Intelligent Surveillance System Using Artificial Intelligence and Machine Learning

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Abstract: *The rapid expansion of urban infrastructure and the increasing complexity of public spaces have intensified the demand for advanced surveillance mechanisms capable of ensuring safety and security. Conventional security systems rely heavily on continuous manual monitoring by human operators, a process inherently limited by fatigue, intermittent attention spans, and delayed reaction times. This paper presents a unified Intelligent Surveillance System leveraging Deep Learning (DL) and Machine Learning (ML) to automate the detection of security threats. The system utilizes state-of-the-art architectures, specifically YOLOv8 (You Only Look Once) for real-time object detection (fire, weapons) and MobileNetV2 combined with Long Short-Term Memory (LSTM) networks for temporal violence recognition.*

The proposed framework processes live video feeds to detect human violence, firearms, sharp weapons, fire hazards, and security violations in real-time. Experimental evaluations demonstrate that the system achieves high detection accuracy—ranging from 74% in initial Inception-v3 prototypes to 95.7% in optimized MobileNetV2 models—while operating at sufficient frame rates (28 FPS) for live monitoring. Furthermore, the system integrates an automated response mechanism capable of dispatching SMS alerts, initiating AI-driven voice calls to the main office, and triggering on-site alarms, thereby transforming passive surveillance into a proactive security solution.

Keywords*: Intelligent Surveillance, YOLOv8, MobileNetV2, LSTM, Weapon Detection, Fire Detection, Real-Time Analytics*