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ADVANCED SHOPLIFTING PREVENTION AND ALERT STSYEM

Author:

M. MUSHARUF RAHMAN
Department of Computer Applications
B. S. Abdur Rahman Crescent Institute of Science and Technology
Vandalur, Chennai-600048

Under the guidance of:

Dr. A. K. ASHFAUK AHAMED
Supervisor
Assistant Professor (Sr.Gr)
Department of Computer Applications
B. S. Abdur Rahman Crescent Institute of Science and Technology
Vandalur, Chennai-600048

Abstract

Detecting human beings accurately in a visual surveillance system is crucial for diverse application areas including abnormal event detection, human gait characterization, congestion analysis, person identification, gender classification and fall detection for elderly people. The first step of the detection process is to detect an object which is in motion. Object detection could be performed using YOLOv7, optical flow and spatio-temporal filtering techniques. Once detected, a moving object could be classified as a human being using shape-based, texture-based or motion-based features. A comprehensive review with comparisons on available techniques for detecting human beings in surveillance videos is presented in this paper.

The characteristics of few benchmark datasets as well as the future research directions on human detection have also been discussed. We can use camera for Human Motion Detection. The Camera is used to catch the live images of the area in which it is being implemented, if any object is moving. The captured images are stored for further work. If motion is found in this video, the computer will start recording, buzz an alarm and send SMS to people listed in its database. In this way the system will provide the security against any misdeed.

Keywords: YOLOv7, SMS, E-mail, CCTV, SMTP, RFID

Introduction

Shoplifting remains a pervasive issue for retail businesses, with theft incidents costing the industry billions of dollars annually. Traditional surveillance methods have proven inadequate in effectively identifying and preventing shoplifting behaviors. As such, there is a growing need for innovative solutions that can enhance security measures and reduce losses. In response to this need, we propose a novel approach leveraging deep learning and computer vision techniques to develop a shoplifting detection and alert system.

Our system is built upon the YOLOv7 object detection framework, renowned for its high accuracy and real-time processing capabilities. By analyzing surveillance video feeds in real-time, our system can detect and track objects of interest, such as suspicious behaviors associated with shoplifting. Upon detection, the system triggers immediate alerts to designated personnel, enabling timely intervention to prevent theft.

The primary goal of our system is to enhance security measures in retail environments, thereby reducing theft incidents and minimizing financial losses. Additionally, our system aims to improve the overall shopping experience for customers by creating a safer and more secure shopping environment.

Literature survey

[1] "Advance Anti-Theft Flooring Security System using Raspberry PI" –2023. Manan Dhawan, Er. Disha Sharma, Shivansh Kumar. The Advanced Anti-Theft Flooring Security System employs Raspberry Pi technology to detect unauthorized entry. Integrated sensors detect weight variances and trigger alerts if anomalies are detected, such as attempts to move or tamper with secured objects. The system utilizes Raspberry Pi's computing power to analyze sensor data in real-time, enabling swift response mechanisms like alarms or notifications to thwart theft attempts.

[2] "Detection of Shoplifting on Video Using a Hybrid Network" –2022. Lyudmyla Kirichenko, Tamara Radivilova. A hybrid network for shoplifting detection on video combines traditional computer vision methods with deep learning techniques. By leveraging the strengths of both approaches, the system can accurately identify suspicious behaviours such as concealing items or abnormal movements in retail environments. Through extensive training on diverse datasets, the hybrid network learns to distinguish between regular shopping activities and potential theft, providing valuable assistance to security personnel in preventing loss and ensuring a safer shopping experience.

[3] "An Expert Shoplifting Activity Recognition System" – 2022. Mohd. Aquib Ansari, Dushyant Kumar Singh. The Expert Shoplifting Activity Recognition System is a sophisticated solution designed to detect and prevent theft in retail environments. Using advanced algorithms and surveillance technology, it identifies suspicious behaviours indicative of shoplifting, such as concealing items, loitering in certain areas, or engaging in unusual movements. By leveraging real-time monitoring and analysis, this system enhances security measures, reduces losses, and ensures a safer shopping experience for customers and staff alike.

[4] "A Supermarket Anti-Theft RFID Scanner: Digicam" – 2023. Benjamin Kommey, Elvis Tamakloe, Eliel Keelson. A hybrid network for shoplifting detection on video combines traditional computer vision methods with deep learning techniques. By leveraging the strengths of both approaches, the system can accurately identify suspicious behaviours such as concealing items or abnormal movements in retail environments. Through extensive training on diverse datasets, the hybrid network learns to distinguish between regular shopping activities and potential theft, providing valuable assistance to security personnel in preventing loss and ensuring a safer shopping experience.

Existing system

Traditional methods for shoplifting detection in retail environments typically rely on manual surveillance by security personnel or the use of basic CCTV systems. These methods have several limitations, including human error, limited coverage, and the inability to provide real-time alerts. Security personnel may not always be able to monitor all areas of a store simultaneously, leaving blind spots where shoplifting incidents can occur undetected. Additionally, manual monitoring is labor-intensive and costly, making it impractical for large retail establishments. Basic CCTV systems, while useful for recording footage, lack the advanced capabilities needed for real-time object detection and behavior analysis.

They often require manual review of recorded footage to identify shoplifting incidents after the fact, which can be time-consuming and ineffective for preventing theft in progress. Overall, these existing methods are reactive rather than proactive, often resulting in a delay in response and a higher likelihood of successful shoplifting attempts.

Drawbacks of existing system

- ✓ Limited Coverage
- ✓ Human Error
- ✓ Reactive Nature
- ✓ Cost and Labor Intensive
- ✓ Lack of Real-Time Alerts

Proposed system

Our shoplifting detection and alert system use YOLOv7 for real-time object detection in surveillance videos, trained to recognize shoplifting behaviors like concealing items or leaving without payment. The system

continuously analyzes video feeds, and when suspicious behavior is detected, it sends an immediate alert to security personnel with relevant details. This proactive approach enables swift intervention, potentially preventing theft. Unlike traditional methods relying on manual monitoring, our system provides real-time alerts, improving the effectiveness of loss prevention.

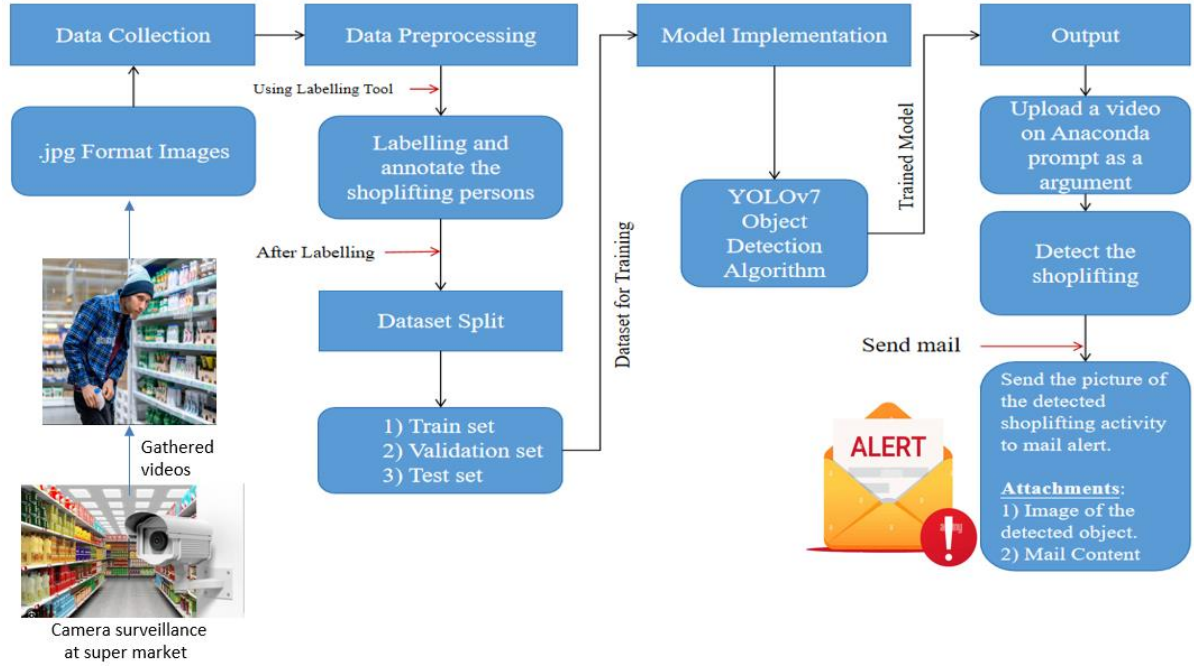
Its automated nature reduces the need for constant human surveillance, making it cost-effective and efficient. Additionally, the system is scalable and can integrate with existing surveillance systems, making it adaptable to various retail environments. Upon detection, the system triggers immediate alerts to store security personnel, enabling proactive intervention. Additionally, it offers analytics tools to identify trends and patterns, enhancing overall loss prevention strategies for retail environments.

Advantage of proposed system

- ✓ Real-time Detection
- ✓ Proactive Approach
- ✓ Cost-effective
- ✓ Scalability
- ✓ Improved Security Measures
- ✓ Enhanced Loss Prevention

Proposed work:

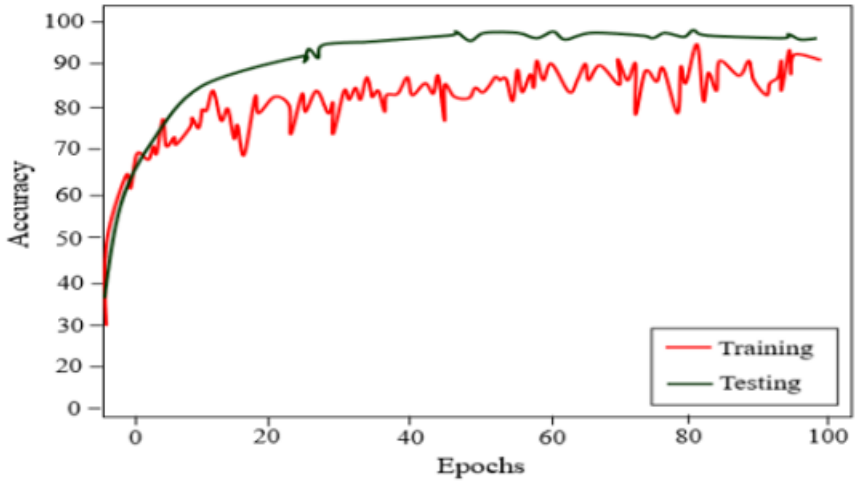
Overall Architecture:



Methodology:

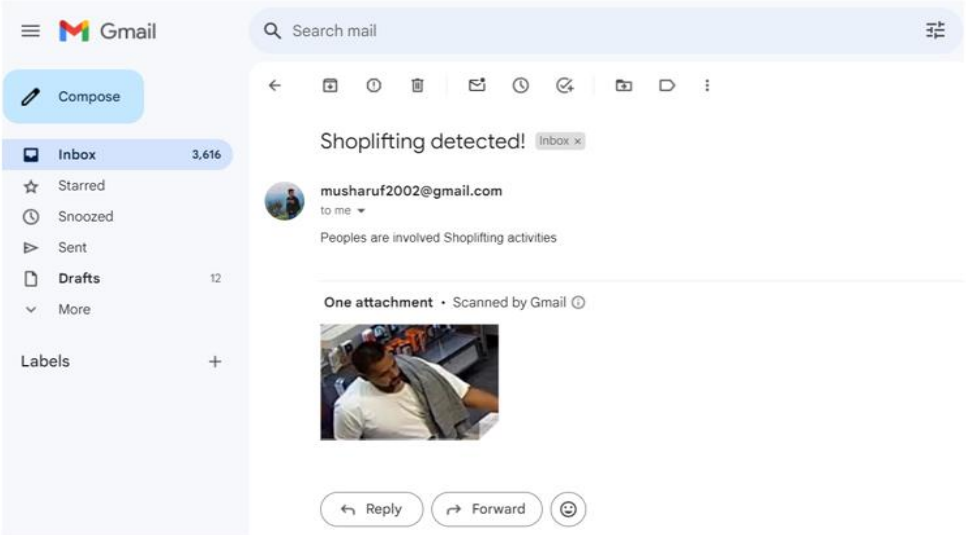
YOLOv7 (You Only Look Once version 7)

You Only Look Once (YOLO) is a state-of-the-art object detection algorithm that revolutionized computer vision by enabling real-time, high-precision detection of multiple objects in images or video frames. Unlike traditional methods that involve multiple passes over an image, YOLO divides the image into a grid and simultaneously predicts bounding boxes and class probabilities for objects within each grid cell. This one-shot approach allows YOLO to achieve remarkable speed without compromising accuracy. YOLO's efficiency and effectiveness make it widely adopted in applications ranging from autonomous vehicles and surveillance to medical imaging, where rapid and accurate object detection is crucial.

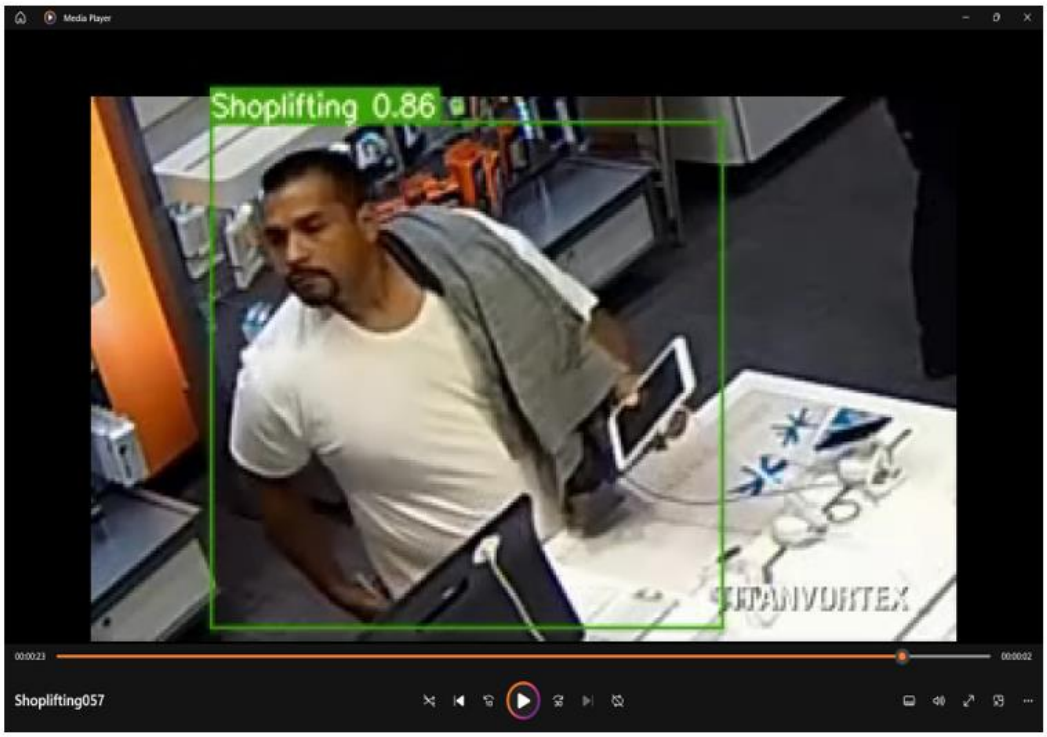


Accuracy of YOLOv7

Output screenshot:



Alert message received in E-mail



Theft person identified

Conclusion:

In conclusion, our shoplifting detection and alert system represents a significant advancement in loss prevention strategies for the retail industry. By leveraging YOLOv7 for real-time object detection, the system offers high accuracy in identifying suspicious behaviors associated with shoplifting. Its proactive approach, coupled with real-time alerts and email notifications, enables swift intervention by security personnel, potentially preventing thefts from occurring. Furthermore, the system's scalability and integration with existing surveillance systems make it adaptable to various retail environments. Overall, our system enhances security measures, reduces theft incidents, and improves the overall shopping experience for customers and employees alike.

References:

[1] Nazir, A., Mitra, R., Sulieman, H., & Kamalov, F. (2023). Suspicious Behavior Detection with Temporal Feature Extraction and Time-Series Classification for Shoplifting Crime Prevention. Sensors, 23(13), 5811.

[2] Kim, S., Hwang, S., & Hong, S. H. (2021). Identifying shoplifting behaviors and inferring behavior intention based on human action detection and sequence analysis. Advanced Engineering Informatics, 50, 101399.

[3] Kamble, K., Jadhav, P., Shanware, A., & Chitte, P. (2022). Smart Surveillance System for Anomaly Recognition. In ITM Web of Conferences (Vol. 44, p. 02003). EDP Sciences.

[4] Abirami, N., Radhika, G., & Radhika, N. (2023, December). Automated Teller Machine Security and Robbery Prevention Based on Human Behaviour Analysis. In 2023 Innovations in Power and Advanced Computing Technologies (i-PACT) (pp. 1-6). IEEE.

[5] Erlina, T., & Fikri, M. (2023). A YOLO Algorithm-based Visitor Detection System for Small Retail Stores using Single Board Computer. Journal of Applied Engineering and Technological Science (JAETS), 4(2), 908-920.

[6] Setiarso, G., Hirzan, A. M., & Hartanto, A. (2023). Human Recognition with Yolo to Reduce False Alarms in the Internet-of-Things-Based Motion Detection System. Journal of Advanced Computing Technology and Application (JACTA), 5(1), 1-12.

[7] Firmasyah, G., Joniwan, J., Widodo, A. M., & Tjahjono, B. (2023). Preventing Child Kidnaping at Home Using CCTV that Utilizes Face Recognition with You Only Look Once (YOLO) Algorithm. Journal of Social Research, 2(9), 3291-3304.

[8] Pavithra, S., & Murugananthan, B. (2024). Utilizing enhanced deep learning methods for residential burglary detection via analysis of human behavior patterns. Multimedia Tools and Applications, 1-20.

[9] KOŞUN, G. O., YILMAZ, S., KAYIPMAZ, Y., & ŞAMLI, R. (2023). Preventing Crime and Terrorist Activities with a New Anomaly Detection Approach Based on Outfit. Journal of Innovative Science and Engineering, 7(2), 167-182.

[10] Dubey, P., & Mittan, R. K. (2024). A Critical Study on Suspicious Object Detection with Images and Videos Using Machine Learning Techniques. SN Computer Science, 5(5), 505.

[11] Rane, N. (2023). YOLO and Faster R-CNN object detection for smart Industry 4.0 and Industry 5.0: applications, challenges, and opportunities. Available at SSRN 4624206.

[12] Damera, V. K., Vatambeti, R., Mekala, M. S., Pani, A. K., & Manjunath, C. (2023). Normalized Attention Neural Network with Adaptive Feature Recalibration for Detecting the Unusual Activities Using Video Surveillance Camera. International Journal of Safety & Security Engineering, 13(1).