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TRACKING AND CLASSIFICATION OF UNUSUAL BEHAVIOUR IN PUBLIC AREAS

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Abstract- **A behaviour recognition approach that depends on object tracking has been introduced and extensively investigated. Automated online and offline videos as input for object tracking has increased its attraction due to the part it plays for detection of unusual behaviour. But object tracking in online videos is costly due to the set of hardware that has been used to detect unusual behaviour as soon as possible. The proposed is designed to find unusual behaviour in offline videos by obtaining 3D object level information to track person and luggage in that raw video. Here training sets are used to make the detection more accurate. First, blob matching technique is used for object and inter object motion feature. Second, people who involve in security violation are detected. Examples are abandoned and stolen objects, fighting, fainting, and loitering are tracked and detected.**

Key words **- blob to object matching, behaviour recognition, occlusion, HOG, SIFT, background subtraction**

I . INTRODUCTION

Video surveillance camera helps security guards and police to notify unusual activity taking place in a particular area. Presence of video surveillance camera and display monitor alone is more labour intensive in case of finding each and every unusual activity takes place in an area[1][2]. Online or offline video analysis is made to find the occurrence of unusual activity in easier way and less time. But during analysis false detection also takes place due to lightening effect [3], low resolution camera and collusion. In video analysis two challengeable factors involves i.e. firstly, object should be found i.e. people and luggage and next event must be found [4].

In the project, preprocessing is done by means of Gaussian model that extracts the foreground without false detection. The background subtraction is done in order to reduce the false detection. Animate and inanimate objects in the scene are found out as a result. But single blob may have multiple objects occluded in it. Blob to object matching is done to overcome false detection due to occlusion. Unusual behavior such as fighting, fainting, meeting and loitering should be found out. Gabor and hog is used to analyze in 3D manner. Support vector machine for Gabor and HOG is used to classify the object in what activity it actually belongs. According to satisfaction of features condition satisfaction the behaviour is classified.

Behaviour recognition [15] [16] has numerous categories, such as crowd behaviour that analyze the characteristics of the crowd, gymnastics that find the [7] characteristics of which category the gymnastics [6] Belongs which has planned and sequential activity [9] [10]. The project is to find and classify unusual behaviour occurs in public areas such as loitering [11], fighting [14] [15], fainting, abandoned object [12] [13] [16] [17] and meeting. So the object should be identified, tracked and then it should be classified in what activity it involves. Grammar based detection such as hidden morkov model [7] [19] in the case of behaviour detection is highly sequential and cannot be employed for fighting which is more difficult. CASE and CASE ^{E} [18] in learning approach deal using agent, predicate, and location and object [20]. The project use Gabor in 3D, support vector machine and feature calculation finds in what unusual activity takes place in particular area.

II.METHODOLOGY

A.PREPROCESSING:

Gaussian Mixture Model (GMM) that represents its color distribution. The ellipse represents the spatial extend of an object that is located at the region, has an orientation h with respect to a local 2D image coordinate frame, and the lengths of its major and minor axes are a and b, respectively. Given a set of image points comprising the image of an object, the parameters can be computed from the covariance matrix of the locations of pixels. We define the spatial distance of an image point from ellipse e. Intuitively, the ellipse is transformed to a circle of radius equal to one and the same affine transformation is applied to the coordinates of the point p.

$$LoG(x,y) = -\frac{1}{\pi\sigma^4}\left[1 - \frac{x^2+y^2}{2\sigma^2}\right]e^{-\frac{x^2+y^2}{2\sigma^2}} \quad (1)$$

B. BACKGROUND SUBTRACTION:

Background subtraction [16] [17] is a technique in image processing and computer vision where an image's foreground is extracted for object recognition. Generally an image's regions of interest i.e. object such as humans, cars, text etc. in its foreground. After the process of image preprocessing object localization is required this may make use of this technique. Background subtraction is an approach for detecting moving objects in videos from static cameras.

Frame difference (absolute) at time t + 1 is

$$D(t+1) = |V(x,y,t+1) - V(x,y,t)| \quad (2)$$

Where t is time. Background subtraction is mostly done if the image in question is a part of a video stream. The accuracy of this approach is dependent on speed of movement in the scene. Then threshold may vary according to threshold variation such as vigorous movements may require higher thresholds.

C.OBJECT MODELING AND STAGED MATCHING:

In the project, at each frame, a list of objects is updated by matching blobs in the current frame with objects from the previous one. The matching process is not necessarily one to-one. The objects have splits, merges, one-to-one matches, creation, and deletion.

To match blobs and objects in two consecutive frames, color histograms and Gabor information are used. Three dimensional Gabor is seen in eight different angles to find out the correct object.

D. OCCLUSION HANDLING:

Occlusion handling is difficult because it bears on the robustness of object tracking and coherence. In the project, the objects that are occluded is completely ignored, a start to adopt the position that all merged objects form a pool (the blob) with no particular occluding/occluded relationships being noted. Dummy object is created for the pool that exhibits the adaptive appearance model necessary for blob matching. Merge and split is performed to find the correct object. Merges and splits of blobs are checked before any one-to-one associations are made.

I. Object Tracking-In this module we separate the foreground and background from the frames. A common assumption for background subtraction is that certain attributes of the objects of interest change more rapidly than the background scene. The simplest methods of background subtraction keep a running mean or median of previous frames as a model for the background. This is efficient and simple to implement. We convert the frames as a binary image. It contains only a 0s and 1s value. We want to assign each pixel to be either foreground or background, in order to maximize the combined compression of mask, foreground and background. Assuming the original bitmap has *N* pixels, there are 2*N* possible masks, and of course we cannot search all possible ones. We also assume that the foreground and the background are constant over small regions, and thus we look for a mask that minimizes the variance within those regions. Our approach is to divide and conquer. Let us partition the image further into 2×2 pixel sub-images.

ii. Tracking process-Video tracking is a is the process of locating a moving object over time using a video. Here we find the pixel variation between the two frames and we draw the blob to the corresponding pixels. Finally we track the person from the video. The objective of video tracking is to associate target objects in consecutive video frames. The association might be difficult when the objects are moving fast or vigorous relative to the frame rate. Another situation which increases the complexity of problem is when the tracked object changes orientation time to time.

For such type of situation video tracking systems employ a motion model which describes how the image of the target might change for different possible motions of the object.

E.OBJECT CREATION AND REMOVAL:

After blob-to-object matching, some of the remaining blobs and objects may remain unmatched. An unmatched blob is ideally a new object that has just appeared in the scene. So, a new object is created for each unmatched blob. In case an unmatched object may also be either an object that has just left the scene or one whose blob has been falsely undetected due to some failure in background subtraction. Therefore, it needs a grace period of a few seconds to allow for the object's recovery.

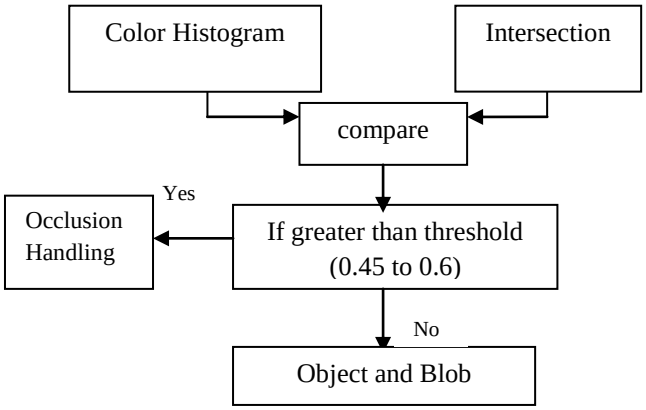

Fig. 1 Flow of Occlusion Handling

F. SPACIAL SPECTRO ALGORITHM

Support vector machine for Gabor is used to obtain training sets and use that training sets to match with frames of video to find object and its behaviour. The calculation is made using the centroid and orientation in eight different patterns to match them and find what activity the object actually belongs too.

Given training data $\mathcal{D}$ and a set of *n* points of the form

$$\mathcal{D} = \{(\mathbf{x}_i, y_i) \mid \mathbf{x}_i \in \mathbb{R}^p,\ y_i \in \{-1, 1\}\}_{i=1}^{n} \quad (3)$$

Where y_i = 1 or −1, indicates that it belongs to the class of point $\mathbf{x}_i$ and each $\mathbf{x}_i$ is a *p*-dimensional real vector. Next have to find out the maximum-margin hyperplane that divides the points have $y_i = 1$ from those having $y_i = -1$. The object recognition using Histogram of Oriented Gradient descriptors is to feed the descriptors into some recognition system such as Support Vector Machine classifier. Support Vector Machine classifier is a binary classifier that looks for an optimal hyperplane as a decision function. Once it has been trained on images containing some object of particular type, the SVM classifier is suitable to take decisions regarding the presence of an object, such as a luggage or human being, in additional test images. In the Dalal and Triggs human recognition tests, they used the available SVM Light software package in

conjunction with their HOG descriptors to find human figures in test images.

III.FEATURE CALCULATION

Histogram of oriented gradient is used in image processing for the purpose of object detection with a set of Gabor filters with eight different frequencies and orientations may be helpful for extracting useful features from an image.

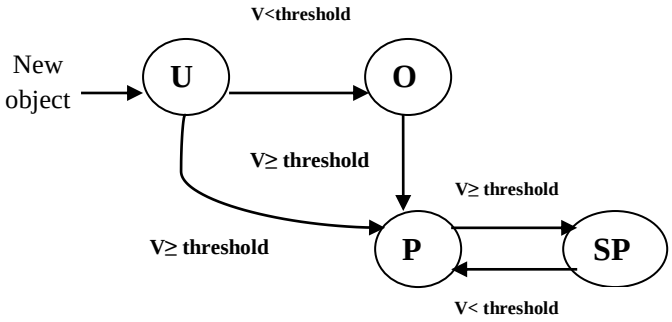

Fig. 2 Object Handling

U-UNKNOWN, O-INANIMATEOBJECT, P-PERSON, SP-STILL PERSON, V-VELOCITY

In addition scale invariant feature transformation is used to detect and describe local feature in image.

DoG image $D(x, y, \sigma)$ is given by

$$D(x, y, \sigma) = L(x, y, k_i\sigma) - L(x, y, k_j\sigma) \quad (4)$$

Where $L(x, y, k\sigma)$ is convolution of the original image $I(x, y)$. The object which was involved in particular activity which is unusual is found out. The detection can also be performed for the particular frames in the video to reduce wastage of time spent to check the full video.

IV.PERFORMANCE EVALUATION

TABLE I
EXPERIMENTAL RESULTS FOR UNUSUAL BEHAVIOUR RECOGNITION FOR DIFFERENT PUBLIC DATASETS
M-MEETING, W-WALKING, FI-FIGHTING, FAI-FAINTING

DATASET	UNUSUAL BEHAVIOUR	EVALUATION	
		QUANTITATIVE (PRECITION/ RECALL)	QUALITATIVE
CAVIAR (Meet-walk-split)	M	100%0%	SUCCESSFUL DETECTION
	W	95%82%	
CAVIAR (Meet-walk-together)	M	35%40%	SUCCESSFUL DETECTION
	W	100%70%	
CAVIAR (fight-one-man-down)	FI	70%35%	SUCCESSFUL DETECTION
	FAI	100%72%	
BAHAVE / Frames 67210-76800	M	100%90%	SUCCESSFUL DETECTION
	FI	65%60%	
BAHAVE / Frames 50315-50932	M	75%50%	SUCCESSFUL DETECTION
	FI	70%50%	
PETS 2006/ S2C3	M	100%92%	SUCCESSFUL DETECTION
PETS 2006/ S4C3	M	100%95%	SUCCESSFUL DETECTION

The experimental result shows that proposed system is more accurate than the existing system.

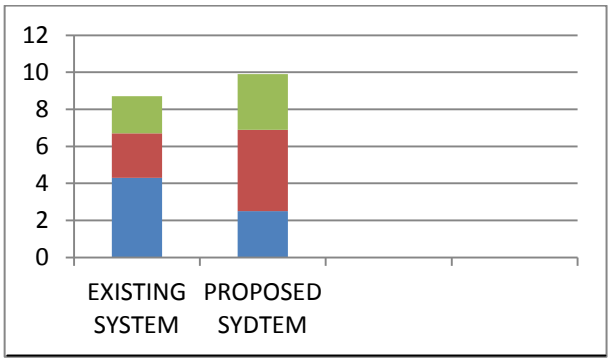

Fig. 3 Accuracy range variation between existing and proposed method.

V.CONCLUSION

Video is cutted into frames then preprocessing and background subtraction is performed to get animate and inanimate object without any false detection of object. Staged matching is performed to overcome occlusion and new blob is created for the object which is newly occurred only if it satisfies the grace period. Gabor and HOG is used

to detect the object and event it involves with the help of support vector classifier. SIFT is used to handle local objects. The offline analysis is used and has the facility of getting the result of particular frames where we want to really check the objects.

REFERENCE

[1] H. Weiming, T. Tieniu, W. Liang, and S. Maybank, "A survey on visual surveillance of object motion and behaviours," *IEEE Trans. Syst., Man, Cybern. C, Appl. Rev.*, vol. 34, no. 3, pp. 334–352, Aug. 2004.

[2] G. L. Foresti, C. Micheloni, L. Snidaro, P. Remagnino, and T. Ellis, "Active video-based surveillance system: The low-level image and video processing techniques needed for implementation," *IEEE Signal Process.Mag.*, vol. 22, no. 2, pp. 25–37, Mar. 2005.

[3] N. Firth, Face recognition technology fails to find U.K. rioters, New-Scientist, London, U.K. [Online]. Available:http://www.newscientist.com/article/mg21128266.000-face-recognition-technology-fails-to-finduk-rioters.html

[4] L. M. Fuentes and S. A. Velastin, "Tracking-based event detection for CCTV systems," *Pattern Anal. Appl.*, vol. 7, no. 4, pp. 356–364, Dec. 2004.

[5] M. Elhamod and M. D. Levine, "A real time semantics-based detection of suspicious activities in public scenes," in *Proc. 9th Conf. CRV*, Toronto, ON, Canada, 2012, pp. 268–275.

[6] N. T. Siebel and S. J. Maybank, "The ADVISOR visual surveillance system," in *Proc. ECCV Workshop ACV*, 2004, pp. 103–111.

[7] Z. Zhang, T. Tieniu, and H. Kaiqi, "An extended grammar system for learning and recognizing complex visual events," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 33, no. 2, pp. 240–255, Feb. 2011.

[8] D. Demirdjian and C. Varri, "Recognizing events with temporal random forests," in *Proc. Int. Conf.Multimodal Interfaces*, Cambridge,MA, 2009, pp. 293–296.

[9] D. Weinland, R. Ronfard, and E. Boyer, "A survey of vision-based methods for action representation, segmentation and recognition," *Comput. Vis. Image Underst.*, vol. 115, no. 2, pp. 224–241, Feb. 2011.

[10] M. Blank, L. Gorelick, E. Shechtman, M. Irani, and R. Basri, "Actions as space–time shapes," in *Proc. 10th IEEE ICCV*, 2005, vol. 2,pp. 1395–1402.

[11] N. D. Bird, O.Masoud, N. P. Papanikolopoulos, and A. Isaacs, "Detection of loitering individuals in public transportation areas," *IEEE Trans. Intell. Transp. Syst.*, vol. 6, no. 2, pp. 167–177, Jun. 2005.

[12] N. Bird, S. Atev, N. Caramelli, R. Martin, O. Masoud, and N. Papanikolopoulos, "Real time, online detection of abandoned objects in public areas," in *Proc. IEEE ICRA*, 2006, pp. 3775–3780.

[13] L. Sijun, Z. Jian, and D. Feng, "A knowledge-based approach for detecting unattended packages in surveillance video," in *Proc. IEEE AVSS*, 2006, p. 110.

[14] S. Blunsden and R. B. Fisher, "The BEHAVE video dataset: Ground truthed video for multi-person behaviour classification," *Annu. BMVA*, vol. 2010, no. 4, pp. 1–11, 2010.

[15] S. Blunsden, E. Andrade, and R. Fisher, "Non parametric classification of human interaction," in *Proc. 3rd Iberian Conf. Pattern Recog. Image Anal., Part II*, Girona, Spain, 2007, pp. 347–354.

[16] P. Fatih, "Detection of temporarily static regions by processing video at different frame rates," in *Proc. IEEE Conf. AVSS*, 2007, pp. 236–241.

[17] A. Singh, S. Sawan, M. Hanmandlu, V. K. Madasu, and B. C. Lovell, "An abandoned object detection system based on dual background segmentation," in *Proc. 6th IEEE Int. Conf. AVSS*, 2009, pp. 352–357.

[18] A. Hakeem, Y. Sheikh, and M. Shah, " CASEE: A hierarchical event representation for the analysis of videos," in *Proc. 19th Nat. Conf. Artif. Intell.*, San Jose, CA, 2004, pp. 263–268.

[19] A. Kojima, T. Tamura, and K. Fukunaga, "Natural language description of human activities from video images based on concept hierarchy of actions," *Int. J. Comput. Vis.*, vol. 50, no. 2, pp. 171–184, Nov. 2002.

[20] A. Hakeem and M. Shah, "Learning, detection and representation of multi-agent events in videos," *Artif. Intell.*, vol. 171, no. 8/9, pp. 586–605, Jun. 2007

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