



UGC MAJOR RESEARCH PROJECT

(2012 - 2015)

FINAL REPORT

Intelligent Suspicious Activity Detection in Real-Time Video for Surveillance Applications



Principal Investigator:

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Department of Computer Science and Engineering,
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Tamil Nadu - 608002.

Co- Investigator:

Dr. T. S. Subashini

Associate Professor

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
FACULTY OF ENGINEERING AND TECHNOLOGY**





**UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110 002**

PROFORMA FOR FINAL REPORT OF THE WORK DONE ON THE PROJECT

1. NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR:

Dr. M. Kalaiselvi Geetha
Associate Professor
Department of Computer Science & Engineering
Faculty of Engineering & Technology
Annamalai University

2. NAME AND ADDRESS OF THE INSTITUTION:

Department of Computer Science & Engineering
Faculty of Engineering & Technology
Annamalai University

3. UGC APPROVAL LETTER NO. AND DATE:

F.No.41-636/2012 (SR), Dated 16th July 2012

4. DATE OF IMPLEMENTATION : 1.7.2012
5. TENURE OF THE PROJECT : From 1.7.2012 to 30.06.2015
6. TOTAL GRANT ALLOCATED : Rs. 13, 08,164/-
- TOTAL GRANT REALLOCATED : **Rs. 12, 78,744/-**
7. TOTAL GRANT RECEIVED : Rs.12, 01,386/-
8. FINAL EXPENDITURE : Rs. 10, 04,406 + 49,858 = **Rs. 10, 54, 264/-**

Rs. 10, 04, 406/- : Expenditure from the Grant released.

Rs. 49, 858/- : Expenditure incurred against the third installment amount, to be released by UGC.

9. TITLE OF THE PROJECT: **Intelligent Suspicious Activity Detection in Real-Time Video for Surveillance Applications**

10. OBJECTIVES OF THE PROJECT

- a) To design an intelligent algorithm for automatic classification of videos of single person to multi people and hence detect strange and suspicious activities.
- b) To extend the approach by developing algorithms for detecting real-time changes in the scene and to trigger an alarm in real time, if the identified activity is suspicious.

11. WHETHER OBJECTIVES WERE ACHIEVED

YES

12. ACHIEVEMENTS FROM THE PROJECT

Year	Proposed Work Plan and Targets	Status
1	Acquiring the video. Designing a system that analyses and segments the objects. Training the system to monitor the moving objects.	Achieved
2	Design a system for classifying the objects and training the system to identify and classify their behaviors.	Achieved
3	Designing self adapting and self calibrating algorithms that identifies the unusual behavior based on changes in the scene in real time so that it activates the alarm in the suspected place for further verification.	Achieved

13. SUMMARY OF THE FINDINGS

Investigation of the project was done based on the following subthemes:

- a) Single Person Action Recognition
 - i) Single View
 - ii) Multi View
- b) Multiple Person Action Recognition
- c) Action Prediction for critical condition evasion.

An analysis of the project revealed the following empirical findings:

- a) Single person action recognition

In KTH dataset, jogging and running actions were misinterpreted. Similarly waving and boxing actions were misconstrued. Consequently, in Weizmann dataset, run and walk were misread and skip and jump actions were misinterpreted. Under multiview scenario, WVU multi-view activity dataset is utilized for experimental purpose. The actions jumping and jogging were misinterpreted and kicking was misinterpreted as either jogging or jumping. Therefore, the approach analysed and found that, an activity is performed by various

individuals in a different manner. Hence it is concluded that the performance of the action recognition system heavily depend on the means of action performed.

b) Multiple Person Action Recognition

For better understanding of the underlying study of this work, a real life scenario for human action recognition is experimented. The actions such as handshake, hug, kick, point, punch, push etc., between two persons meeting each other are to be recognized. In such a scenario, it is found that occlusion is a challenging issue. It is always complicated to handle this problem when the object is occluded by another entity with similar shape and motion. The work employed Segmentation based Fractal Texture Analysis (SFTA) algorithm to handle this issue. The experimental results revealed that the punch - handshake and push – hug actions are difficult to be distinguished.

c) Action Prediction for critical condition evasion.

Predicting the future activity is defined as: '*inference of the ongoing activity given temporally incomplete observations*'. In general, activity recognition considers the complete video observation sequences, whereas, activity prediction predicts the ongoing activity, given an incomplete video observation sequence. It is observed that the proposed system is able to predict the action even with an observation ratio of 0.2 of the test video and the prediction accuracy is improved by increasing the observed samples. Provided the suitable features to the system in real-time, the approach is able to predict the ongoing activities in real-time. It is fascinating to notice that the proposed approach is able to predict the ongoing activity at an early stage (approximately 0.15 seconds). The fine-grained semantics of an activity is likely to appear around 5 to 7 frames before the actual intended action is initiated.

14. CONTRIBUTION TO THE SOCIETY

1. Technical interest in video surveillance has moved to complex scene analysis to detect human and other object behaviors for analyzing patterns of activities or events, for standoff threat detection and prevention that results in recognition of the criminal and preventing suspicious activities.
2. The activity analysis research forms the basis for healthcare monitoring application. There have been significant contributions in the area of vital sign monitoring in hospitals by providing assistance to patients, at-home assistance for elderly people and child monitoring.
3. Multiple people interaction and crowd behavior that includes people counting, people tracking and crowd behavior understanding have drawn societal impact of the research.
4. Human tracking results are further exploited to detect suspicious behaviors such as entering a secured place, running or moving around capriciously, loitering against traffic, dropping any suspicious things in public places.

5. Other suspicious actions due to loitering such as drug-dealing, bank robbery, theft and pickpocketing can be prevented by activity recognition and prediction approaches.
6. Further, vision-based surveillance systems are more attractive and authenticative since it can be performed at a distance and secretly, whereas other biometric methods would require physical touch or close distance recognition.
7. In entertainment environment, various events can be recognized. Safety can be assured in swimming pools.
8. In addition, video based activity recognition systems can be applied in marketing analysis such as detecting customers' interest about the products while shopping.

15. WHETHER ANY Ph.D. ENROLLED/PRODUCED OUT OF THE PROJECT

Ph.D Enrolled : YES
 Candidate Name : **J. ARUNNEHRU**
 Enrolled on : November 2012
 Status : Pursuing

16. NO. OF PUBLICATIONS OUT OF THE PROJECT

JOURNALS

S. No.	Paper Title	Name of the Journal	Month/Year
1	A Quantitative Real-Time Analysis Of Object Tracking Algorithm For Surveillance Applications	International Journal on Emerging Technology and Advanced Engg.	Jan 2013
2	Automatic Activity Recognition for Video Surveillance	International Journal of Computer Applications	Aug. 2013
3	Motion Intensity Code for Action Recognition in Video Using PCA and SVM	Lecture Notes in Artificial Intelligence, Springer. (Anna University, Annexure II)	Dec. 2013
4	Human Activity Recognition Based on Projected Histogram Features in Surveillance Videos using Tree Based Classifiers	International Journal of Applied Engineering Research (Anna University, Annexure II)	Dec. 2014
5	An Efficient Multi-view Based Activity Recognition System for Video Surveillance Using Random Forest	Smart Innovation, Systems and Technologies, Springer.	Jan. 2015
6	Maximum Intensity Block Code for Action Recognition in Video Using Tree-based Classifiers	Advances in Intelligent Systems and Computing, Springer.	Jan. 2015
7	Human Activity Recognition Based on Motion Projection Profile Features in Surveillance Videos using Support Vector Machines and Gaussian Mixture Models	Communications in Computer and Information Science, Springer. (Anna University, Annexure II)	Aug 2015

8	Occlusion Detection based on Fractal Texture Analysis in Surveillance Videos using Tree-based Classifiers	Communications in Computer and Information Science, Springer. (Anna University, Annexure II)	Aug 2015
9	Vision-Based Human Action Recognition in Surveillance Videos using Motion Projection Profile Features	Lecture Notes in Computer Science (LNCS), Springer. (Anna University, Annexure II)	Dec 2015
10	Automated Complex Activity Recognition in Multiple Person Interaction	Journal of Imaging and Robotics, CESER Publication (Anna University, Annexure II)	Jul 2016
11	Difference Intensity Distance Group Pattern for Recognizing Actions in Video using SVM	Journal of Pattern Recognition and Image Analysis, Springer (Anna University, Annexure I)	Oct 2016
12	Recognition of Visual Activities using Difference Intensity Distance Group Pattern using SVM and HMM	IETE Journal of Research, Taylor & Francis (Anna University, Annexure I)	Under Review

INTERNATIONAL CONFERENCES

S.No.	Paper Title	Name of the Conference	Month/Year
1	Behavior recognition in surveillance video using temporal features	Fourth International Conference on Computing, Communications and Networking Technologies, IEEE, 2013.	July. 2013
2	Codebook Generation for Action Classification in Vision based Surveillance	8 th International Conference on Image and Signal Processing (Elsevier Proceedings)	July. 2014
3	Maximum Motion Representation and Recognizing Activity in Surveillance Video	2 nd International Conference on Emerging Research in Computing, Information, Communication and Applications (Elsevier Proceedings)	July. 2014

BOOK CHAPTER

S.No.	Paper Title	Name of the Conference	Month/Year
1	Early Recognition of Suspicious Activity for Crime Prevention	Emerging Technologies in Intelligent Applications for Image and Video Processing (IGI Global Publishers)	Jan 2016
2	Automatic Human Emotion Recognition in Surveillance Video	Intelligent Techniques in Signal Processing for Multimedia Security, Springer	Oct 2016
3	Internet of Things based Intelligent Elderly Care System	Internet of Things: Novel Advances and Envisioned Applications, Springer	Accepted for Publication