IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 2, November 2025
Impact Factor: 7.67

Hybrid Viola–Jones and ArcFace Based Real-Time Face Surveillance Framework

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Abstract: *In recent years, intelligent surveillance has become a crucial aspect of modern security systems, demanding automated, accurate, and real-time face recognition capabilities. This paper presents a hybrid framework that combines the classical Viola–Jones algorithm for rapid face detection with the deep-learning-based ArcFace model for high- precision face recognition. The proposed system captures live video streams through a standard webcam, detects faces using Haar cascade classifiers, and generates 512-dimensional embeddings via ArcFace to identify individuals accurately. Cosine similarity is employed to match live embeddings with pre-stored feature vectors in the gallery database. Upon recognition, the system triggers an audible alarm and sends an automated email notification to authorized personnel, ensuring immediate response to potential security events. The framework is implemented using Python, OpenCV, and Flask, providing an easy-to-use web interface for real-time monitoring and dataset management. Experimental results demonstrate that the hybrid approach achieves enhanced accuracy, reduced latency, and efficient performance on standard CPU-based hardware, making it suitable for intelligent security applications.*

Keywords: Face Detection, Face Recognition, Viola–Jones Algorithm, ArcFace, Real-Time Surveillance, Deep Learning, Intelligent Security Systems

DOI: 10.48175/IJARSCT-29731