Intelligence Surveillance System Using Machine Learning

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Chapter : 1

Abstract :

The improvement of vision-based artificial intelligence, the rise of the Internet of Things connected cameras, and the increasing common need for rapid security, the demand for exact real-time intelligent surveillance has never been higher. For a human it is very difficult to monitor surveillance videos continually, so a smart and intelligent system is essential that can do real time monitoring of all activities and can categories between usual and some unusual activities. This paper aims to transform the surveillance landscape, to bring more effective, intelligent, and equitable security to the field, resulting in safer and more protected communities without requiring people to compromise their right to privacy.

Keys—Surveillance, artificial intelligence, IOT, computer vision, application, real-world, real-time, edge,

➢ **Key Features of the system are**:

- ❖ Real-time monitoring.
- ❖ Automatic threat detection
- ❖ Behavior analysis
- ❖ Integration with existing systems
- ❖ With machine learning algorithm depend on condition call on emergencyno. 112

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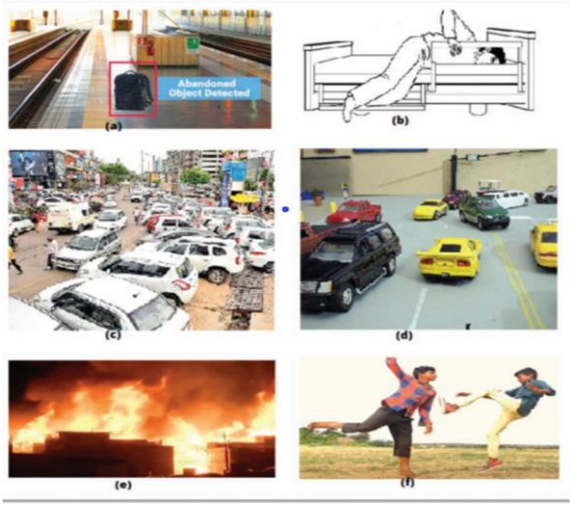

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MOTIVATION :

Intelligent Surveillance systems for suspicious activity revealing are very important to prevent theft cases, explosive attacks, Fire at sensitive areas, fights, accidents on roads,etc.

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This smart and intelligent video surveillance system can protect these sensitive areas from suspicious activities:

1. Airports: Airports are one of the most sensitive areas of any country. If a real time check through video surveillance is done then safety of passengers, airport will increase.

2. In College and University Campus: These smart and intelligent systems can be placed in college and university campus to prevent fight and for the safety of resources.

3. Railway, Bus Stations: Railway and Bus stations are targeted by terrorist of acts. With the help of smart video surveillance system, railway stations, bus stands, parking area can be monitored and activities can be detected at real time.

4. Banks: Banking sector need more security as anyone with arms can conduct robbery. If an intelligent surveillance system is installed then police can beinformed on time and robbery can be stopped or prevented on time.

5. Hospitals: In hospitals doctors can monitor patients remotely with this. In case of elderly patients falling, vomiting, fainting or occurrence of any other abnormalactivity can be informed on real time to doctors.

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LITERATURE SURVEY RELATED TO TOPIC

SL No.	Paper Title	Authors	Year	Name of Publisher
1	Scalable Intelligent Video Surveillancefor the Artificial Intelligence of Things	Armin Danesh Pazho , Christopher Neff	9 Mar 2023	IEEE INTERNET OF THINGS JOURNAL
2	Anomaly detection using edge computing in video surveillance system	Devashree R. Patrikar, MayurRajaram Parate	13 February2022	International Journal of Multimedia Information Retrieval
3	Intelligent Surveillance Systems? An Extended Technology Acceptance Model	Ying Lu and Yunxuan Deng	23 January 2022	MDPI
4	Hawk-Eye: An AI- Powered Threat Detector for Intelligent Surveillance Cameras.	Ahmed Abdelmoamen Ahmed	May 3, 2021.	IEEE ACCESS
5	Low-cost intelligent surveillance systembased on fast CNN	Zaid Saeb Sabri and Zhiyong Li	25 February2021	PreejCs
6	Suspicious Action Detection in Intelligent Surveillance System Using Action Attribute Modelling	Manisha Mudgal , Deepika Punj andAnuradha Pillai	17 February2021	Journal of Web Engineering
7	A deep learning approach to building an intelligent video surveillance system	Jie Xu	7 October 2020	Springer

8	Personal Identification Based on Deep Learning Technique Using Facial Images for Intelligent Surveillance Systems	Van-Huy Pham, Diem-Phuc Tran, and Van-Dung Hoang	4, August 2019	International Journal of Machine Learning and Computing.
9	Deep learning-based helmet wear analysis of a motorcycle rider for intelligent surveillance system	B. Yogameena , K. Menaka , S.Saravana Perumaal	17th April 2019	IET Intelligent Transport Systems
10	Deep learning-based helmet wear analysis of a motorcycle rider for intelligent surveillance system	B. Yogameena , K. Menaka , S.Saravana Perumaal	17th April 2019	IET Intell
11	Object Tracking in Vary Lighting Conditions for FogBased Intelligent Surveillance of Public Spaces	GAOCHENG LIU, SHUAI LIU , KHAN MUHAMMAD	June 20, 2018.	IEEEAccess
12	Protection of Crops from Wild Animals Using Intelligent Surveillance System.	Vikas Bavane,Arti Raut,Pradip Jawandhiya	9 April 2018	ResearchGate
13	A Multi-Resolution Mode CMOS ImageSensor with a NovelTwo-Step Single- Slope ADC for Intelligent Surveillance Systems	Daehyeok Kim , Minkyu Song , Byeongseong Choe and Soo Youn Kim	25 June 2017	MDPI
14	A novel framework for intelligent surveillance system based on abnormal human activity detection in academicenvironments	Malek Al- Nawashi Obaida M. Al-HazaimehMohamad Saraee	3 June 2016	Springer

15	Stereo Camera-based Intelligence Surveillance System	Junghwan Ko and Jungsuk Lee	3, June 2015	Journal of Automation and ControlEngineering
16	Intelligent Surveillance Robot with Obstacle Avoidance Capabilities UsingNeural Network	Widodo Budiharto	6 May 2015	Hindawi Publishing Corporation
17	Is There a Chink in Your ARMOR? Towards Robust Evaluations for Deployed Security Systems	Matthew E. Taylor, Christopher Kiekintveld, Craig Western, and Milind Tambe	11July 2009	IJCAI
18	REAL-TIME VIDEO INTELLIGENT SURVEILLANCE SYSTEM	Weidong Zhang, Feng Chen, WenliXu, Enwei Zhang	11July 2009	IEEE
19	Quantitative Risk Analysis for SecurityApplications	Januaz Marecki,Katiasycara	11 July	IJCAI
20	Intelligent Surveillance in Visible and Multi-modal Framework	Praveen Kumar, Ankush Mittal andPadam Kumar	December 21, 2006	Informatica

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LITERATURE REVIEW

We observe that deep learning is being applied for surveillance purpose and opening new research prospects in an area which does not have been significantchanges during last many years. We also found that new vast datasets are being produced to solve issues regarding security.

It is focused on autonomous surveillance, gathering in a single document the technical innovations about surveillance systems, their applications and central components.

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PROBLEM FORMULATION

Issues And Challenges Faced :
Some issuesand challenges are:

Processing at Real Time: The most Difficult task is to develop a real time system. Sometimes video with complex background takes more time in processing and tracking of object may take time.

Changes Due To Lighting: Nature is quiet volatile, sometimes illumination occurs due to change in weather, it can also occur during day-night change. And Illuminationin video can be a challenge for video analysis.

Object Shadow: Shadow of an object can create problem while tracking an object and can change the appearance of that object.

Noise in Video: Noise can also act as a problem in video analysis. Noise can be of any kind like rain, dust, waving created by branches of tree.

Huge Crowd: Object detection from a huge crowd is very difficult. In more crowded areas detection of violence, slapping, theft, hitting is very difficult task.

Blurred Objects: It is very difficult to find features of Blurred Objects and its get very difficult to recognize.

Poor Resolution: If the resolution is not good then it becomes very difficult to detect foreground objects from videos. It becomes difficult to classify the objects as boundaries of the object are not very clear.

OBJECTIVES:

- **Improved situational awareness**
- **Effective incident management**
- **Object recognition and behavior analysis**

1. **Subtraction of background:** It is very important to focus the object by detecting the changes in the sequence of frames. For this one of the powerful mechanisms is subtraction of background.
2. **Detection of Object:** Object detection is one of the most important tasks. It can be done through tracking or non-tracking based approaches.
3. **Extraction of features:** Feature extraction of objects like shape and motionis done to through different algorithms to identify objects. These feature vectors are then passed to classifiers as input.
4. **Classification of Object:** This is done to classify objects of videos. For classification of objects different algorithms can be used like SVM, Face Recognition.
5. **Analysis of Object:** After Object recognition analysis of object activity is conducted. These are then compared with different threshold values

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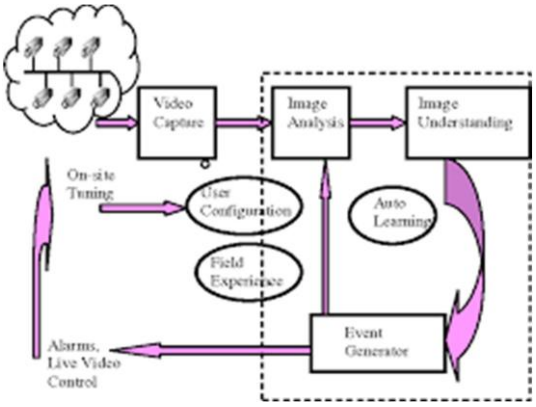
METHODOLOGY/ PLANNING OF WORK

- 3D video Analytics
- Use YOLO (you look only once) and advance CNN algorithm.
- Use advance alarm system
- Machine learning Algorithms
- Advance Sensors



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This framework will work for abandoned objects, theft incidents, fire, falling of ahuman, illegal parking, violence detection.
These are the steps for recognition of suspicious acts along with different algorithms andapproaches to improve the Security.

1. **Foreground Object Detection :** Extraction of foreground object is a very important step. It is an initial step for detection of suspicious activities. Subtraction of background is performed to detect the changes in the frames and to do the extraction of foreground object. Moving objects in a video are considered as foreground objects and static objects are considered as video background. For detection of moving object any of the two methods can be followed – (i)Background modeling
(ii). Change detection

2. **Object Tracking:** Tracking of Object is also a difficult task in computer vision field. For object tracking a trajectory is created over time by tracing the position of object in sequential frames. Object representations that are used for tracking object are object contours, geometric shapes, points, articulates etc. Noise, complex shapes of objects, partial occlusion of objects sometimes createproblems in tracking of objects.

3. **Extraction of Features:** It is very important to select appropriate features forautomatic detection of suspicious activities from videos

4. **Classification of Activities**: After extracting moving and static foreground objects, the classification of object is implemented to classify between normal and abnormal behavior. For classification several researchers have used differentmethods like Support Vector Mechanism, K-NN, YOLO ,Neural Network, and Multi- SVM.

5. Data Sets and Evaluation Measures

i. Dataset Violence detection dataset mainly consists of four types of video sequences of fight scenes. In some videos people meet, fight and run away. In other videos two or three people meet, fight and then one fell down and second person runs away. This can also possible that people meet, fight and then chaseby running behind each other.
For this kaggle dataset can be used. In these data sets realistic action videos have been collected from online video store spaces like YouTube. For traffic MIT traffic dataset is available and for parking I-LIDS parking dataset alsoprovides sequence of videos of illegal parking.

ii. Evaluation Measures Evaluation of Intelligent video surveillance system for checking performance for different activities like theft, violence detection, illegal parking, accident, fall detection, fire detection is one of the most important tasks. Many quantitative accuracy test measures have been used by researches like:
Recognition Accuracy: For recognition accuracy of different activities measureslike:

$$\text{Accuracy}(\%) = \frac{(T^p + T^N)}{(T^p + T^N + F^p + F^N)}$$

Here T^p represents True positive which means suspicious activity detection assuspicious by classifier.
T^N represents True negative means non suspicious activity detections as non- suspicious. F^p represents false positive means classification of non- suspicious assuspicious.

F^N represents false negative which means suspicious as non-suspicious. Precision, Recall are used as experimental evaluators. In which Precision represents True alarms % and Recall represents detected event %.

$$\text{Recall}(\%) = \frac{(T^p)}{(T^p + F^N)}$$

$$\text{Precision}(\%) = \frac{(T^p)}{(T^p + F^p)}$$

6. Proposed Framework For Violence Detection

In the proposed model similarity between violence activities to normal action is exploited to train a large UAM which move around attributes across all actions. Universal Attribute Model(UAM). UAM is not dependent on labeled violence videos for training.

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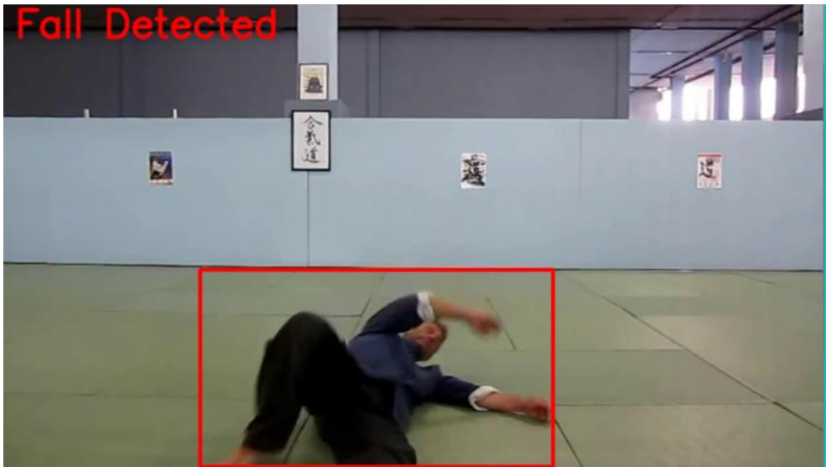

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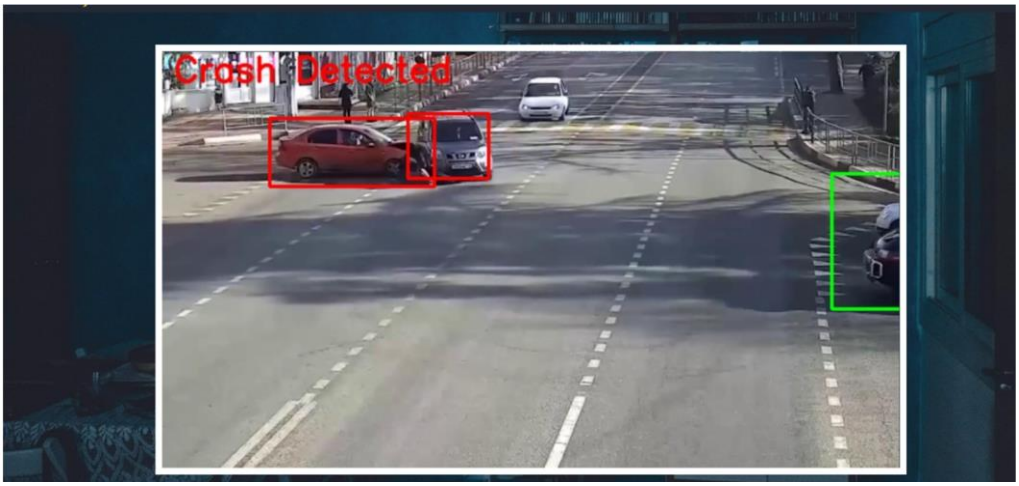

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FACILITIES REQUIRED FOR PROPOSED WORK

- CCTV CAMERA
- SMOKE SENSOR
- MACHINE LEARNING ALGORITHMS
- PYTHON PROGRAMMING
- ALARAM
- Python: Language in which code is written
- CMake: For compiling openCV
- Visual Studio Code: For building openCV and darknet code
- Nvidia GPU Driver: For faster GPU performance
- CUDA: For parallel computing using GPU
- CuDNN: A GPU-accelerated library of primitives for deep neuralnetworks
- OpenCV: For working on images/videos in python
- Darknet: Neural network framework for YOLO

Chapter : 8

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- REAL-TIME VIDEO INTELLIGENT SURVEILLANCE SYSTEM
- Quantitative Risk Analysis for Security Applications
- Intelligent Surveillance in Visible and Multi-modal Framework
- Kaggle.com(for dataset)