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Smart Surveillance System for Women and Children Using Machine Learning

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Abstract

The safety of women and children is a major concern in modern society due to increasing incidents of harassment and violence. Conventional monitoring methods rely heavily on manual observation and passive video recording, often resulting in delayed responses and missed critical events. To address these limitations, this project proposes a Smart Surveillance System that leverages Machine Learning techniques for intelligent video analysis. The system is designed as a web-based application that allows users to upload video files for automated processing. It utilizes YOLOv8 (You Only Look Once Version 8) for real-time human detection and suspicious activity identification. When potential threats are detected, the system triggers an immediate visual alert through a full-screen flashing red overlay along with a siren sound. All incidents are automatically recorded in an SQLite database with timestamps for future reference and analysis. The proposed system emphasizes automation, rapid response, reliability, and ease of use. Experimental evaluation demonstrates high detection accuracy and prompt alert generation. This intelligent application-based solution provides a proactive safety mechanism suitable for homes, schools, hostels, and public environments.

Keywords: Smart Surveillance, Machine Learning, YOLOv8, Real-Time Detection, Violence Alert, Women Safety, Children Safety, Automated Monitoring.

1. Introduction

Ensuring the safety and security of women and children has become a critical societal priority. Incidents of harassment, abuse, and violence occur in various domestic, institutional, and public environments. Traditional monitoring approaches depend largely on human supervision of recorded videos. Such methods are labor-intensive, prone to human error, and often result in delayed responses to emergencies. Advancements in Machine Learning and Computer Vision have enabled intelligent systems to automatically analyze video content and detect suspicious activities in real time. These technologies reduce dependence on manual monitoring and provide immediate alerts when abnormal behavior is detected. This project presents a web-based Smart Surveillance Application that processes uploaded video files using the YOLOv8 object detection model. The system analyzes video frames to detect human presence and identify potentially violent behavior. When suspicious activity is detected, an automated alert mechanism is activated, including a full-screen red flashing overlay, a siren sound, and automatic database logging. The system is designed to provide a proactive, intelligent, and user-friendly solution to enhance the safety of women and children.

2. Review of Literature

Recent developments in deep learning have significantly improved intelligent video surveillance systems. The introduction of YOLO (You Only Look Once) revolutionized object detection by treating detection as a single regression problem rather than a multi-stage process. Earlier versions such as YOLOv3 and YOLOv4 demonstrated high detection speed and improved accuracy, making them suitable for real-time applications. The latest version, YOLOv8, introduced by Ultralytics, provides enhanced performance through anchor-free detection and optimized training techniques, making it highly effective for real-time human detection tasks. Foundational research in machine learning and deep learning has contributed significantly to the development of such intelligent systems. Pattern recognition and probabilistic learning theories form the backbone of automated detection models. Convolutional Neural Networks (CNNs), in particular, have shown remarkable performance in image and video classification tasks. These models extract hierarchical features from visual data, enabling systems to differentiate between normal and abnormal activities effectively. Several researchers have proposed intelligent video monitoring systems using computer vision techniques. Studies on deep

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learning-based violence detection demonstrate that automated systems can classify violent and non-violent activities with considerable accuracy. However, many existing works focus mainly on detection algorithms without integrating a complete web-based alert system and structured database logging. The present system addresses this gap by combining real-time detection, automated audio-visual alerts, and incident logging within a single user-friendly application framework. Swarm Optimization with Neural Networks for Effective Classification Techniques" by K. Kalyani (2021) introduces a hybrid EHBMO-NN model, combining Extended Honey Bee Mating Optimization with Artificial Neural Networks to improve classification accuracy and reduce training time. It uses HBMO to select optimal weights for neural network hidden layers, outperforming conventional methods on benchmark datasets. The accurate cancer classification is very important task for cancer treatment. Recently the informative genes are identified from the thousands of genes for correct cancer classification. The collection of microscopic Deoxyribo Nucleic Acid (DNA) microarray is attached in the solid surface. In this study, DNA microarray data is used for cancer classification. The accurate cancer classification is very important task for cancer treatment. Recently the informative genes are identified from the thousands of genes for correct cancer classification. The collection of microscopic Deoxyribo Nucleic Acid (DNA) microarray is attached in the solid surface. In this study, DNA microarray data is used for cancer classification (6)

3. Existing System

Conventional surveillance systems largely depend on manual monitoring and passive video recording. Human operators must continuously watch CCTV footage or review recorded videos to detect suspicious activities. This approach is time-consuming, labor-intensive, and prone to errors, as critical incidents can easily be missed due to fatigue, distraction, or oversight. As a result, these systems are mostly reactive, identifying threats only after reviewing footage, which often leads to delayed intervention. Another limitation of traditional systems is the lack of automated real-time alerts. Unlike intelligent monitoring, conventional setups do not trigger immediate visual or audio warnings, such as flashing lights or sirens, when abnormal behavior occurs. This makes rapid response dependent entirely on human observation, reducing the effectiveness of surveillance in urgent situations. Moreover, existing systems do not provide a structured mechanism for logging incidents. While video footage may be stored, there is no organized database to record events with timestamps and detailed descriptions, making it difficult to retrieve, analyze, or reference past incidents efficiently. These combined limitations emphasize the need for an intelligent, automated surveillance system that can detect threats in real time, generate instant alerts, and maintain organized records, thereby significantly enhancing the safety of women and children.

4. Proposed System

The proposed Smart Surveillance System is a web-based intelligent monitoring application that integrates Machine Learning with real-time alert mechanisms. The system allows users to upload video files through a simple interface. The uploaded video is processed frame-by-frame using the YOLOv8 model to detect human presence and potential suspicious behavior. When abnormal activity is identified, the system triggers a full-screen flashing red overlay and activates a loud siren alarm. Simultaneously, the incident is logged into an SQLite database with relevant details such as timestamp and event description. The alert system is designed to prevent repeated alarm spamming, ensuring reliability and professional operation. By combining intelligent detection, automated alerts, and structured logging, the system provides proactive monitoring and enhances the safety of women and children in homes, educational institutions, and public spaces.

System Workflow:

The workflow begins when the user uploads a video through the web interface. The system processes the video frame-by-frame using YOLOv8. Human presence and suspicious behavior are detected through the trained model. If a potential threat is identified, the system activates the red flashing alert and siren sound while logging the event in the database. The user can manually stop the alarm using the STOP ALARM button provided in the interface.

5. Experimental Results

The proposed Smart Surveillance System was tested using a set of pre-recorded video files containing both normal activities and simulated violent scenarios. The implementation was carried out using Python 3.10 and the Flask framework for the web interface. OpenCV was used for video frame processing, YOLOv8 for human detection and activity recognition, and SQLite for incident logging. Videos included a mix of indoor and outdoor scenes with varying lighting conditions and multiple human subjects to assess the robustness of the system. The accuracy of human detection was evaluated by comparing the system's predictions against manually labeled frames. Out of 1,000 annotated frames, the system correctly identified humans in 975 frames, resulting in a detection accuracy of 97.5%. False positives were minimal, with only 15 frames incorrectly flagged as containing human presence. These results indicate that YOLOv8 performs reliably in real-time detection, even under challenging conditions such as partial occlusions or crowded environments. To evaluate the system's ability to detect suspicious or violent behavior, 200 video clips simulating abnormal activity were tested. The system successfully detected potential threats in 186 clips, achieving a threat detection accuracy of 93%. In 14 clips, minor misclassifications occurred due to ambiguous motion patterns, which demonstrates that while the model is highly effective, extreme or subtle behaviors may occasionally be misinterpreted. The real-time alert mechanism was also tested for responsiveness. Upon detecting abnormal activity, the system immediately activated the full-screen red overlay and siren alarm. The average response time measured from the frame where the abnormal behavior first appeared to the alert activation was 0.42 seconds, confirming the system's ability to provide rapid warnings without noticeable delay. The STOP ALARM button successfully deactivated the alerts in all cases, ensuring user control and preventing repeated alarm spamming. Database logging performance was evaluated by checking the recorded incidents in SQLite. Each detected event was automatically logged with a timestamp, video frame number, and brief description of the activity. Out of 186 detected violent incidents, all were accurately recorded without loss, demonstrating 100% logging reliability. This allows administrators to review events efficiently and maintain structured records for analysis or reporting. The system's overall performance was tested by running multiple videos simultaneously on a standard computer setup (Intel i5 processor, 16GB RAM). There was no noticeable lag or

system crash, and the frame processing rate averaged 18–20 frames per second, which is sufficient for near real-time monitoring. The web interface functioned smoothly, with video upload, alert activation, and alarm control responding without delay. In summary, the experimental results confirm that the Smart Surveillance System is accurate, responsive, and reliable. With 97.5% human detection accuracy, 93% threat detection accuracy, 0.42-second alert response time, and 100% incident logging reliability, the system demonstrates its effectiveness in providing a proactive safety mechanism for women and children. These results validate the proposed approach as a practical and scalable solution for homes, schools, hostels, and public spaces.

6. Conclusion

The Smart Surveillance System for Women and Children Using Machine Learning demonstrates an intelligent and automated approach to safety monitoring. By integrating YOLOv8-based detection with a web-based interface and real-time alert mechanisms, the system overcomes the limitations of traditional manual monitoring methods. The application processes uploaded videos, detects suspicious activities, and triggers immediate audio-visual alerts. Structured database logging ensures proper record maintenance and future analysis. Experimental results confirm that the system is accurate, reliable, and user-friendly. The system provides a proactive safety mechanism suitable for domestic, institutional, and public environments. Future enhancements may include email or SMS notifications, multi-camera live streaming support, and advanced deep learning-based violence classification models to further improve system effectiveness.

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