Surveillance Based Anomaly Detection Using Deeplearning

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Abstract- As violent criminals, such as child sex offenders, tend to have high recidivism rates in modern society, there is a need to prevent such offenders from approaching socially disadvantaged and crime-prone areas, such as schools or childcare centers. Accordingly, national governments and related institutions have installed surveillance cameras and provided additional personnel to manage and monitor them via video surveillance equipment. However, naked-eye monitoring by guards and manual image processing cannot properly evaluate the video captured by surveillance cameras. To address the various problems of conventional systems that simply store and retrieve image data, a system is needed that can actively classify captured images in real-time, in addition to assisting surveillance personnel. Therefore, this paper proposes a video surveillance system based on a composable deep face recognition method. The proposed system detects the faces of criminals in real time from videos captured by a surveillance camera and notifies relevant institutions of the appearance of criminals. For real-time face detection, a down-sampled image forked from the original is used to localize unspecified faces. To improve accuracy and confidence in the recognition task, a scoring method based on face tracking is proposed. The final score combines the recognition confidence and the standard score to determine the embedding distance from the criminal face embedding data. The blind spots of surveillance personnel can be effectively addressed through early detection of criminals approaching crime-prone areas. The contributions of the paper are as follows. The proposed system can process images from surveillance cameras in real-time by using down-sampling.
Keywords : surveillance cameras, Deep face recognition method, Crime-prone areas

I. INTRODUCTION

A good understanding of "normal" can be invaluable in the detection and identification of possible preoperational surveillance activities at the local level. Just as staging can be detected in violent crime because most criminals do not have a good working knowledge of "normal crime trends" and patterns, those unfamiliar with "normal" in other environments also might reveal themselves when they fail to blend into the surrounding environment. Complex attacks, such as robberies, kidnapping, and terrorist attacks, frequently include a period of preoperational surveillance. Analysis of this activity can be particularly challenging given its relatively low frequency, as well as issues associated with obtaining accurate, complete, and reliable reporting before an attack. Moreover, since the analyst generally is trying to identify and characterize an attack in the planning stages in support of information-based prevention and thwarting, they may never know whether their analysis was successful. While it is difficult to prove a negative, however, no analyst wants to be "right" about predicting an attack.

Again, identifying suspicious or unusual activity can be compared to finding a needle in a haystack. This is where anomaly detection, which is a very powerful, automated process that can be used to identify and characterize extremely low-frequency events, can have tremendous value. Once a single event has been identified and characterized, it can be modeled and used as a veritable data "magnet" to identify additional needles in the informational haystack.

As described earlier, characterization and analysis of suspicious situation reports can guide future surveillance detection operations by highlighting the times and/or locations that are generating the greatest apparent interest. It is always important to remember, however, that there are the incidents that the analysts know about, and those that they do not. Suspicious situation reports generally reflect only a small percentage of all surveillance behavior. By identifying the times and/or locations associated with the greatest degree of apparent interest, as indicated by an increased number of suspicious situation reports, operational resources can be deployed. This has the potential to increase the amount of behavior that is documented through good, targeted surveillance detection.

In addition to supporting general risk and threat assessment, thoughtful analysis of preoperational surveillance reports also can provide some indications regarding the nature of the planned attack to include timing and location, as well as other indicators of the adversary's intentions. This information can be used to prevent or otherwise thwart the planned incident, while also supporting informed response planning and consequence management in the event that the attack cannot be prevented.

It is always essential to review surveillance detection or suspicious situation reports within a larger context. Obvious changes, including surveillance detection training, reports that heighten awareness, or major incidents, can greatly impact natural surveillance and reporting and concomitantly influence the data. While high-profile events or recent training can increase awareness, apathy, complacency, or frustration can decrease reporting. Efforts to maintain reporting and surveillance detection efforts can include reminders and refresher courses, particularly if personnel changes are frequent, to ensure that the information is valued and that attitude is conveyed to the frontline personnel.

Any analytical program, regardless of the sophistication of the analytical tools employed, will be severely compromised by incomplete, inaccurate, or unreliable reporting. You cannot analyze what you do not have, so it behooves the analyst to work with the larger team in an effort to ensure data quality to whatever degree possible. Finally, all results should be interpreted cautiously. Abundant domain expertise and a certain degree of caution is an asset to reviewing these data.

II. RELATED WORK

Ao Shen,et al, Marine debris poses a critical threat to environmental ecosystems, necessitating effective methods for its detection and localization. This study addresses the existing limitations in the literature by proposing an innovative approach that combines the instance segmentation capabilities of YOLOv7 with various attention mechanisms to enhance efficiency and broaden applicability. The primary contribution lies in the exploration and comparison of three attentional models: lightweight coordinate attention, combining spatial and channel focus (CBAM), and bottleneck transformer based on self-attention. Leveraging a meticulously labeled dataset of satellite images containing ocean debris, the study conducts a comprehensive assessment of box detection and mask evaluation. The results demonstrate that CBAM emerges as the standout performer, achieving the highest F1 score (77%) in box detection, surpassing coordinate attention (71%) and YOLOv7/bottleneck transformer (both around 66%). In mask evaluation, CBAM continues to lead with an F1 score of 73%, while coordinate attention and YOLOv7 exhibit comparable performances (around F1 scores of 68% and 69%), and bottleneck transformer lags behind at an F1 score of 56%. This compelling evidence underscores CBAM's superior suitability for detecting marine debris compared to existing methods. Notably, the study reveals an intriguing aspect of the bottleneck transformer, which, despite lower overall performance, successfully detected areas overlooked by manual annotation.

Moreover, it demonstrated enhanced mask precision for larger debris pieces, hinting at potentially superior practical performance in certain scenarios. This nuanced finding underscores the importance of considering specific application requirements when selecting a detection model, as the bottleneck transformer may offer unique advantages in certain contexts.

Bowie Liu,et al, Many countries across the globe face the serious issue of traffic congestion. This paper presents a low-cost graph-based traffic forecasting and congestion detection framework using online images from multiple cameras. The advantage of using a graph neural network (GNN) for traffic forecasting and detection is that it represents the traffic network in a natural way. This framework requires only images from surveillance cameras without any other sensors. It converts the online images into two types of data: traffic volume and image-based traffic occupancy. A clustering-based graph construction method is proposed to build a graph based on the traffic network. For traffic forecasting, multiple models, including statistical models and deep graph convolutional neural networks (GCNs), are used and compared using the extracted data. The framework uses logistic regression to determine the threshold of traffic congestion. In the experiment, we found that the Decoupled Dynamic Spatial-Temporal Graph Neural Network (D2STGNN) model achieved the best performance on the collected dataset. We also propose a threshold-based method for detecting traffic congestion using traffic volume and image-based traffic occupancy. This framework provides a low-cost solution for traffic forecasting and congestion detection when only surveillance images are available.

Simon Wagner,et al, With the rapid development of unpiloted aerial vehicles (UAVs), also known as drones, in recent years, the need for surveillance systems that are able to detect drones has grown as well. Radar is the technology with the potential to fulfill this task, and several previous publications show examples of radar detection and classification schemes. The purpose of this article is related to the detection scheme used in these approaches. Most surveillance systems use a background subtraction and a threshold to detect targets. This

threshold often depends on a model of the radar noise and the background, which is imperfect by nature. The approach presented here uses a data-driven machine learning algorithm that is trained with measured background profiles of the radar and is applied afterward to the given background for target detection. This scheme can in general be applied to any detection problem in a fixed area, but is shown here with examples from measurements of drones and persons. The results show that the chosen approach gives better detection rates for low false alarm rates with real data than that given by background subtraction.

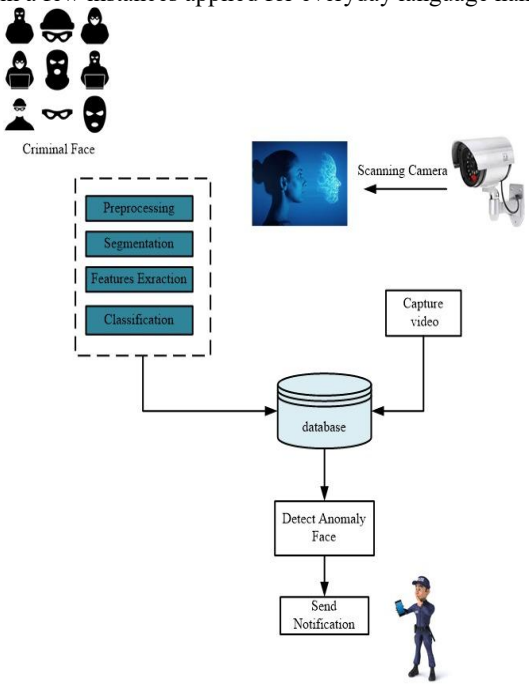
III. PROBLEM DESCRIPTION

Anomaly detection, also known as outlier detection, is a critical task across various domains including cybersecurity, finance, healthcare, manufacturing, and more. The primary goal is to identify patterns or instances that deviate significantly from the norm or expected behavior within a dataset. These anomalies can represent important insights, errors, or malicious activities that require attention. In recent years, with the surge in data generation and complexity, anomaly detection has gained immense importance as organizations strive to maintain operational efficiency, security, and integrity.

The significance of anomaly detection lies in its ability to uncover hidden insights that might otherwise go unnoticed. These insights can lead to proactive decision-making, improved operational efficiency, fraud detection, fault diagnosis, and early warning systems. However, the task of anomaly detection is fraught with challenges. One of the primary challenges is the imbalanced nature of real-world datasets, where anomalies are often rare compared to normal instances. This imbalance poses difficulties in accurately identifying anomalies without raising excessive false alarms. Furthermore, anomalies can manifest in various forms, such as point anomalies, contextual anomalies, collective anomalies, and more, each requiring specialized detection techniques. Moreover, with the advent of big data, streaming data, and complex data structures, traditional anomaly detection methods may struggle to scale and adapt effectively

IV .PROPOSED MODEL

Deep Convolutional Neural Network: Profound studying is an AI technique used to assemble automatic reasoning (AI) frameworks. It relies upon at the opportunity of faux mind organizations (ANN), supposed to carry out complicated research of plenty of data with the aid of using going it via one of a kind layers of patterns.There is a huge collection of profound mind organizations (DNN). Profound convolutional mind organizations (CNN or DCNN) are the kind maximum commonly used to differentiate designs in pix and video.DCNNs have constructed from ordinary faux thoughts associations, the use of a three-layered cerebrum configuration energized with the aid of using the visible cortex of creatures.Deep convolutional mind networks are predominantly targeted round programs like object recognition, photograph characterization, idea frameworks, and are likewise in a few instances applied for everyday language handling



V. PROPOSED METHODOLOGY

The proposed methodology addresses the pressing need to prevent violent criminals, particularly child sex offenders, from accessing socially vulnerable areas like schools and childcare centers, given their high recidivism rates. While surveillance cameras and additional personnel have been deployed by governments and

institutions to monitor these areas, conventional systems relying on manual monitoring and image storage fall short in evaluating captured video data effectively. To overcome these limitations, the paper suggests a novel video surveillance system leveraging composable deep face recognition technology. This system aims to actively classify captured images in real-time, assisting surveillance personnel in identifying and notifying relevant authorities about the presence of criminals. Key to this approach is the use of a down-sampled image for swift real-time face detection, enhancing computational efficiency. Furthermore, a scoring method based on face tracking is proposed to improve recognition accuracy and confidence by evaluating consistency across frames and comparing facial embeddings with known criminal data. By combining recognition confidence and standard scores, the system determines the embedding distance from criminal face data, thus enabling early detection of criminals approaching crime-prone areas and addressing surveillance blind spots. A notable contribution of the proposed system is its ability to process surveillance camera images in real-time through down-sampling, enhancing the responsiveness and effectiveness of crime prevention measures.

VI . CONCLUSION

In conclusion, the proposed methodology offers a comprehensive solution to the critical issue of preventing violent criminals, particularly child sex offenders, from accessing socially vulnerable areas such as schools and childcare centers. Despite the deployment of surveillance cameras and additional personnel by governments and institutions, conventional systems have struggled to effectively evaluate captured video data, leaving these areas susceptible to criminal activity. By introducing a novel video surveillance system built on composable deep face recognition technology, this paper provides a timely and innovative approach to address these shortcomings.

The proposed system's ability to actively classify captured images in real-time significantly enhances the capabilities of surveillance personnel, empowering them to swiftly identify and notify relevant authorities about the presence of criminals. Leveraging a down-sampled image for rapid face detection ensures computational efficiency without compromising accuracy. Moreover, the introduction of a scoring method based on face tracking improves recognition accuracy and confidence by assessing consistency across frames and comparing facial embeddings with known criminal data.

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