WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Video Surveillance System

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ABSTRACT—

Today's institutions are facing major security issues; consequently, they need several specially trained personnel to attain the desired security. There is a need to develop a video monitoring system which works in different modes for different tasks using machine learning. Our objective is to develop automated video understanding technology for use in future surveillance applications which allows a single human operator to monitor activities over a broad area. Our project will consist of 5 modes – Monitor, Identify, Noise, In/Out detection and Record. Algorithms like Structural Similarity Index (SSIM) for Monitor mode, Haar Cascade algorithm (Face Detection) and LBPH algorithm (Face Recognition) for Identify mode, find difference in gray scale pixel values between frames for Noise detection and track the horizontal motion for In/Out detection are used. Thus far, the In/out Detection mode of our project is completed which has given us good accuracy in results but with some limitations like giving false positives due to background disturbances.

Keywords— Haar Cascade, Local Binary Pattern Histogram (LBPH), Structural Similarity Index (SSIM), etc.

I. Introduction

In any Surveillance System Automatic detection and recognition of objects is of most important for this type of surveillance security systems. Automated video surveillance focuses on the real-time observation of objects in a constrained environment. Outside surveillance systems must be able to detect and track moving objects in their view field, as well as classify and detect some of their activities. Surveillance systems are responsible for monitoring stationary and moving objects in a specific scene in real time.

In order to achieve the appropriate security, today's institutions need a number of individuals who have received specialized training. These employees make mistakes that could lower the security level because they are fallible human beings. An excellent option for home security that can serve as a deterrent and a recovery tool is a home security camera system. Properties with clearly visible security cameras raise the ire of burglars. Security cameras can also assist in gathering evidence if a crime is committed.

Video surveillance is attractive research area in artificial intelligence, computer vision and digital image processing. Closed-circuit television (CCTV) was an expensive and unreliable way to watch events unfold in real time. Video surveillance system provides safety and security in public places. The main problem encountered in video surveillance is low resolution quality of the scenes obtained. Surveillance system depends on human operators who detect some useful activities in a video scene. Current state of surveillance systems involves human operators to sit and monitor everything carefully for any kind of suspicious behaviour. This process of monitoring goes on for 24x7 and even then slight mistakes or lack of concentration can lead to the bypass of the surveillance system by criminals.

II. Literature Survey

The following papers provide a summary of the security literature with a focus on autonomous surveillance, gathering technological developments in surveillance systems, and important components. These papers provide a thorough examination of such video surveillance systems and the related components. These systems' most important analysis and the employed designs are discussed. Existing surveillance systems were contrasted in order to provide a more thorough understanding of the system and a wider picture.

A. Video Surveillance for Real-Time Applications

M. Sahasri et al. [1] presented increasing need for safety and security everywhere. The prevalence of surveillance cameras has recently grown to address this issue. However, manually storing and keeping track of the obtained data on a continuous basis is challenging. There are various methods to complete this task without requiring human involvement. The fundamental idea behind each of these techniques is the identification, segmentation, and tracking of moving objects in the live stream. This is a particularly difficult process because it takes into consideration the noise, object occlusions, and their

intricate structures. The object detection system based on cascade classifiers and an adaptive background modelling system are combined in a novel way in this paper for use in video surveillance.

The surveillance system presented in this paper can detect and track moving objects in a video sequence and is resilient against temporal illumination changes. The system also adapts itself to long lasting changes in the background over time. Surveillance System: The security system described in this study can recognize and track moving objects in a video stream and is resistant to changes in temporal illumination. The system gradually adapts to ongoing changes occurring in the background. a surveillance system.

Ľuboš OVSENÍK et al. [2] reviews numerous video surveillance technologies that are already in use. Video surveillance systems must support security personnel in monitoring and tracking actions because of the increasing volume of security footage. Target detection, tracking, and classification are the objectives of surveillance applications. In this study, object modelling, activity analysis, and change detection are discussed.

B. Classification of Objects and Tracking

Visual surveillance system helps to detect as well as to track objects to know the behavior of objects with multiple cameras. There are various technologies like CCD cameras, night vision cameras, goggle, and thermal imaging cameras. Object Tracking is used to find the area where objects are available and shape of objects in each frame. An intelligent surveillance system extracts information from large scale data set. Video surveillance is an attractive research area in artificial intelligence, computer vision and digital image processing.

The main aim of Video surveillance system is to solve different kinds of problems such as object detection, object tracking and pattern recognition. Surveillance system depends on human operators who are able to detect some useful activities in a video scene. An automated visual surveillance system consists of motion detection, object tracking, and person identification [4]. Various features in biometric such as face and style of walking or non-biometric features such as appearance can be used for person recognition. If we use multiple cameras then various problems occurs such as camera calibration and object matching.

The idea of object tracking is also discussed in this survey study. This concept can be carried out utilizing a variety of techniques, including point tracking, kernel tracking, color, edges, and texture. In order to monitor items, two methods are used: the first method relies on correspondence matching, and the second method relies on distinct tracking [5]. A multi-object tracking system that is divided into three components visual tracking, track management, and online model learning is also included in my description. The study activity that is being proposed will make an effort to create and develop algorithms for reliable object detection and tracking in the future. This survey paper's main drawback is that it is useless in situations where object detection calls for higher key frames. Another drawback is that it cannot monitor moving objects in denser situations, such as moving crowd of people.

C. Automatic Video Surveillance

Fereshteh Falah et al. [7] provides a comprehensive and well-organized study of the 2010–2011 literature on video surveillance systems. The analysis was culled from internet digital repositories. The six-layer framework, which consists of the Concept and Foundation Layer, Network Infrastructure Layer, Processing Layer, Communication Layer, Application Layer, and User Interaction Layer, is the foundation for the proposed categorization architecture of video surveillance systems. Video surveillance systems obtain a great interest as application-oriented studies that have been growing rapidly in the past decade. This paper provides a comprehensive and systematic review on the literature from various video surveillance system studies published from 2010 through 2019. This analysis shows that, despite the focus on the real-time aspect of the issue in many publications and studies, relatively few studies have examined the use of extracted and retrieved information for video surveillance.

This study demonstrates that there is a rising need for apps that provide monitoring in places like parking lots, shopping malls, airports, and train stations. This is due to the development, accessibility, and low cost of processors and sensors. This leads to interdisciplinary research on video surveillance systems that is connected to image analysis, pattern recognition, signal processing, embedded computing, and communication. The main goals of this review are to describe and categorize research on video surveillance systems, to construct and provide a conceptual framework to integrate, and to categorize publications in accordance with, those categories. The categorization framework was developed with the goal of classifying the papers that were gathered for this study. The six tiers of the proposed classification are user interface layer, application layer, communication layer, processing layer, network infrastructure layer, and concept and foundation layer. This study demonstrates how video surveillance system research is always progressing, although the majority of articles only address parking garages, malls, hospitals, airports, and other similar location

D. Security and Privacy

Qasim M. R. et al. [3] defines the various security and privacy needs in a video surveillance system. A video surveillance system must fundamentally have components for recording, storing, and displaying video, as well as a method to transfer video data between these components and to the users. The key components of our architecture, which consists of four parts—video collection, transit, monitoring, and storage.

We may define the domain and scope for numerous security and privacy criteria that may apply to video surveillance systems using the four elements. However, to establish all the security and privacy criteria for video surveillance systems, we also need to consider the interests of the many stakeholders. The persons being monitored by the system and the owner, who commissions and maintains the system, are the two main stakeholders in all video surveillance systems. These two groups are depicted in as the two main competing forces. However, in reality, owners typically hire a guard company or another company to manage the video surveillance equipment instead of doing it themselves. This company is referred as operator.

The privacy of the people being watched, however, is seriously threatened by the advanced functions given by these devices. It is crucial to safeguard people's privacy from inner staff members who are involved in monitoring surveillance data. We list the security and privacy requirements for a video surveillance system, as well as the difficulties and future research directions to address these requirements.

III. Methodology

A. Block Diagram

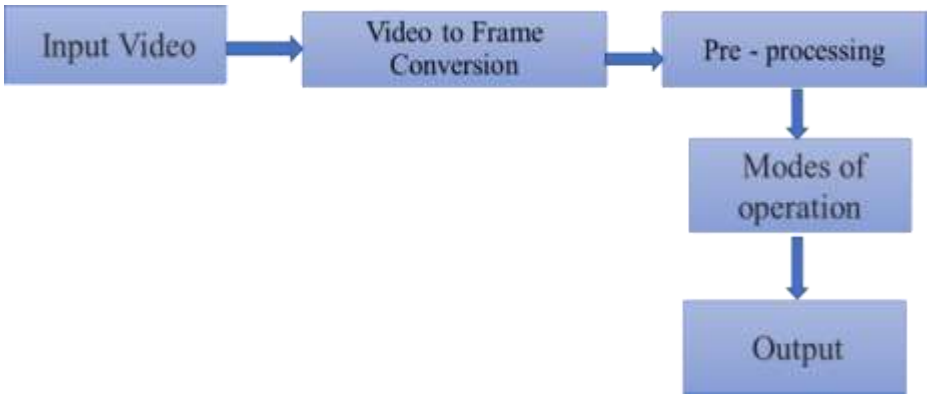

Fig 3.1 General Block diagram of the system

1) Input Video: Input is taken with a webcam or PTZ camera.

2)Video to Frame Conversion: The input video is then converted into frames for further operations.

3) Pre – processing:

This step involves preprocessing of the image which is as follows:

•Images are rendered in color layered with 3 channels (Blue, Green, and Red), Grayscale with pixel values varying from 0 (black) to 255 (white), and binary portraying black or white values (0 or 1) only.

•Adjust contrast and brightness for an image applying local point operators. Multiplying individual image pixels by a constant and adding a bias will cause the image to be more or less brighter and the contrast more or less noticeable.

•Image noise reduction and increasing of image sharpness is also done.

4) Modes of Operation:

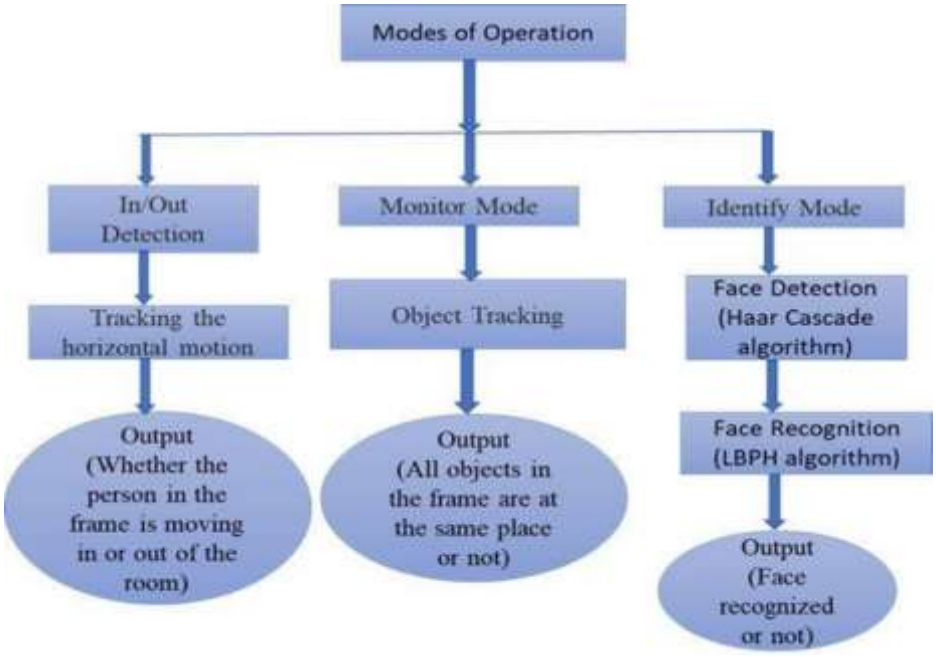

Fig 3.2 Modes of Operation

IV. RESULTS AND DISCUSSIONS

A. Identify Mode

Fig.4.1 Face recognition

In this Fig. 4.1, we can see that all three persons in the frame are labelled with their names. The person in the center has higher confidence level (lower similarity) due to the person being at a higher distance. Hence there is lower similarity between the training data and the test data. Other persons are being shown similar with low confidence (high similarity) since the persons are at a lower distance.

B. In Out Mode

Coming In

Fig. 4.2 In Detection

This is testing of in out mode. Here we have taken 3 test cases with 3 different objects. The working of this mode is quite simple, here the frame is divided into three parts left, centre, right. When an object moves from right part to the centre part and then to the left part, this completion of object motion in all the three frames will decide the object is coming in. All the images of coming in and going out of the room are stored in separate folders with timestamps.

Going Out

Fig. 4.3 Out Detection

This is testing of in out mode. Here we have taken 3 test cases with 3 different objects. The working of this mode is quite simple, here the frame is divided into three parts left, centre, right. When an object moves from left part to the centre part and then to the right part, this completion of object motion in all the three frames will decide the object is going out.

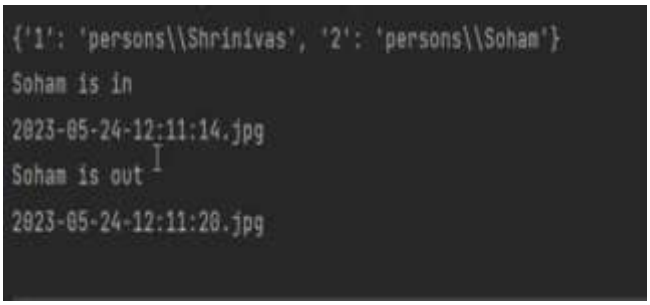

Fig. 4.4 Console output of in/out detection

The console output shows that who went inside the room and who came out of the room with a timestamp associated image which are stored in separate folder. In this case, "Soham" is the person who went in and came out of the room.

C. Monitor Mode

a) b) c)

Fig. 4.5

Fig. 4.5 (a) is before the action is occurred, system checks that is there any change in the frame or not, in this case we are monitoring a water bottle. If there is change in frame, Fig. 4.5 (b) is given which is when the bottle is removed from the frame, here we can see the difference in the frames after the action has occurred and the Fig. 4.5 (c) is the difference in gray scale of the tracked object.

V. FUTURE SCOPE

Below are some future workout on this project:

1. Adding in-built night vision capability.
2. More feature such as
    - Deadly weapon detection
    - Accident detection
    - Fire Detection
3. Making a standalone application with no requirements such as python, etc.

CONCLUSION

We have successfully developed an automated video understanding technology for use in future surveillance applications. This system allows a single human operator to monitor activities over a broad area. However, there are some issues while identifying persons in low light environment. It also has problems when resolution of image is too low. This problem can be solved to some extent by operating in better lighting conditions.

Acknowledgment

The success and final outcome of this project required a lot of guidance and assistance from many people, and we are extremely privileged to have got this all along the completion of first stage of our project. All that we have done is only due to such supervision and assistance and we would not forget to thank them. We owe our deep gratitude to our project guide Dr. S.S. Vasekar, who took keen interest on our project work and guided us all along till the completion of our project work by providing all the necessary information. A special thanks to our HOD, Dr. M. V. Munot for their direct and indirect contribution in this project.

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