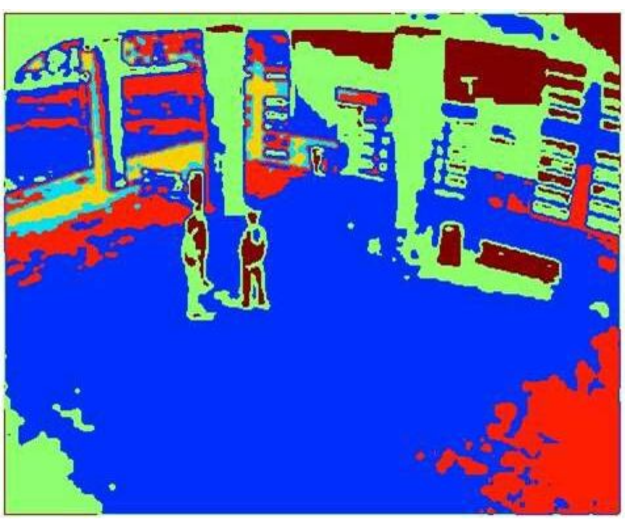

FIGURE 3 MULTIPLE SEGMENTED IMAGE

The segmented image is then compared with the template. The template is generated by performing similarity calculations from the segmented images. The template is matched with the image to get the target. Figure 4 shows the output obtained from after the template comparison. This output has lot of unwanted targets which are cleared using removal of shadowing.

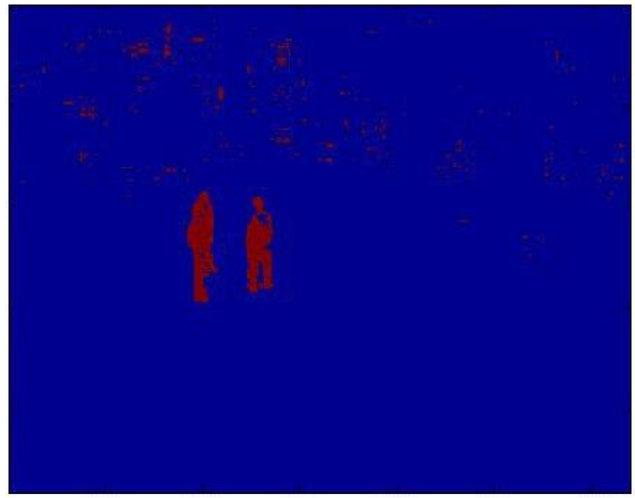

FIGURE 4 DETECTED TARGET FROM SEGMENTED IMAGE

The presence of shadows in the template might lead to improper target detection. The shadows are deleted from the template to get better target detection. Figure 5 shows the extracted target obtained after the similarity computations.

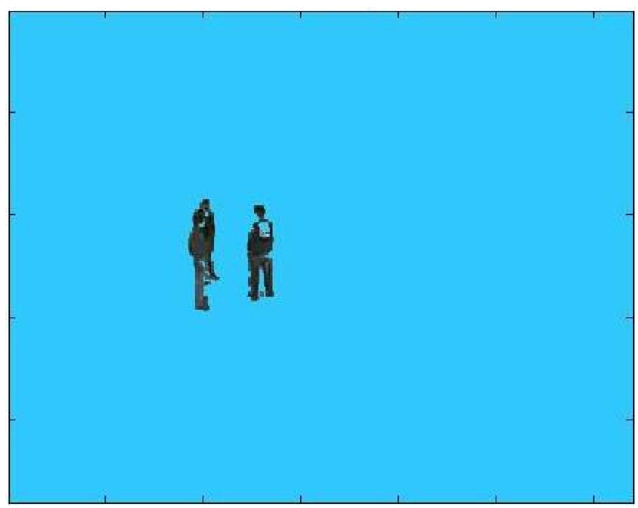

FIGURE 5 EXTRACTED TARGET

V. CONCLUSIONS

In this paper, contour-based target detection in real-time video is implemented using MATLAB. Multiple segmentation are used to detect the target regions and based on the contour similarities, the seed regions are identified. Spatial relationship is used to obtain the missing regions of the target. This model cannot be used with viewpoint changes, and can be concentrated as a future work with global and local shape features.

REFERENCES

[1] A. C. Berg, T. L. Berg, and J. Malik, "Shape Matching and Object Recognition using Low Distortion Correspondences", Proceedings of CVPR, Vol. 1, pp. 26-33, June 2003.

[2] Chein-I Chang, Hsuan Ren, and Shao-Shan Chiang, "Real-Time Processing Algorithms for Target Detection and Classification in Hyperspectral Imagery", IEEE Transactions on Geoscience and Remote Sensing, Vol. 39, No. 4, pp. 760-768, April 2001.

[3] Dimitris Manolakis, David Marden, and Gary A. Shaw, "Hyperspectral Image Processing for Automatic Target Detection Applications", Lincoln Laboratory Journal, Vol. 14, No. 1, pp. 79-116, 2003.

[4] Fergus R., P. Perona, and A. Zisserman, "Object Class Refognition by Unsupervised scale-invarient Learning", in proceedings with the CVPR, Vol. 2, pp. II-164-271, June 2003.

[5] Ferrari V., L. Fevier, F. Jurie, and C. Schmid, "Groups of Adjacent Contour Segments for Object Detection, "IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 30, No. 1, pp. 36-51, Jan 2008.

[6] Huabo Sun, Lei Yan, Peter Mooney, and Rui Liang, "A New Method for Moving Object Detection using Variable Resolution Bionic Component Eyes", International Journal of the Physical Sciences, Academic Journals, Vol. 6, No. 24, pp. 5618-5622, 16 October 2011, ISSN 1992-1950.

[7] Lei Yan, Pengqi Gao, Huabo Sun, and Hongying Zhao, "A New Method of High Temporal Resolution Remote Sensing Imaging: Moving Target Detection with Bionics Compound Eye", Aerospace Technologies Advancements, pp. 492, INTECH, January 2010, ISBN:978-953-7619-96-1.

[8] Opelt A., Pinz A., and A. Zisserman, "A Boundary Fragment Model for Object Detection", ECCV, 2006.

[9] Padmapriya K., and T. K. Bino, "Boundary Detection using Edge Following Algorithm and Enhancement of the Image", International Conference on Computing and Control Engineering (ICCCE 2012), 12-13 April 2012.

[10] Patil D, and Sonal G. Deore, "Medical Image Segmentation: A Review", International Journal of Computer Science and Mobile Computing", Vol. 2, Issue 1, pp. 22-27, 1st Jan. 2013.

[11] Patnaik L. M., and Rajan K., "Target Detection through Image Processing and Resilient Propagation Algorithms", Neurocomputing, Elsevier, Vol. 35, pp. 123-135, 2000.

[12] Santhosh Kumar A., and J. Seetaram, "Medical Images Boundary Detection using a New Novel Algorithm and Gradient Features", International Journal of Engineering Research and Technology (IJERT), Vol. 1, Issue 8, pp. 1-4, October 2012.

[13] Shotton J., A. Blake, and R. Cipolla, "Contour-Based Learning for Object Detection", Proceedings of International Conference on Computer Vision, 2005.

[14] Subash M., and S. R. Malathi, "Using Multiple Viewpoint Templates for Target Detection in High Resolution Images", International Journal of Engineering Research & Technology (IJERT), Vol. 2, Issue 6, pp. 704-708, June 2013, ISSN: 2278-0181.

[15] Ulisses Braga-Neto, Manish Choudhary, and John Goutsias, "Automatic Target Detection and Tracking in Forward-Looking Infrared Image Sequences Using Morphological Connected Operators", Journal of Electronic Imaging, 3 June 2003.

[16] Veeralakshmi S., S. Vanitha Sivagami, V. Vimala Devi, and R. Udhaya, "Boundary Exposure using Intensity and Texture Gradient Features", IOSR Journal of Computer Engineering (IOSRJCE), Vol. 8, Issue 1, pp. 28-33, Nov.-Dec. 2012.

[17] Yang M., K. Kpalma, and J. Ronsin, "A Survey of Shape Feature Extraction Techniques", Pattern Recognition, pp. 43-90, Nov 2008.

[18] Yu Li, Xian Sun, Hongqi Wang, Hao Sun, and XiangjuanLi, "Automatic Target Detection in High-Resolution Remote Sensing Images using a Contour-Based Spatial Model", IEEE Geoscience Remote Sensing, Vol. 9, No. 5, pp. 886-890, Sep 2012.