Face Recognition for Train Ticket Verification System

Arun R, Karan K, Ramanan M,
UG Scholar, Department of CSE, A.R.J College of Engineering and Technology,
Mannargudi, Thiruvarur, Tamilnadu-614 001, India

Kumaresan K,
Assistant Professor, Department of CSE, A.R.J College of Engineering and Technology,
Mannargudi, Thiruvarur, Tamilnadu-614 001, India

Abstract: The Face Recognition Train Ticket Verification System utilizes cutting-edge technology based on the YOLO (You Only Look Once) algorithm to revolutionize the process of boarding trains. By integrating facial recognition capabilities with ticket verification, the system enhances both security and efficiency in train boarding procedures. Upon boarding, passengers' faces are scanned in real-time and compared with the verified train ticket database. This instantaneous process ensures that only individuals with booked tickets are granted access to the train, enhancing security by preventing unauthorized entry. The YOLO algorithm, known for its speed and accuracy in object detection tasks, plays a pivotal role in this system by swiftly analyzing facial features and matching them with the stored ticket data. This allows for seamless and efficient verification, eliminating the need for manual ticket checks or physical barriers. As a result, boarding procedures are streamlined, reducing congestion and enhancing the overall passenger experience. Moreover, the automated nature of the system minimizes the risk of human error, further bolstering security measures. By implementing the Face Recognition Train Ticket Verification System, railway authorities can significantly improve the integrity of ticketing processes while optimizing operational efficiency. Not only does the system enhance security by ensuring that only valid ticket holders can access the train, but it also facilitates smoother boarding procedures, ultimately leading to a more seamless and enjoyable travel experience for passengers. With its advanced technology and robust capabilities, this system represents a significant advancement in the realm of railway security and passenger management.

Keyword: YOLO algorithm, CNN, Facial recognition, LBPH.

1. Introduction

The Face Recognition Train Ticket Verification System represents a significant advancement in the realm of railway security and passenger management. With the overarching goal of enhancing security and efficiency in train boarding procedures, this innovative system leverages cutting-edge technology, specifically the YOLO (You Only Look Once) algorithm. By integrating facial recognition capabilities with ticket verification processes, the system aims to automate ticket validation, ensuring that only passengers with valid tickets can access the train. This technology-driven solution marks a departure from traditional ticketing methods, offering a seamless and efficient boarding experience for passengers. At the heart of the system lies the YOLO algorithm, renowned for its speed and accuracy in object detection tasks. By harnessing the power of this algorithm, the system can swiftly scan and analyze passengers' faces in real-time, comparing them with the verified ticket database.

This instantaneous verification process not only streamlines boarding procedures but also minimizes the risk of unauthorized entry, thereby enhancing overall security measures. With automated ticket validation, railway authorities can effectively mitigate the possibility of ticket fraud or unauthorized access, ensuring a safer and more secure travel environment for all passengers. Moreover, the implementation of the Face Recognition Train Ticket Verification System offers environmental benefits by reducing the reliance on manual ticket checks and traditional paper-based ticketing methods. By digitizing ticket verification processes, the system contributes to the conservation of resources and reduction of carbon footprint associated with paper usage. This eco-friendly approach aligns with the growing emphasis on sustainability in transportation systems, demonstrating the system's multifaceted benefits beyond security and efficiency improvements. By embracing technology-driven solutions like the Face Recognition Train Ticket Verification System, railway authorities can optimize operational efficiency while enhancing the overall passenger experience.

The system's ability to automate ticket validation not only accelerates boarding procedures but also reduces congestion at entry points, leading to smoother and more streamlined operations. As a result, passengers can enjoy a hassle-free boarding experience, knowing that their journey is safeguarded by state-of-the-art

security measures and efficient ticket verification processes. In summary, the proposed system represents a paradigm shift in train boarding procedures, offering a comprehensive solution that addresses security concerns, enhances operational efficiency, and contributes to environmental sustainability. By harnessing the capabilities of the YOLO algorithm and facial recognition technology, the system sets a new standard for ticket verification in the railway industry, paving the way for safer, more efficient, and more sustainable transportation systems.

2. Literature Survey

Marilyn V Xavier, et.all;(2020), Ticket Verification is described asModernization of railways has forever been an issue focused on the development of the fundamental infrastructure of a nation. Since the railways represent one of the most effective modes of transport offered to the people, it would not be possible to merely keep increasing the fares to satisfy costs incurred due to maintenance and therefore the expansion activities. The railways ought to take into account upgrading itself to modern technologies for higher potency and price reduction. One such up gradation is that the role of knowledge technology and e-ticketing that is achieved with the assistance of face recognition technology. This technology has been extensively employed as a biometric method. The thought has evolved from a scientific study of the mechanization of railways and therefore the loopholes within the everyday system. A straightforward theoretical model is projected that once enforced might lead to a better management of the tedious ticketing mechanism.

SamikshaPatil, et.al,(2021), Railway ticket verification is described as the history of the Indian railway dates back to over 160 years. Since then, manual verification of passenger tickets has been practiced by the ticket examiners. This process is very wasteful, in terms of resources, and also tends to be inconvenient for the passengers at times. This project aims at alleviating the problems and modernizing the conventional ticket checking system by the application of computer vision techniques. The system's goal is to create a scalable and efficient approach in order to eliminate the need for carrying a ticket which reduces the usage of paper as well as improves the convenience of passengers. This digitization also provides a clean and organized system throughout the ticket verification life-cycle. With the recent advancements in the field of computer vision and the astounding improvements in the capacity of deep learning algorithms to impart the abilities of human eyesand brain to computer systems, the concept of facial recognition was applied as a solution to railway ticketing modernization. Various face detection and recognition algorithms were studied and a model was created using Haar Cascade Classifiers for human face detection and Local Binary Pattern Histogram (LBPH) method for face recognition. Using this model, this project aims at converting the ticket checking process into a digitized and paperless system, which would be much more convenient for the passengers and efficient for the ticket examiners.

3. Proposed System

The proposed face recognition-based train ticket verification system offers a modern and effective solution for streamlining boarding procedures and enhancing security in railway transportation. By utilizing the YOLO algorithm, the system ensures accurate and efficient matching of passengers' faces with verified ticket information stored in a database. This advanced technology enables swift and reliable verification, granting access to the train only to passengers with valid tickets. Conversely, unauthorized access is denied, bolstering security measures and safeguarding the integrity of the boarding process. Beyond enhancing security, the system also contributes to environmental sustainability by reducing the reliance on paper-based ticketing methods. By digitizing ticket verification processes, the system minimizes paper usage, thereby reducing waste and carbon footprint associated with traditional ticketing.This dual benefit of improved operational efficiency and environmental sustainability makes the proposed system a forward-thinking solution for modernizing train boarding procedures, offering passengers a seamless and secure travel experience while aligning with broader sustainability goals.

4. System Architecture

The input module captures input data, including images of passengers' faces and scanned train tickets and face detection system uses algorithms to detect and extract faces from the captured images. Feature extraction once faces are detected, the system extracts facial features using a multi-CNN algorithm. These features are then converted into numerical vectors.
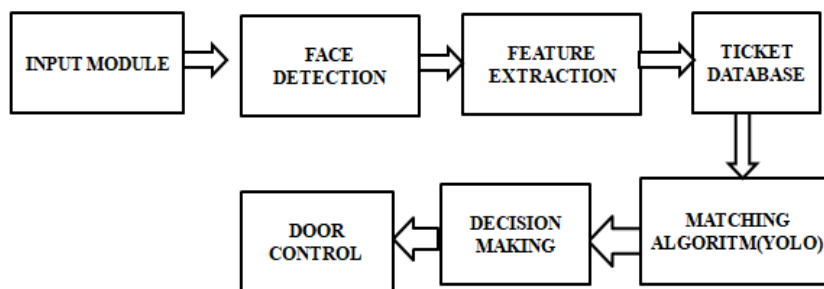
Figure 1: System Architecture

Ticket Database is a database stores verified train ticket information, including passenger details and corresponding facial feature vectors and matching algorithm is used for the system compares the extracted facial features of passengers with the facial feature vectors stored in the ticket database to identify matches. Decision Making is based on the matching results, the system decides whether a passenger's ticket is valid or invalid and door control, if the ticket is valid, the system activates the door mechanism to allow the passenger to board the train. Otherwise, access is denied.

5. Implementation
The face train ticket using conventional neural network methodology is a system that uses machine learning technique to recognize and verify person identity.The process typically works as follows:

Input Module: The Input Module serves as the entry point for the face recognition-based train ticket verification system, capturing essential input data required for the verification process. This module collects images of passengers' faces as they approach the boarding point, along with scanned images of their train tickets. These inputs are then forwarded to subsequent modules for analysis and processing. By efficiently capturing and organizing this data, the Input Module ensures that the verification system has access to the necessary information to accurately match passengers' identities with their corresponding ticket data, facilitating a seamless and secure boarding process.

Face Detection: During the Face Detection stage, the system employs sophisticated algorithms to identify and extract faces from the captured images. These algorithms analyze the input data and locate facial features, such as eyes, nose, and mouth, to accurately detect and isolate human faces within the images. By effectively recognizing and extracting faces, this stage prepares the input data for further processing in subsequent stages, such as facial recognition and ticket validation.He Face Detection stage plays a crucial role in enabling the system to identify individuals and proceed with the verification process, contributing to the overall efficiency and accuracy of the train ticket verification system.

Feature Extraction: In the Feature Extraction stage, the system utilizes a multi-CNN (Convolutional Neural Network) algorithm to analyze the detected faces and extract relevant facial features. These features, which include characteristics such as the shape of the eyes, nose, and mouth, are then transformed into numerical vectors. This process involves encoding the facial features into numerical representations, enabling the system to quantitatively analyze and compare different faces. By converting facial features into numerical vectors, the system prepares the data for the subsequent stages of the verification process, such as matching against the stored ticket database.
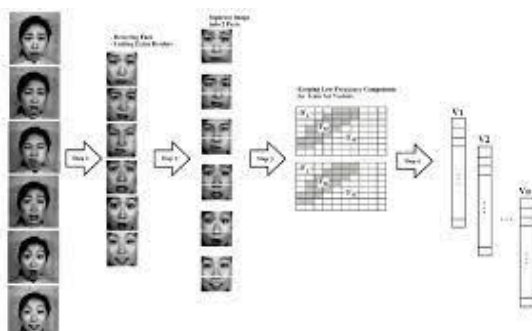
Figure 1: Diagram of Feature Extraction

In facilitating accurate facial recognition and ticket verification, enhancing the efficiency and effectiveness of the train boarding system.

Ticket Database: The Ticket Database serves as a centralized repository for verified train ticket information within the face recognition-based train ticket verification system. It contains essential details such as passenger information and corresponding facial feature vectors, which are numerical representations of the passengers' facial characteristics extracted during the verification process.This database enables the system to efficiently compare the facial feature vectors extracted from the input images with the stored data, facilitating accurate verification of passengers' identities and ticket validity. By storing this information securely, the Ticket Database ensures reliable and streamlined ticket verification, contributing to the overall security and efficiency of the train boarding process.

Matching Algorithm (Yolo): In the Matching Algorithm stage, the system compares the facial feature vectors extracted from passengers' faces with the facial feature vectors stored in the ticket database.This comparison process aims to identify matches between the extracted features and the stored data, indicating that the passenger's identity and ticket information are consistent with the database records. By efficiently analyzing and matching facial features, the system verifies passengers' identities and ticket validity, allowing only authorized individuals with valid tickets to access the train. This crucial stage ensures the accuracy and reliability of the verification process, enhancing security and efficiency in train boarding procedures.

Decision Making: In the Decision Making stage, the system evaluates the matching results obtained from comparing the extracted facial features with the stored data in the ticket database. Based on this comparison, the system determines whether a passenger's ticket is valid or invalid. If a match is found between the passenger's facial features and the stored data, indicating a valid ticket, the system grants access to the train.Conversely, if no match is detected, indicating an invalid ticket or unauthorized entry, the system denies access to the train. This critical stage plays a pivotal role in ensuring the security and integrity of the boarding process by accurately verifying passengers' identities and ticket validity.

Door Control: In the Door Control stage, the system operates the door mechanism based on the decision made in the previous stages of the verification process. If the passenger's ticket is deemed valid, indicating a successful match between the facial features and the ticket database, the system activates the door mechanism to allow the passenger to board the train. However, if the ticket is found to be invalid or unauthorized, access is denied, and the door remains closed, preventing entry.This stage serves as the final step in the verification process, ensuring that only authorized passengers with valid tickets can access the train, thereby enhancing security and efficiency in boarding procedures.

6. Results

The implementation of a Train Ticket Verification System utilizing cameras revolutionizes the approach to access control and security within transportation hubs. This system relies on a series of interconnected components to ensure seamless operation and effective verification processes.

The initial step in the system's workflow involves the DATASETCREATOR module. This crucial component is responsible for compiling comprehensive datasets that include images of valid ticket holders, biometric data, and relevant identification information. These datasets serve as the foundation for subsequent training and verification stages.Once the datasets are established, the TRAINER module takes charge, employing machine learning algorithms to analyze and learn from the provided data. Through iterative training sessions, the system hones its ability to recognize and differentiate between authorized passengers and unauthorized individuals, ensuring accuracy and reliability in identification.
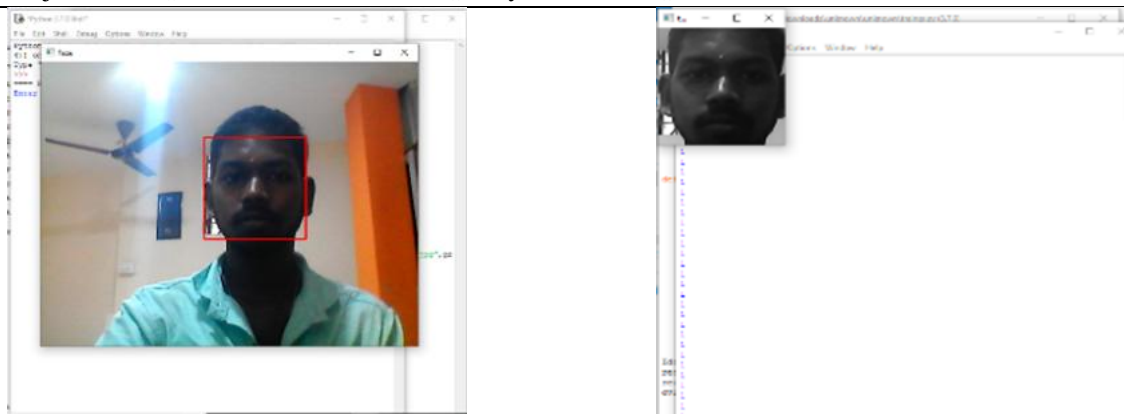
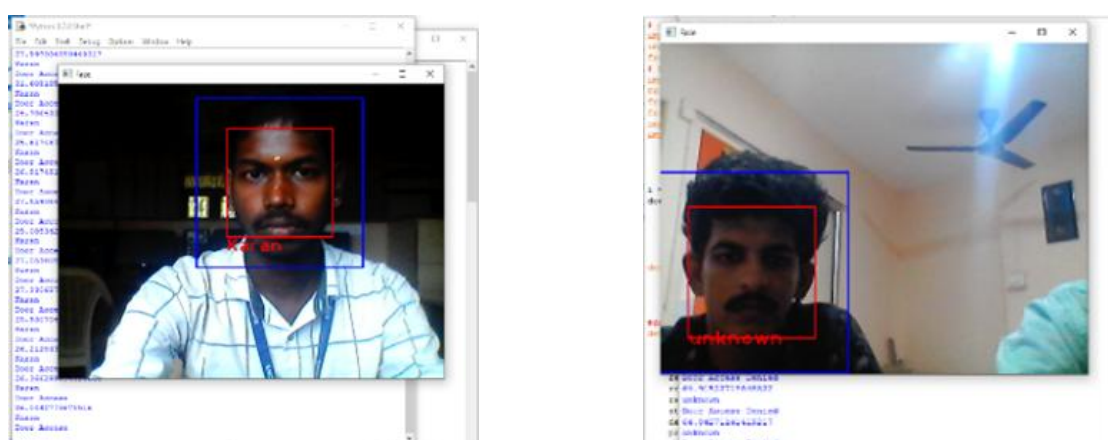Figure 2: a) Data Selector and b) Trainer

Figure 3: Detect and Door Control a) Accept(Door Open) and b) Deny(Door not open)

With the trained model in place, the DETECT module comes into action. Equipped with advanced image recognition capabilities, this component continuously scans the surroundings using cameras installed at strategic locations. When a person approaches the ticket verification point, the system analyzes their facial features and compares them against the stored data. If a match is found, the Door accepted signal is triggered, granting access without delay.However, if the system fails to identify the individual or detects discrepancies in the presented credentials, the Door Denied (unknown person)/Rejected response is activated. This prompt denial of access helps prevent unauthorized entry and ensures the integrity of the transportation facility's security measures.

7. Conclusion

In conclusion, the face recognition-based train ticket verification system presents a modern and effective solution for enhancing security and efficiency in train boarding procedures. By leveraging sophisticated algorithms such as the YOLO algorithm for face detection and multi-CNN for feature extraction, the system accurately verifies passengers' identities and ticket validity in real-time. The integration of a centralized ticket database enables seamless comparison of facial features, allowing the system to make informed decisions regarding passenger access. Furthermore, the automated door control mechanism ensures that only passengers with valid tickets are granted entry, thereby minimizing the risk of unauthorized access and enhancing overall operational efficiency. This system represents a significant advancement in railway security and passenger management. Not only does it streamline boarding procedures and improve the overall passenger experience, but it also contributes to environmental sustainability by reducing paper usage associated with traditional ticketing methods. With its robust security measures and efficient verification processes, the face recognition-based train ticket verification system sets a new standard for modernizing train boarding procedures, offering a secure, seamless, and sustainable solution for railway transportation systems.

8. References

[1]. Research on Privacy Protection Technology in Face Identity Authentication System Based on Edge Computing, 2019

[2]. TANG Guofeng. Research on Face Recognition Method Based on Deep Learning [D]. Jiangsu University of Science and Technology, 2019.

[3]. Ja Surfeit. Research on facial expression recognition algorithm based on local features [D].Nanjing University of Posts and Telecommunications, 2020.

[4]. KOMAZ M, KOMAZ M, KOMAZ M, ET AL. A new approach to face recognition [J].Nanjing University of Posts and Telecommunications, 2020.

[5]. ZHOU Anglican. Research on Face Recognition Algorithm Based on Fusion Method [D]. Nanjing University of Posts and Telecommunications, 2020.

[6]. FAN Enhance. Deep learning based low resolution face recognition [D]. Nanjing University of Posts and Telecommunications, 2018.

[7]. Li Jinny. Research on Multi-pose Face Recognition Algorithm [D]. Beijing Civil Engineering University, 2020.

[8]. LIU Y P. Design and implementation of household service platform based on face recognition [D].Beijing Liaoning University, 2019.

[9]. LI P, LI J, HUANG Z, ET AL. Privacy-preserving outsourced classification in cloud computing [J]. Cluster Computing, 2018, 21(1): 277 – 286.

[10]. WANG Q, HU S, REN K, ET AL. Cloud BI: Practical privacy-preserving outsourcing of biometric identification in the cloud[C] // European Symposium on Research in Computer Security. 2019: 186 – 205.