

# CCTV Intrusion Detection Model Using Spatiotemporal Frequency Analysis

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**Abstract**— A CCTV-based intrusion detection system is a security technology that detects intrusions by analyzing real-time video feeds, commonly used in public spaces, businesses, and other critical infrastructures to safeguard assets and individuals. These systems are essential for ensuring security, as they provide continuous monitoring and alert capabilities. However, conventional systems often rely on simple rule-based models that lack adaptability to complex and dynamic environments, leading to frequent false positives and missed detections. For example, environmental factors such as lighting changes, shadows, or the movement of animals can trigger unnecessary alarms, creating inefficiencies and diminishing trust in the system's reliability. Additionally, these systems usually require intricate manual configurations, where users need to define specific detection rules for each camera or surveillance area. This can become particularly challenging in large-scale environments with multiple cameras, as it increases the risk of human error, slows down deployment, and limits the system's overall management efficiency.

To address these limitations, the proposed model acquires real-time streaming data from CCTV cameras using the RTSP protocol and utilizes the YOLO deep learning object detection algorithm to accurately detect objects such as people, vehicles, and other relevant entities within the video. YOLO's high-speed and precise object detection capabilities allow for more reliable identification of potential intrusions, even in real-time scenarios. Once the objects are detected, their positional data is fed into a spatiotemporal grid frequency analysis model, which examines the frequency of object occurrences over time and across different areas within the surveillance zone. Areas with low occurrence frequencies are automatically designated as restricted zones using a threshold mechanism, reducing the need for manual input and constant monitoring. This automated approach not only lightens the load on users but also significantly enhances the system's ability to detect actual threats while minimizing false alerts. By integrating advanced deep learning techniques and automation, the model offers a more efficient, accurate, and user-friendly solution for modern security needs

**Keyword**— CCTV-based Intrusion Detection, YOLO, RTSP, Spatiotemporal Grid Frequency Analysis, Restricted Zones Detection.



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