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Smart Surveillance Using Computer Vision

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Abstract:- Security and protection are the most important issues in modern times. This document reviews some of the latest developments in the field of computer vision and image processing to solve safety issues. It also describes the efforts of the development teams to incorporate some of these pioneering ideas into a consistent prototype system. Computer vision expands the paradigm of image processing, including the understanding of scene content, object tracking and classification. The development of computer vision technology often takes into account very specific applications, and the goal of a more complete understanding of computer vision systems still exists outside the existing technology, at least for now. In this paper we are mainly stressing on the features of smart surveillance which are monitoring feature, noise detection, face identification and visitors in room detection. This can be achieved by integrating camera with python computer vision algorithms.

Keywords:- *Computer Vision, Object Tracking, Computer Vision Algorithms, Face Identification.*

I. INTRODUCTION

In the modern world, the security paradigm has changed from "investigating incidents" to "preventing potentially catastrophic incidents." Affordable digital video surveillance systems only provide the infrastructure for capturing, storing, and distributing video, leaving the task of threat detection specifically to human functions. Human gazing of surveillance video is a completely human in depth task. It is largely agreed that looking video feeds calls for a better degree of visible interest than maximum regular errands. In particular, vigilance, that is, the power to remain targeted and react to rare events, is very exacting and is susceptible to errors because of neglect of attention. Face recognition technology has created nice strides within the past 2 decades. Verify credentials for secure transactions, observation and security tasks, and access management. These applications usually run in a controlled environment and detection algorithms, which can take advantage of the limitations of the environment to achieve a high level of detection accuracy. In-depth research is ongoing in the field of intrusion detection. In our project, we successfully developed a reliable and scalable face recognition. Ready-to-use transmission system. Poor performance in the early stages of operations (especially the high false alarm rate) has led to research on more complex solutions. Artificial intelligence concepts such as neural networks and expert systems have been integrated into more computer-oriented systems.

II. LITERATURE SURVEY

- Yong-Liang Zhang, Zhi-Qin Zhang, Gang Xiao, Rui-Dong Wang proposed a method to detect intruders by identifying human targets in the images captured by the surveillance system.
- Jayathi Ghosh Dastidar, Rana Biswas proposed a method for intrusion detection in critical environments, by changing the focus of the camera to ensure security and tracking the attacker's movement.
- Hang Chen zeo, Dong Chen,and Xifeng Wang proposed a method of controlling the algorithm program of a mixed mathematical model, which is mainly based on the standard model of Gaussian mixture. After updating the model according to the characteristics of continuous video frames, the background model is divided into static regions. And dynamic areas and update the background of different strategies. Penetration is judged based on the position of the target's center of mass, where the center of gravity is in a given space. Means breaking in and calling the police.

III. REQUIREMENTS

Since this is software based project, it must run on certain hardware and operating systems, the following requirements must be met to run this software. Any version of Windows / Linux / Mac OS so that it can run on any platform. You need to install Python on your system to run successfully.

Python package required are:

- openCV
- Skimage
- Numpy
- Tkinter

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In terms of hardware requirements, you don't need much, but you still need to meet the following requirements:

- Working PC or Laptop
- Webcam with drivers installed.
- Flash light or led if using this at night.

IV. METHODOLOGY

The scope of our project is , generally in normal CCTV, it only record the visual content in its vision, where as in this smart cctv , we have introduced features like monitoring the objects, noise detection , face identification and person in and out capturing features.

Below are the different features which can performed by using this project:

1. Monitor
2. Identify the person
3. Detect the noise
4. In and Out detection

4.1 Monitoring feature:

This feature is used to find stolen goods in the frame visible to the webcam. Value Constantly monitor the frame and check which object or thing in the frame has been taken by the thief. It uses structural similarity to find differences in two frames. Take two pictures first when there is no noise, and take the second picture when the noise stops. The Structural Similarity Index (SSIM) metric extracts 3 key *features* from an image: Luminance, Contrast and Structure. The comparison between the two images is performed on the basis of these 3 features.

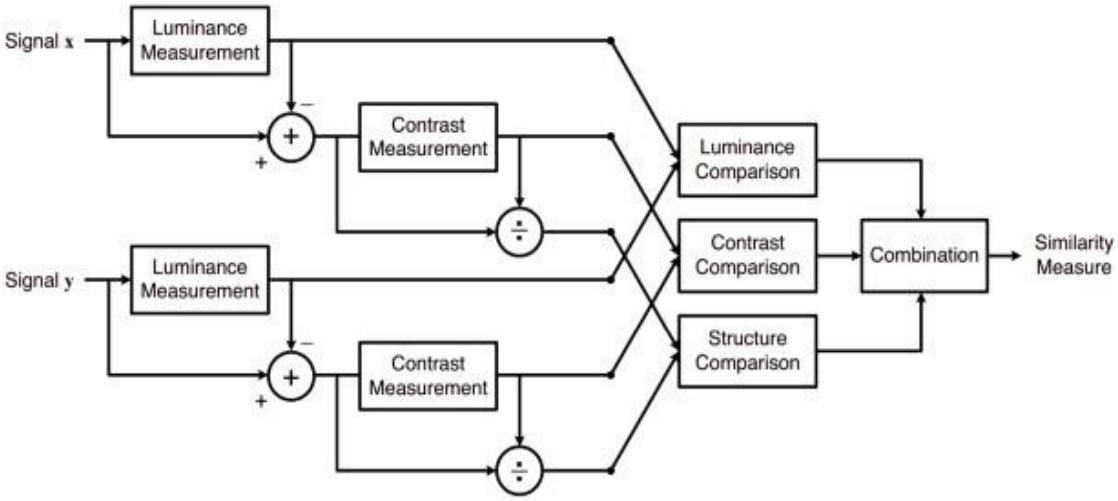

Fig.1: SSIM algorithm block diagram

Fortunately, because of the ski-image package in Python, we don't have to copy all the math into Python, because ski-image has a prebuilt function that can do all these tasks for us just by calling the built-in functions. We captured them before, so we just need to enter them and get a masked image with score.

4.2 Face identification feature:

This feature is very useful feature of our project, It is used to find if the person the frame is known or not. It do this in two steps:

1. Find the faces in the frames
2. Use LBPH(local binary pattern histogram) face recognizer algorithm to predict the person from already trained model.

The LBPH uses 4 parameters: Radius, neighbors grid x and grid y .

The first calculation step of LBPH is to create an intermediate image that better describes the original image by extracting facial features. To this end, the algorithm uses a sliding window concept based on radius and neighboring parameters. Now that we have the image generated in the previous step, we can use the parameters Grid X and Grid Y to divide the image into multiple grids, as shown in the following figure: predict what you want to meet, apply the same steps to the mark The histogram is compared with the trained model. This is how the function works.

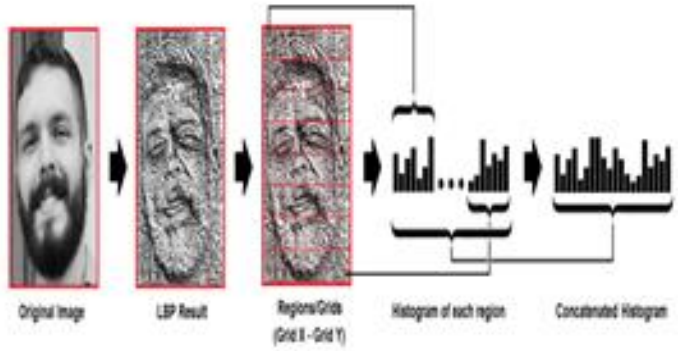

Fig.2: LBPH model

4.3 Noise detection feature:

This feature is used to find the noises in the frames. Talking in simple way all the frames are continously analyzed and checked for noises. Noise in checked in the consecutive

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frames. Simply we do the absolute difference between two frames and in this way the difference of two images are analyzed and Contours (boundaries of the motion are detected) and if there are no boundaries then no motion and if there is any then there is motion. As you would know all images are just integer/ float values of pixels which tells the brightness of pixel and similarly every pixel has that values of brightness. So we just do simply absolute difference because negative will make no sense at all.

frame1			
10	90	16	16
0	11	11	11
18	30	33	33
18	18	18	18

frame2			
10	90	16	16
0	13	17	11
18	34	31	33
18	17	19	18

frame2 - frame1			
0	0	0	0
0	2	6	0
0	4	-2	0
0	-1	1	0

abs (frame2 - frame1)			
0	0	0	0
0	2	6	0
0	4	2	0
0	1	1	0

Fig.3: noise detection grid plot

4.4 Intruder In and out capturing feature:

This is the feature which can detect if someone has entered in the room or gone out.

So it works using following steps:

1. It first detect for noises in the frame.
2. Then if any motion happen it find from which side does that happen either left or right.
3. Last if checks if motion from left ended to right then its will detect it as entered and capture the frame. Or vise-versa.

So there is not complex mathematics going on around in this specific feature. So basically to know from which side does the motion happened we first detect for motion and later on we draw rectangle over noise and last step is we check the co-ordinates if those points lie on left side then it is classified as left motion.

V. RESULTS

Fig.4: face identification

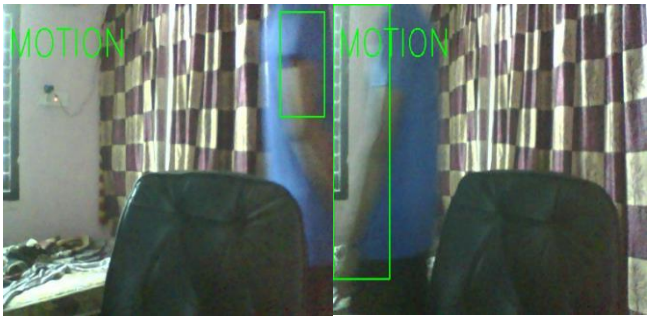

Fig.5: Intruder In and out capturing feature

Fig.6: Object monitoring feature

VI. FUTURE SCOPE

Due to technological advancements such as low capacity but high computing power, the project can be widely used. Below are some future exercises for this project. There is a high-performance device. Additional features, such as lethal weapon detection, incident detection, fire detection and more...Build a stand-alone application without requirements such as Python. Build an independent device. Adding DL support will expand the scope of the project because we can use DL to add more features.

VII. CONCLUSION

In-depth research is ongoing in the field of intrusion detection. In this work, we successfully completed the tasks set for continuing the project. The purpose is to recognize faces and process these faces, and identify whether the recognized faces match existing faces. Exist in the database (the database contains pre-encoded training faces) If the detected face does not match the face in the database, will be sent with frame capture hit the intruder in the face. Although all these processes run in the background, users can broadcast the entire live broadcast via their PC or through the Android

application we developed to complement the live broadcast on the smartphone. Even the difference between the most advanced computer vision standards and the analytical skills of ordinary security personnel will be seen. However, long-term pressure to improve security and reduce the cost of providing surveillance services is increasing, which is still the driving force for research on advanced computer vision technology.

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