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Smart Eye Using Deep Learning

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ABSTRACT:

Right now, security as well as safety is the most crucial considerations. In order to address security concerns, this talk aims to assess recent developments in computer vision and image processing. The efforts made by the evolution teams to incorporate some innovative ideas into a single prototype system are also covered. Computer vision (CV) broadens the paradigm of image processing with its ability to comprehend scene information, track objects, and categories images. The goal of gaining a deeper understanding of CV systems exists outside of current technology, and the development of CV technology typically considers particularly narrow applications. The tracking function, rectangle motion identification, face identification, noise detiction, visitor count and visiting room detiection are some of the smart CCTV capabilities that we primarily highlight in this article. Combining CV techniques with camera will enable this.

KEYWORDS: Face Identification, Computer vision, Motion, Noise, Object Tracking's, Tkinter, Open CV.

I. INTRODUCTION

In today's society, guaranteeing securite is critical, not only focusing on incident investigation but also on averting possibly disastrous situations. The ability to record, store, and distribute video footage is now a feature of more affordable digital video surveillance systems, although danger detection still primarily depends on human interaction. Surveillance video monitoring of humans is a big and complicated job. But thanks to technological improvements, surveillance systems may now run around-the-clock and retrieve recorded video as needed.

These technologies can help authorities detect and solve crimes and prevent crime, however they often struggle to identify and track down the individuals involved in the crime. Our approach makes use of computer vision software, such OpenCV, which offers an extensive toolkit for image processing and allows real-time image analysis. We have created an infrastructure that not only captures events but also recognises and authenticates people by incorporating intelligent monitoring into it.

Our project aims to overcome these constraints by developing a comprehensive system that uses computer vision and artificial intelligence (AI) to combine facial recognition with other features. Real-time image analysis is made possible by the extensive library of image processing tools offered by OpenCV, open-source computer vision software. Our system now includes intelligent surveillance, allowing us to create a system that can identify and authenticate individuals in addition to recording occurrences.

II. LITERATURE SURVEY

Following an extensive literature review, we have chosen a few notable works, which are mentioned below:

Sandeep Singh et al [1], offer an affordable security camera that achieves 83% accuracy in face and person detection at night by utilising OpenCV for night vision. In the paper titled "Smart Surveillance," it is possible for individuals to have a low-cost system for controlling the camera through custom artificial intelligence assistants.

B. Varma Teja Reddy et al [2], the article titled "smart cctv camera monitoring system using iot" proposes a smart CCTV surviellance system with intrusion identification, live steaming, face identification autentication, IP technology & picture analysis.

Hritika Pandit Patil et al [3], Wellfare & security are given top priority in modernism, and computer vision systems offer cutting-edge capabilities like monitors, noise identification, visitor count, face identification & video recording for intelligent surviellance. "Smart surveillance system" is the title of the paper.

M. Naveen et al [4], "CNN Algorithm & Machine Learning-Powered Intelligent Surveillance System" The goal of this paper is to optimise data storage and minimise storage requirements by employing sophisticated machine learning techniques to detect humans. Distinctive characteristics like erect posture, neck, and proportion of distance are employed for recognition.

Prasanna Rajendra et al [5], explains how IP cameras and face recognition are used in a smart surveillance system to enhance security through the use of effective algorithms like motion detection, facial landmarking, and Local Binary Patterns Histogram (LPBH). The system's face recognition accuracy ranges from 85% to 95%.

Dr. Sanjay M. Malode et al [6], offers a "Smart Security Camera using Machine Learning" that uses a device's built-in camera to create a low-cost security system. In addition to supporting cloud services, the system can upload videos and images and send notification. It reduces the need for human labour and offers reliable data for monitoring.

Anna Irin Anil et al [7], outlines a distributed surviellance system that operates in real-time and uses embedded technology for traffic monitoring and image detection. In retail establishments, smart cities, and corporate campuses, it uses edge computing to provide real-time tracking and surveillance.

III. PROBLEM STATEMENT

The present generation of Closed Circuite Television systems (CCTVs) used for surviellance & security has severe shortcomings in terms of precise object and action detection and identification. These systems mainly depend on manaul monitoring, which slows down real-time incident response because it is labor-intensive and prone to human error. As a result, there is an urgent need for a sophisticated smart video surveillance system that uses deep learning to improve tracking, object identification, and activity recognition—all of which strengthen security and surveillance capabilities.

By utilising the capabilities of deep learning algorithms, the suggested Smart CCTVs seeks to address drawbacks of conventional CCTVs. This technology will transform object detection by utilising state-of-the-art developments in computer vision and machine learning, enabling accurate and dependable real-time identification of a wide range of objects and actions. The system will continously adapt & learn to newly scenarios and patterns through the application of deep learning models, greatly improving alarams & increasing the overall accuracy of surviellance operations.

IV. DESIGN AND IMPLEMENTATION

Traditional CCTVs only offer basic video recording at this time; they don't offer any sophisticated features. We suggest creating a Smart CCTVs that is powered by deep learning in order to improve the capabilites of surviellance systems. By adding cutting-edge features like face identification, object monitoring, noise detection, in-and-out identification, regular video identification, and selected area noise identification, this system seeks to transform conventional CCTV functionalities.

The following figure 1 displays a flowchart of the various functions that this project may accomplish:

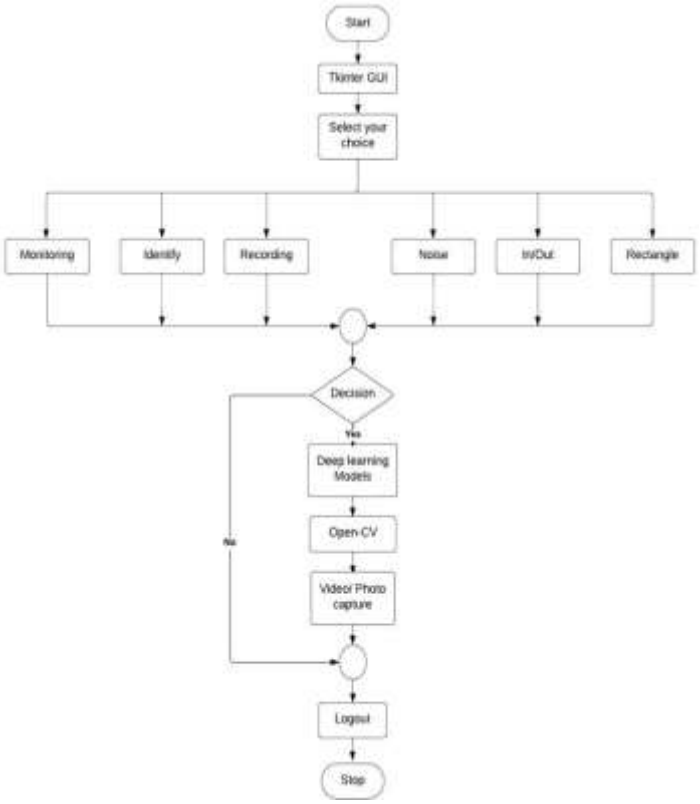
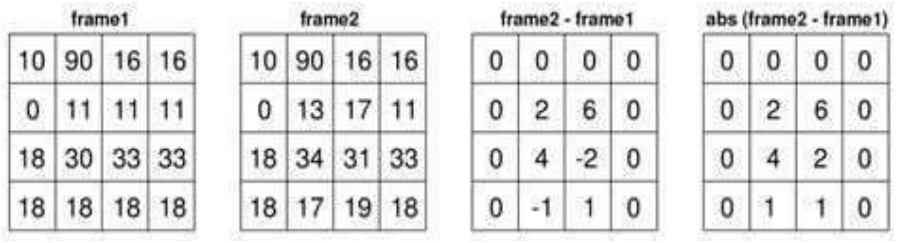


Fig 1: Flow-chart of the Smart Eye

1. **Monitoring**: It keeps an eye on the frames all the time, identifying the object or thing from each frame that the burglar has stolen. To determine the differences between the two frames, this employs structural similarity. In the first frame, no noise was present, and in the second, noise was present but eventually stopped occurring. An approach for evaluating the quality of images that is simple, highly efficient, and more consistent is called SSIM (Structural Similarity Image Measurement). The PNSR (Peak Signal-To-Noise Ratio) and MSE (Mean Square Error) are inferior to it in terms of performance evaluation.
2. **Noises**: It is a feature which are used to identify noise in the framees, is present in most CCTVs; nevertheless. To put it simply, noise-checking and continuous analysis are performed on each frame. The subsequent frames perform a noise analysis. In other words, we figure out the difference between two frames. This method allows for the analysis of the differences between two images and the determination of contours, or the boundaries of motion.



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 2: Noises Sample

As you are aware, all images are simply float or integer values representing the brightness of each pixel, and each pixel has its own brightness values. Due to the fact that negative will be completely illogical, we merely make the absolute difference.

3. **Visitors Count:** This function allows you to know if someone has entered the room or left. Thus, it functions by taking the subsequent actions::
   - It 1st detects for noises occured in the frames.
   - Next, if motion is identified, it determines whether it is coming from the left or the right.
   - Lastly, if motion is identified from left to right, it will be identified as entered and the frames will be captured or the other way around.

Therefore, this particular feature does not involve complex mathematics. Basically, in order to establish which side the moiton originated, we first search for moiton, then we draw a rectangle over the noise, and finally we check the coordinates; if those point fall on the left, the motion classed as coming from that side.

4. **Drawing rectangle and detecting motion:** If motion is detected, the model detects it by analysing the visual data in that region. When motion is detected within the rectangle, the model can be programmed to carry out a particular task, like informing the user or turning on extra security. This facilitates recognising possible dangers and odd activity within the monitored area and taking appropriate action.
5. **Recording:** Every detail of the room will be noted during this routine recording. The same functionality as a traditional CCTV is provided by this function. We did this so that the owner would receive both the additional and fundamental functions. The Computer Vision domain will be used to create these modules using OpenCV.
6. **Face identification:** To reliably identify people based on their faces, create a face identification system that makes use of the LBPH algorithm. Facial image capture, local binary pattern extraction, and histogram representation of the extracted patterns should be possible tasks for the system. The next step should be to train a classifier that can differentiate between various people using machine learning methods. The goal is to develop a reliable and effective face recognition system that can be used for security, monitoring, and customised services, among other uses.

V. RESULTS AND DISCUSSION

The Smart CCTVs uses deep learning algorithm to enhance vidieo analysis and monitoring. These algorithms provide vital information for security and surveillance reasons by enabling real-time object identification, recognition, and behaviour analysis. Aside from identifying suspicious behaviour and anomalous activity, the technology also enables quick notifications and alarms. The CCTV system is now far more intelligent and adaptive because to the deep learning algorithms that have been integrated. Due to its ability to automate monitoring procedures, offer real-time insightis, and facilitate the detection trends, patterns, and possible thraets, the system has the possibilities of significantly enhance overall security measures. All things considered, the Smart CCTV system exhibits encouraging promise for enhancing security protocols and updating video surveillance.

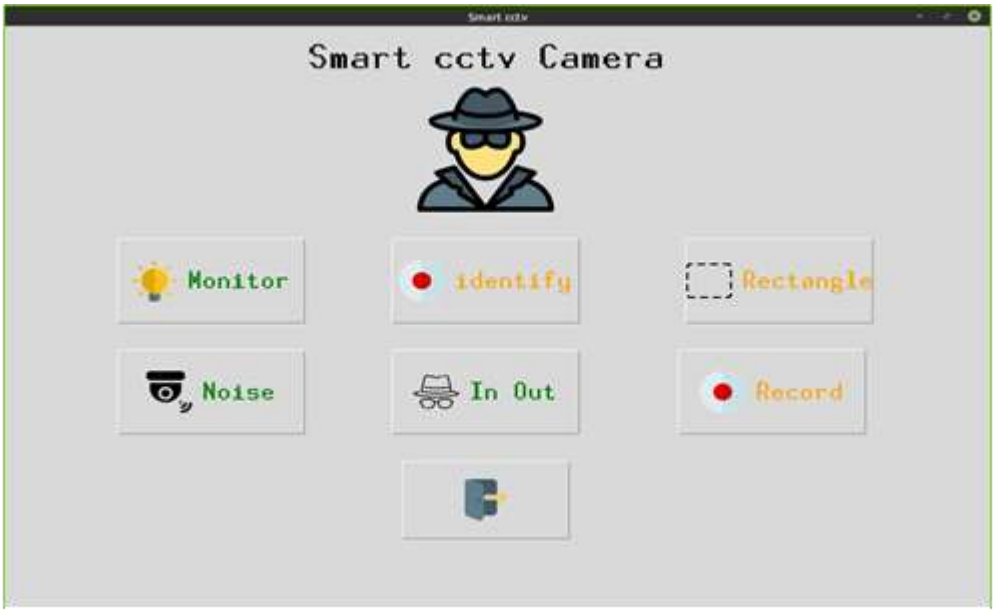


Fig 1: Tkinter GUI of Smart Eye

The above figure show the results of GUI which supports different buttons of multiple features like identification, noise identifation, monitoring, recording, rectangle, in/out & logout options.

VI. CONCLUSION

For improved video analysis and monitoring, the Smart CCTV system makes use of deep learning algorithms. The technology allows for real-time alerting and monitoring by identifying and detecting objects in real-time video feeds. In reaction to possible dangers or occurrences, these permits prompt action. Enhancing the system's intelligence and flexibility is the incorporation of deep learning algorithms. Other deep learning algorithms, such as those for face recognition, noise detection, and other aspects, might be added in the future to build a more complete security ecosystem. Enabling effective monitoring, danger identification, and proactive security measures, the Smart CCTVs offers an innovative and intelligent solution for video surveillance.

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