



# Improved Accuracy of Suspicious Activity Detection in Surveillance Video

S. S. Gurav, B. B. Godbole, M. S. Sonale

**Abstract:** Suspicious activity detection from surveillance video is the main objective of the work presented in this paper. The method developed consist of various stages of suspicious frame detection, and verifying the frame for suspicious activity related analysis of human movements within obtained set of suspicious frames. The method consist of GLCM feature extraction which constitutes the features such as energy, prominence, contrast, entropy, homogeneity type of features and matching using Euclidian distance along with descriptor features obtained by using Harris corner features and cosine similarity index estimation. The successful suspicious activity detection rate is analyzed which shows better performance and time saving method while analyzing large surveillance video dataset.

**Keywords:** Surveillance video, GLCM, Cosine similarity, descriptors, Harris corner, Euclidian distance.

## I. INTRODUCTION

Human conduct observing in observation video is pressing need of an opportunity to control the wrongdoing and guarantee the wellbeing for the general public. The persistent manual observing in plain view screen is inclined to human mistakes and missing of significant exercises when wrongdoing occasion happen. The checking is required to be helped with computerized work which can give unwavering quality while guaranteeing the wellbeing needs. The vigorous and dependable working calculations are basic objective that must be engaged while building up the action checking calculations. The usage practicality and multifaceted nature of calculations are two principles entomb subordinate angles as video information dealing with requires enormous extra rooms. The execution time versus wrongdoing happening time ought to likewise be ideal to such an extent that inside time investigation will be with security individual for further exercises to be completed. The calculations for human checking alongside action observing are perplexing so far made accessible by the scientists. This paper centers around

straightforward yet powerful suspicious action checking strategy valuable for observation video frameworks.

## II. LITERATURE SURVEY

Xiaojing Chen, Le An, and Bir Bhanu, [1], have given a technique for following different items in multi camera situation. The shading histogram, related brilliance works are the strategies utilized for following the object of intrigue. The exhibition of the framework debases as for number of articles to be followed. Rohit Agarwal et al [2] have given a strategy for swarm thickness estimation utilizing three modalities, viz., carbon dioxide level, sound power level, and got signal quality. The grouping calculations for the element types, for example, transient, spatial, and spatio-fleeting are utilized. The combination of data with setting is utilized for proficient group observing. The acoustic impacts are considered while sending the sound catching sensors and separate pre-handling capacities are utilized to stifle the commotions and resonation impacts.

Md. Shakowat Zaman Sarker et al [3], have division strategy for foreground and foundation estimation material for object following. The incorporation of watershed for multi object division and foreground distinguishing proof is finished. The district contiguousness list (RAL) is worked for the area blending process. The consolidating impacts are seen with various test inputs. Seema Kamath [4], have given camera adjustment strategy. The state updates and estimation varieties are rectified utilizing probabilistic blunder redressing strategy. After adjustment, LBP based item following is utilized. Loris Bazzani [5], have given a strategy for explicit individuals ID from a gathering of individuals. The up-and-comer coordinating technique is utilized for object following in single and non-covering multi camera recordings. The competitor coordinating is finished utilizing descriptors based highlights coordinating.

Atif ILYAS [6], given article re distinguishing proof in multi camera recordings. A codebook based closer view and foundation division technique is utilized. The descriptor based item includes coordinating technique is utilized for object distinguishing proof. The smallness and power are principle focal points of the calculation. Branko Markoski, ai [7], have given technique for ball player distinguishing proof. The head leg arms of the individual are divided and LBP, HOG highlights are extricated. The highlights are supported utilizing adaboost technique. The SVM based coordinating shows great outcomes for player recognizable proof.

The observation network knows about the developing demand for HR to translate information, for example, live video streams [8].

Revised Manuscript Received on February 18, 2020.

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The universal organization of arranged static and versatile cameras makes a tremendous measure of video data that is being transmitted to server farms for investigation [9] and to atomize the procedure [10]. Many robotized object detection algorithms have been examined utilizing ML [11] and statistical analysis [12] approaches that are actualized at the server side of the observation system.

Sachin Gurav et al [13] have given a method of suspicious activity detection using SURF based descriptor matching process. The performance shows significant improvement in tracking. The accuracy of detection is also better.

### III. PROPOSED WORK

The first step in proposed work consists of suspicious activity dataset generation. The dataset consists of various suspicious positions of human beings such as seating, bending, irregular hand extending, leg extending. The cropping based human object frames are generated using set of images clicked using mobile camera. This set is further used during matching process in descriptor based matching stage for correct suspicious activity detection.

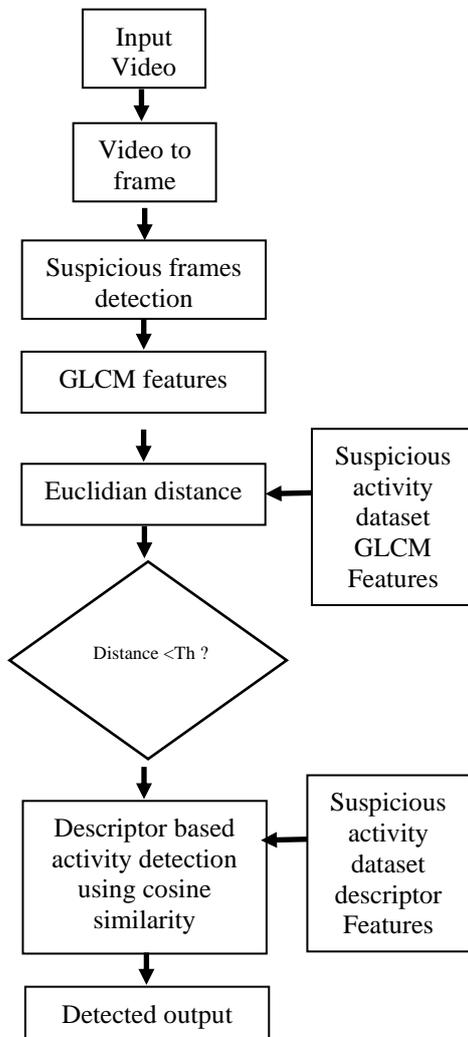


Figure 1: System flow of proposed work

The proposed work also consists of suspicious frame detection and processing for suspicious activity detection. Figure 1 shows the flow diagram of suspicious activity detection using different processing stages. Firstly input

video is converted into frames and suspicious frame detection method mentioned in [13] is used. Also, the Haar cascade method is used to find the window around the human object in the frame. The frames with no human can be separated using such method as mentioned in [13]. In [13], the suspicious activity is detected by using SURF feature extraction method. In the work presented here, different types of features are extracted to detect the suspicious activity. The detected suspicious frames are then processed for feature extraction. Grey level co-occurrence matrix GLCM feature are extracted. The features from GLCM consist of following different types. Energy features are extracted using the summation method given as,

$$E = \sum_{i,j=1}^N P_{ij} \quad \dots(1)$$

Prominence features are extracted using the formula given as,

$$P = \text{sgn}(B)|B|^{1/4} \quad \dots(2)$$

Contrast features, which are actual information content, are extracted using the formula,

$$C = \sum_{i,j=1}^N P_{ij}(i-j)^2 \quad \dots(3)$$

Entropy of the ROI is estimated as,

$$En = \sum_{i,j=1}^N -\ln(P_{ij})P_{ij} \quad \dots(4)$$

Homogeneity of the ROI is estimated as,

$$Hm = \sum_{i,j=1}^N \frac{P_{ij}}{1+(i-j)^2} \quad \dots(5)$$

Where,

$P_{ij}$  is pixel in the image ROI.

$N$  is the count of grey levels

And  $i, j$  are locations of pixels.

The obtained feature vectors consist of five different characteristic features. The features from set of suspicious frames are compared with each other. The matching scenario indicates the normal size and propagation of human object from different frames. The variation based analysis in the feature values is used to decide the presence and absence of suspicious activity. The variation is observed using Euclidian distance estimation by considering predefined set of GLCM features for suspicious activity dataset and current frame ROI GLCM features. Less distant frames which are more probable for suspicious activity presence are then processed using descriptor based suspicious activity detection.

The second phase of suspicious activity is consist of Harris corner based descriptor features extraction. These are specific feature sets that qualify under correct feature consideration due to bending and seating positions of the body. Hence selecting Harris corner features over SURF features shows better accuracy in classifying activity under suspicious or normal category.

The processing using Harris corner based descriptor features consist of following steps,

1. Extract Harris corners from ROI window.
2. Convert Harris corner features into descriptors.
3. Perform matching using cosine similarity with predefined suspicious activity dataset.
4. If cosine similarity > Threshold  
Show detected suspicious  
Else  
No suspicious

The cosine similarity is estimated using following formula,  
 $Similarity = \cos(\text{dot product of } (des1, des2))$

... (6)

Where, des1 and des2 are the descriptor feature vectors of test ROI and image from activity dataset respectively.

#### IV. RESULTS AND ANALYSIS

The results of proposed method are analyzed using implementation in MATLAB. The video input is used to convert into frames for further processing. The figure 2 and 3 show normal and suspicious activity frames respectively as a sample from activity dataset developed in this work.



Figure 2: Normal activity of human



Figure 3: Suspicious activity of human

The performance evaluation of proposed method is done using,

Accuracy= (Total number of detected frames for suspicious activity) / (Total number of actual frames of suspicious activity)

The table 1 shows the result obtained along with comparative study with histogram based tracking method and method mentioned in [13].

Table I: comparative study of precision vs location error

Video	Histogram tracker method	Method in [13]	Proposed method
Video 1	0.13	0.03	0.026

Video 2	0.14	0.04	0.033
Video 3	0.112	0.024	0.014
Video 4	0.16	0.04	0.03
Video 5	0.18	0.07	0.052
Video 6	0.146	0.053	0.036
Video 7	0.11	0.03	0.014

The proposed method outperforms in terms of location versus precision error over histogram based tracker and method in [13].

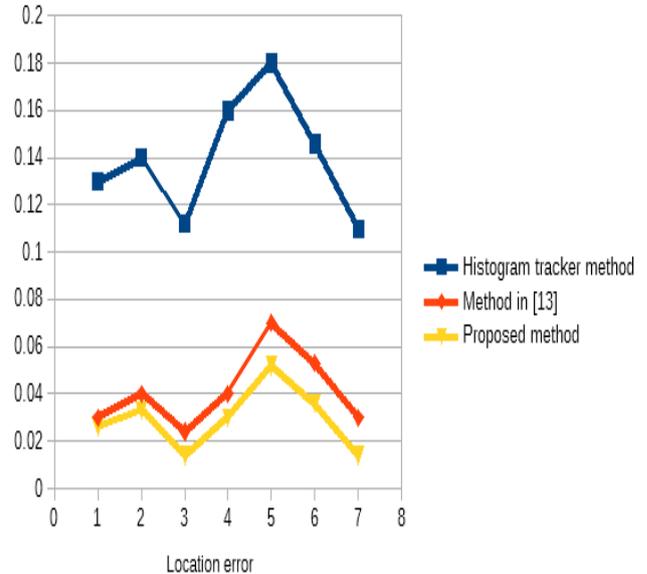


Figure 4: Precision versus location error comparative analysis

Table II: Accuracy analysis

Video	Actual Suspicious Frames	Detected Suspicious Frames	Accuracy
Video 1	32	31	0.96875
Video 2	28	26	0.9285714
Video 3	41	40	0.9756098
Video 4	34	33	0.9705882
Video 5	36	35	0.9722222
Video 6	29	28	0.9655172
Video 7	30	29	0.9666667

Table III: Comparative study of accuracy

Video	Method in [13]	Proposed method
Video 1	0.935	0.96875
Video 2	0.95	0.9285714
Video 3	0.965	0.9756098
Video 4	0.942	0.9705882
Video 5	0.955	0.9722222
Video 6	0.96	0.9655172
Video 7	0.94	0.9666667

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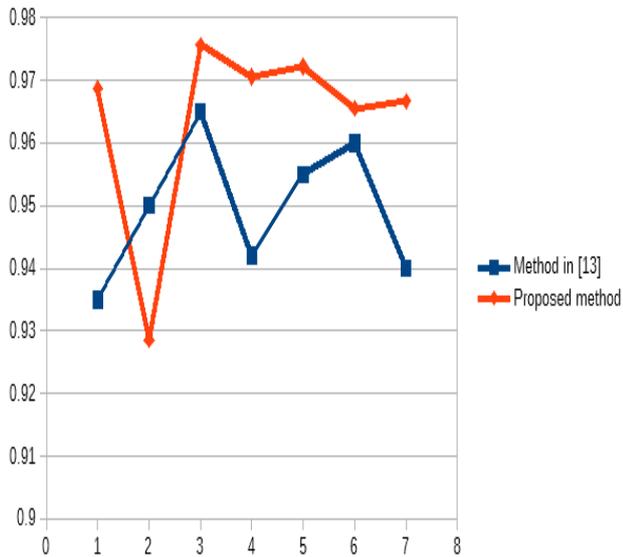


Figure 7: Accuracy of detection analysis

### V. CONCLUSION

The proposed method in this paper shows outstanding performance and robustness in suspicious activity detection. The double stage detection improves the reliability and performance of the system along with Harris corner based more informative descriptor features. The predefined dataset eliminates the consideration of scale change and rotation variations in the object considered under monitoring. The resulting accuracy obtained is considerable and robust enough for practical applications.

### REFERENCES

1. Xiaojing Chen, Zen Qin, Le An, BirBhanu "An Online learned Elementary Grouping model for multi-target tracking", University of California, Riverside, In CVPR 2014.
2. Rohit Agarwal, Sudhir Kumar, Rajesh M. Hegde "Algorithms for Crowd Surveillance Using Passive Acoustic Sensors Over a Multimodal Sensor Network", IEEE Sensors Journal, Vol. 15, No. 3 March 2015.
3. Md. Shakawat Zaman Sarker, Tan Wooi Haw and Rajasvaran Logeswaran "Morphological based technique for image segmentation" International Journal of Information Technology, Vol. 14 No. 1.
4. Seema Kamath "Distributed algorithms for camera network localization and multiple targets tracking using mobile robots" Master of Science Thesis, RPI Troy, New York, Nov 2007.
5. Loris Bazzani "Beyond Multi-target Tracking Statistical Pattern Analysis of People and Groups", University degli Studi di Verona Department of Informatics." May 3, 2012.
6. Numerod'ordre, Annee "Object Tracking and Re-identification in Multi-Camera Environments", Thesis University Lumiere Lyon, 17 June 2011.
7. Branko Markoski, Zdravko Ivankovic, Ladislav Ratgeber, Predrag Pecev, Dragana Glusac "Application of AdaBoost Algorithm in Basketball Player Detection" University of Novi Sad, Acta Polytechnica Hungarica Vol. 12, No. 1, 2015.
8. E. Blasch, E. Boss e, and D. A. Lambert, High-level information fusion management and systems design. Artech House, 2012.
9. E. P. Blasch, K. Liu, B. Liu, D. Shen, and G. Chen, "Cloud based videodetection and tracking system," 06 2016, uS Patent 9,373,174.
10. J. Ma, Y. Dai, and K. Hirota, "A survey of video-based crowd anomaly detection in dense scenes," Journal of Advanced Computational Intelligence and Intelligent Informatics, vol. 21, no. 2, pp. 235-246, 2017.
11. J. Ma, Y. Dai, and K. Hirota, "A survey of video-based crowd anomaly detection in dense scenes," Journal of Advanced Computational Intelligence and Intelligent Informatics, vol. 21, no. 2, pp. 235-246, 2017.

12. T. Fuse and K. Kamiya, "Statistical anomaly detection in human dynamics monitoring using a hierarchical dirichlet process hidden markov model," IEEE Transactions on Intelligent Transportation Systems, 2017.
13. Mr. Sachin Gurav, Dr. B. B. Godbole. "An Efficient Method for Suspicious Activity Detection" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-11, September 2019

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