

Person Re-Identification for Public Safety in Indian Railways using Deep Learning

¹Ch.Sindhu Priyanka,²N.Durga Manasa,³R.Jitendra,⁴N.Amulya,⁵T.Bhuvana Chandrika

¹Associate Professor, Department of Computer Science & Engineering, Eluru College of Engineering and Technology

^{2,3,4,5} B. Tech Student, Department of Computer Science & Engineering, Eluru College of Engineering and Technology

ABSTRACT

The increasing threat to public safety in crowded transportation hubs like Indian Railways necessitates the deployment of intelligent surveillance systems. This project presents a deep learning-based approach for Person Re-Identification (Re-ID), aimed at identifying and tracking suspicious individuals across multiple surveillance feeds. Traditional methods relying on handcrafted features often fall short in accuracy; thus, this system leverages Convolutional Neural Networks (CNNs) to extract robust facial and pose features from images. The project pipeline includes: (1) uploading a database of suspicious individuals; (2) extracting features using CNNs; (3) training classification models such as Random Forest and SVM to optimize detection; and (4) deploying a real-time video monitoring system accessible by railway personnel. Alerts generated from surveillance videos are logged and reviewed by the admin for actionable intelligence. Implemented using Python and MySQL, the system offers modules for both administrative control and employee-level video monitoring. Results from testing indicate that the Random Forest model achieved higher accuracy, effectively identifying suspects like “Osama” from test videos and minimizing false positives. This solution showcases the practical potential of deep learning in bolstering public safety within India's railway infrastructure through automated and scalable surveillance.

Keywords: Person Re-Identification, Deep Learning, Convolutional Neural Networks (CNN), Surveillance System, Suspicious Person Detection, Random Forest, Support Vector Machine (SVM), Video Monitoring, Public Safety, Indian Railways Surveillance.

I. INTRODUCTION

In a vast and populous country like India, ensuring public safety within the railway network—a primary mode of transportation—is a complex and critical task. One of the pressing challenges is the identification and tracking of suspicious individuals across the extensive surveillance systems deployed at railway stations. Traditional person identification systems, which rely on hand-crafted image features, often suffer from low accuracy and fail to adapt to variations in appearance, pose, and lighting across different camera views. To address these limitations, this project implements a Person Re-Identification (Re-ID) system utilizing Deep Learning techniques. The goal is to accurately detect and match individuals across multiple CCTV camera feeds by extracting high-level face and pose features using

Convolutional Neural Networks (CNNs). These features are then used to train classification models such as Random Forest and Support Vector Machine (SVM) to identify and flag suspicious persons based on pre-existing criminal databases. This system is tailored for the Indian Railways environment and includes multiple modules, such as: Admin Panel for uploading datasets, training models, and managing employee access. Employee Panel for monitoring live or recorded CCTV footage and triggering alerts based on re-identified individuals. Alert System that logs all suspicious detections for administrative review.

The software infrastructure includes a Python-based web server and MySQL database for storage and processing. The system allows real-time video monitoring, intelligent alert generation, and

centralized management—making it a robust solution for enhancing railway security and public safety.

II. LITERATURE SURVEY

1. Title: Person Re-Identification Using Deep Convolutional Neural Networks for Surveillance Systems

Abstract:

Person re-identification has become an important task in modern surveillance systems for tracking individuals across multiple camera views. Traditional methods based on handcrafted features often struggle to capture complex visual variations such as pose changes, illumination differences, and occlusions. This study proposes a deep learning-based approach using Convolutional Neural Networks (CNNs) to automatically extract discriminative features from images. The extracted features are then used to match individuals across different cameras. Experimental results show that deep learning significantly improves identification accuracy compared to conventional feature extraction techniques, making it suitable for large-scale surveillance environments.

2. Title: Deep Learning-Based Suspicious Person Detection in Public Surveillance

Abstract:

Public transportation hubs such as railway stations require advanced surveillance systems to ensure passenger safety. This research presents a deep learning-based suspicious person detection system that uses CNN models to extract facial and body features from surveillance images. The extracted features are classified using machine learning algorithms to identify individuals from a predefined suspicious persons database. The system is capable of monitoring real-time video streams and generating alerts when a match is detected. The proposed approach improves surveillance efficiency and reduces manual monitoring efforts.

3. Title: Machine Learning Techniques for Person Re-Identification in Multi-Camera Surveillance

Abstract:

Person re-identification plays a critical role in

intelligent video surveillance systems. This study explores the use of machine learning algorithms such as Support Vector Machine (SVM) and Random Forest for identifying individuals across multiple camera feeds. Features extracted from images using deep learning models are used as input for classification. The performance of different classifiers is evaluated based on accuracy and detection rate. Results indicate that combining deep learning feature extraction with machine learning classifiers improves identification performance in complex environments.

4. Title: AI-Based Surveillance System for Public Safety in Railway Stations

Abstract:

Ensuring safety in crowded railway stations requires intelligent monitoring systems capable of detecting suspicious activities automatically. This paper proposes an AI-driven surveillance framework that integrates deep learning for image feature extraction and machine learning for classification. The system maintains a database of suspicious individuals and compares them with faces detected in surveillance videos. When a match is identified, alerts are sent to security personnel for immediate action. The proposed system enhances real-time monitoring and improves the overall safety of railway infrastructure.

5. Title: CNN-Based Feature Extraction for Person Re-Identification in Intelligent Surveillance

Abstract:

Person re-identification involves matching individuals captured by different surveillance cameras in large-scale environments. This research focuses on the use of Convolutional Neural Networks (CNNs) for extracting robust facial and body features from images. The extracted features are used to train classification models that identify individuals accurately. Experimental analysis demonstrates that CNN-based feature extraction significantly improves recognition performance and reduces false matches in surveillance systems.

III. EXISTING SYSTEM

In the current security infrastructure of Indian Railways, person identification across different surveillance cameras relies heavily on manually crafted image features. These traditional systems attempt to match a person captured on one camera with their images on other cameras by extracting basic visual attributes. However, these handcrafted features lack robustness and are highly susceptible to changes in lighting, pose, clothing, and camera angle, leading to significantly low accuracy in identifying individuals. This limitation poses a serious risk in scenarios involving the monitoring and tracking of suspicious or criminal individuals across vast railway networks. Additionally, the system does not integrate any automated learning mechanism, making real-time recognition and alerting both slow and unreliable.

IV. PROPOSED SYSTEM

To address the shortcomings of existing systems, the proposed solution leverages deep learning techniques, specifically Convolutional Neural Networks (CNNs), for efficient person re-identification. This system enhances surveillance by automatically extracting high-level face and pose features from video footage and matching them with a preloaded database of suspicious individuals. These features are then classified using machine learning algorithms such as Random Forest and Support Vector Machines (SVM), ensuring high accuracy in detection. The system includes separate interfaces for railway administrators and employees: administrators manage data uploads, feature extraction, and model training, while employees can monitor railway video feeds in real time. Upon identifying a match, the system instantly logs alerts, enabling faster and more informed responses to potential threats, thereby improving public safety within the railway premises.

V. SYSTEM ARCHITECTURE

The diagram illustrates the Person Re-Identification (Re-ID) process used in intelligent surveillance systems. In this process, a probe image (an image of a person captured from a surveillance camera) is first provided as input to the system. At the same time, a template gallery contains a database of images of different individuals collected from various cameras or stored datasets. For both the probe image and the gallery images, the system performs descriptor generation, where deep learning models such as Convolutional Neural Networks (CNNs) extract important visual features like body shape, clothing patterns, facial characteristics, and pose information. After extracting these features, the system performs matching score computation, where the similarity between the probe image and each gallery image is calculated. Based on these similarity scores, the system generates a ranked list of gallery images, ordered from the most similar to the least similar to the probe image. The correct match usually appears at the top of the ranked list, highlighted in the results. This ranking helps surveillance systems quickly identify whether the person in the probe image matches any individual in the database, enabling efficient tracking and identification of suspicious persons across multiple camera views.

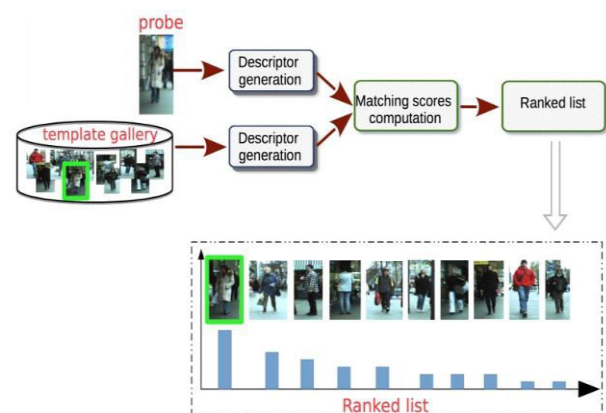


Fig 5.1: Structure of the Proposed System

VI. IMPLEMENTATION

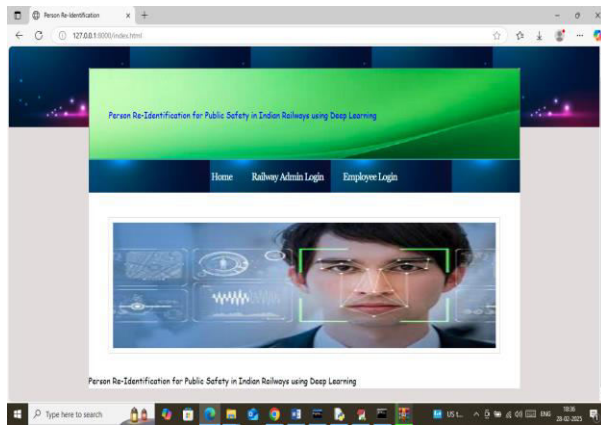


Fig 6.1: Home Page

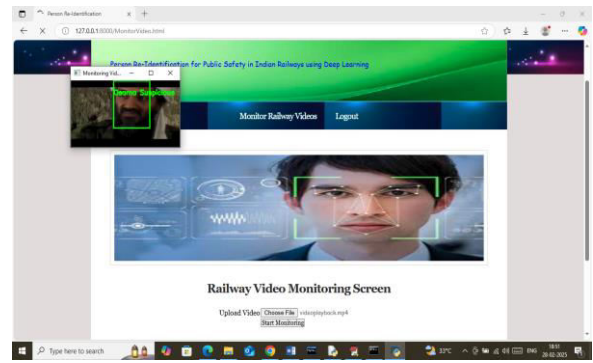


Fig 6.5: Result Page

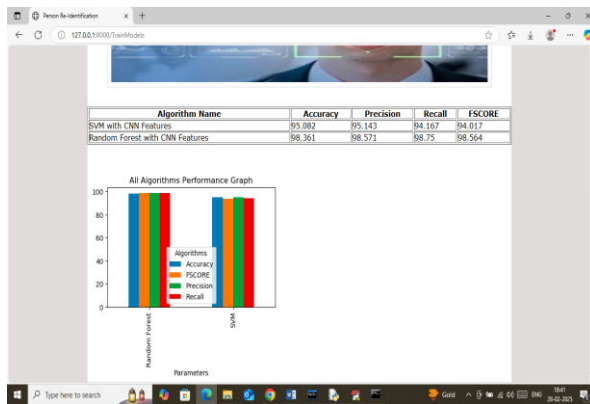


Fig 6.2: Model Training Page

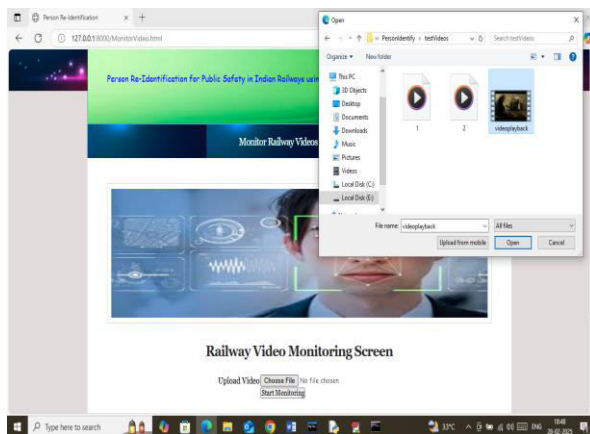


Fig 6.3: Prediction inputs Page

VII. CONCLUSION

The implementation of a Person Re-Identification (Re-ID) system for public safety in Indian Railways using Deep Learning has shown promising results. By replacing traditional hand-crafted image features with CNN-based feature extraction, the system significantly improved the accuracy of suspicious person identification across different camera angles and video feeds. The use of Random Forest and SVM algorithms further allowed for efficient classification and recognition, with Random Forest outperforming in accuracy during testing. The modular approach, involving Admin and Employee functionalities, ensured seamless integration of dataset management, model training, and real-time monitoring capabilities. This project provides a scalable and practical solution for enhancing security surveillance in high-traffic public environments like railway stations.

VIII. FUTURE SCOPE

While the current system demonstrates effective person re-identification using pre-recorded videos, several improvements can enhance its performance and practical applicability. Integrating the system with live CCTV feeds would allow real-time monitoring and instant alert generation, enabling quicker responses in crowded environments such as railway stations. Expanding the training dataset with diverse images, including variations in lighting conditions, occlusions, and crowd density, would improve the system's robustness and accuracy in real-world situations. The system can also be

enhanced through multimodal recognition, where face and pose recognition are combined with additional biometric features such as gait analysis and clothing patterns to ensure reliable identification even when faces are partially visible or images are of low resolution. Furthermore, optimizing the system for scalability and edge deployment on embedded devices within CCTV cameras can reduce latency and dependence on centralized servers. Addressing privacy and ethical considerations is also important, including implementing data anonymization, user consent policies, and compliance with legal regulations. Finally, improving the user interface and user experience (UI/UX) for administrators and railway employees can make the system easier to operate, streamline workflows, and enhance overall system usability.

IX. REFERENCES

- [1] L. Zheng, L. Shen, L. Tian, S. Wang, J. Wang, and Q. Tian, "Scalable person re-identification: A benchmark," in Proceedings of the IEEE International Conference on Computer Vision (ICCV), 2015, pp. 1116–1124, doi:10.1109/ICCV.2015.133.
- [2] Y. Sun, L. Zheng, Y. Yang, Q. Tian, and S. Wang, "Beyond part models: Person retrieval with refined part pooling (and a strong convolutional baseline)," in Proceedings of the European Conference on Computer Vision (ECCV), 2018, pp. 480–496.
- [3] A. Hermans, L. Beyer, and B. Leibe, "In defense of the triplet loss for person re-identification," arXiv preprint arXiv:1703.07737, 2017. [Online]. Available: <https://arxiv.org/abs/1703.07737>
- [4] H. Zhao, M. Tian, S. Sun, J. Shao, J. Yan, S. Yi, X. Wang, and X. Tang, "SpindleNet: Person re-identification with human body region guided feature decomposition and fusion," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017, pp. 1077–1085.
- [5] C. Szegedy, V. Vanhoucke, S. Ioffe, J. Shlens, and Z. Wojna, "Rethinking the inception architecture for computer vision," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016, pp. 2818–2826.
- [6] N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," in Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 2005, pp. 886–893.
- [7] H. Liu, Y. Tian, Y. Yang, L. Pang, and T. Huang, "Deep relative distance learning: Tell the difference between similar vehicles," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017, pp. 2167–2175.

