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Smart CCTV Camera Surveillance System: A Review

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ABSTRACT: With recent advances in both AI and IoT capabilities, it is possible than ever to implement surveillance systems that can automatically identify people who might represent a potential security threat to the public in real-time. Imagine a surveillance camera system that can detect various on-body weapons, masked faces, suspicious objects and traffic. This system could transform surveillance cameras from passive sentries into active observers which would help in preventing a possible mass shooting in a school, stadium or mall. In this paper, we present a prototype implementation of such systems, Hawk-Eye, an AI-powered threat detector for smart surveillance cameras. Hawk-Eye can be deployed on centralized servers hosted in the cloud, as well as locally on the surveillance cameras at the network edge. Deploying AI-enabled surveillance applications at the edge enables the initial analysis of the captured images to take place on-site, which reduces the communication overheads and enables swift security actions. At the cloud side, we built a Mask R-CNN model that can detect suspicious objects in an image captured by a camera at the edge. The model can generate a high-quality segmentation mask for each object instance in the image, along with the confidence percentage and classification time. The camera side used a Raspberry Pi 3 device, Intel Neural Compute Stick 2 (NCS 2), and Logitech C920 webcam. At the camera side, we built a CNN model that can consume a stream of images directly from an on-site webcam, classify them, and displays the results to the user via a GUI-friendly interface. A motion detection module is developed to capture images automatically from the video when a new motion is detected. Finally, we evaluated our system using various performance metrics such as classification time and accuracy. Our experimental results showed an average overall prediction accuracy of 94% on our dataset.

KEYWORDS: CCTV, Security.

I. INTRODUCTION

Around 100 people are killed by guns each day in the United States, and an additional 200 people are shot and injured, according to the charity Gun Violence Archive [1]. In the United States, there have been more than 350 mass shootings this year. Beyond these victims, such gun violence has far-reaching implications. Millions of people witness it and live in constant worry of the next shooting, which alters their lives. Therefore, there is a rising social need for the creation of efficient technical solutions to reduce gun violence.

Using surveillance cameras, which are commonly deployed in practically every public location, including schools, malls, businesses, residential flats, and parking lots, is a classic method of reducing possible security concerns. The conventional methods of monitoring, however, necessitate continuous human inspection through a multitude of monitors in real time. Due to fatigue, lack of focus, or loss of important information in the surveillance films, this may cause vulnerable circumstances to be missed [2]. Therefore, it is imperative to have an intelligent surveillance system that can detect security hazards in a stream of videos without human intervention.

The advancement of Artificial Intelligence (AI), Machine Learning (ML), and Internet of Things (IoT) opens up an opportunity to implement such intelligent surveillance systems. Imagine an AI-powered security camera system that can alert about various weapons and guns, masked faces, and suspicious objects in real-time. This can prevent a mass shooting or terrorist attack before it happens. To detect threatening objects in a live video, advanced deep learning models must be deployed on-site to improve object detection and semantic segmentation of the video content. However, it is challenging to deploy ML-enabled surveillance applications on cameras at the network edge because of its intensive computational requirements



II. RELATED WORK

GURUH FAJAR SHIDIK 1 , EDI NOERSASONGKO 1 , ADHITYA NUGRAHA 1 , PULUNG NURTANTIO ANDONO 1 , JUMANTO JUMANTO 2 , AND EDI JAYA KUSUMA 1- In this paper, Intelligent Video SurveillanT (IVIST) is also introduced. IVIST is a prototype system with EDCAR knowledge that provides automatic support to implement related inference procedures such as object tracking and detection to trigger alarms. IVIST system has been investigated by using several target scenarios such as “steal baggage”, “crowd activity”, “unattended baggage”, and “fighting”. From investigation result, each scenario can precisely be detected using IVIST system integrated with EDCAR Framework.

Ahmed Abdel Moamen, Student Member, IEEE, Nadeem Jamali- In this study, we examine the impact of continuous mobile sensing on the energy usage of wearables and smartphones. We first examine several existing systems for serving such applications before presenting some illustrative continuous mobile sensing applications.

Syed Umaid Ahmed Hamza Khalid , Muhammad Affan - This study introduces a face-identification and face-recognition intelligent system with applications in private security, home surveillance, and person tracking. In the event of an unidentified or unknown individual, the real-time video stream is processed, motion is detected, and dual-axis pan-tilt servos track that person with a camera. This is how an automatic facial recognition solves security issues with flexibility. Additionally, video recordings of these odd acts are synced from cloud storage, and mobile notifications are generated.

AHMED ABDELMOAMEN AHMED - In this paper, we present a prototype implementation of such systems, Hawk-Eye, an AI-powered threat detector for smart surveillance cameras. Hawk-Eye can be deployed on centralized servers hosted in the cloud, as well as locally on the surveillance cameras at the network edge. Deploying AI-enabled surveillance applications at the edge enables the initial analysis of the captured images to take place onsite, which reduces the communication overheads and enables swift security actions.

Haoren Cui, Zhihua Wei, Pengyu Zhang, Di Zhang - In this paper, we propose a multiple granular cascaded model of object tracking under surveillance video. For frames in surveillance video, we analyze the frames from different granularity levels. At the coarse level, we utilize Gaussian mixture model combined with a three-frame difference method to extract the foreground region of the frame. At the fine level, a cascaded multi-source feature fusion method is used to classify the region proposal and obtain the location of the target. Finally, we propose some optimization strategies for the online tracker updating. We conduct several comparative experiments on actual surveillance video.

Abhishek Dutta Andrew Zisserman - In this paper, we introduce a simple and standalone manual annotation tool for images, audio and video: the VGG Image Annotator (VIA). This is a light weight, standalone and offline software package that does not require any installation or setup and runs solely in a web browser. The VIA software allows human annotators to define and describe spatial regions in images or video frames, and temporal segments in audio or video

Yun-Xia Liu, Yang Yang, Aijun Shi, Peng Jigang, LiuHaowei- the monitor faces dozens of surveillance video images, which is easy to fatigue. It may not be able to respond in time to abnormal situations due to lack of concentration, and loss key information in the video. In addition, because a large amount of surveillance video needs to be stored for months or years, it will result in a large storage cost. Therefore, the intelligent video surveillance system is urgently needed to assist the monitoring personnel to use the intelligent detection technology to process, analyse and understand the video signal while retaining the original video key information, and automatically detect the target category and location information without manual intervention

Umadevi V Navalgund ,Priyadharshini.K – In this paper author described an automatic handgun detection system in surveillance videos, System controls the occurrences of crimes by detecting the guns in the surveillance videos, it will classify objects like gun or not, predict the crime occurred or not, it gives the solutions which have been compared with sliding window proposal approach, the good results are obtained by FRCNN and RCNN based models trained on dataset. This model shows a high crime prediction occurrence even in low quality videos then produces the best satisfactory results

Ya Wang, Tianlong Bao, Chunhui Ding, Ming Zhu - In this paper, we propose a method for face recognition in real-



world surveillance videos by deep learning. First, a novel dataset from target real-world surveillance videos is constructed automatically and incrementally with the process of face detection, tracking, labeling and purifying. Then, a convolutional neural network with the labeled dataset is finetuned. On the testing dataset collected from the campus surveillance system, the network after fine-tuning achieves recognition accuracy of 92.1 %, which obviously outperforms the network without fine-tuning, which returns a recognition accuracy of 83.6%.

Yi Zhou, Li Liu, Ling Shao - In this paper, we present a fast algorithm: detection and annotation for vehicles (DAVE), which effectively combines vehicle detection and attributes annotation into a unified framework. DAVE consists of two convolutional neural networks: a shallow fully convolutional fast vehicle proposal network (FVPN) for extracting all vehicles' positions, and a deep attributes learning network (ALN), which aims to verify each detection candidate and infer each vehicle's pose, color, and type information simultaneously

III. EXISTING SYSTEM/OPEN ISSUES

The use of a surveillance system for image detection is becoming more important. An embedded surveillance system is frequently used in the home, office or factory for image processing of the surveillance system and also for traffic monitoring but this configuration requires a high performance core, which works against some advantages of embedded systems, such as low power consumption and low cost. Some designs propose the use of different sensors to track the sequence of the human body movement

Negative comments

Depends on Wi-Fi strength: The biggest disadvantage of a wireless camera system is that **it is completely dependent on the strength of your Wi-Fi connection**. Any interruption or weak signal can mean that you may lose connection to the system, resulting in the loss of the film, which can be critical.

IV. CONCLUSION

This study introduces a face-identification and face-recognition intelligent system with applications in private security, home surveillance, and person tracking. In the event of an unidentified or unknown individual, the real-time video stream is processed, motion is detected, and dual-axis pan-tilt servos track that person with a camera. This is how an automatic facial recognition solves security issues with flexibility. Additionally, video recordings of these odd acts are synced from cloud storage, and mobile notifications are generated.

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