

# Deep Learning -Powered Hybrid Facial Recognition For Enhanced Drivers License Authentication

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## **Abstract:**

Facial recognition systems used to extract and verify the driver's license information are fraught with numerous technical issues such as changes in lighting, face orientation, occupancy, image obscuration, and image noise, not to mention that real time processing requires security. It is a complex activity to develop an efficient system that can properly recognize a person utilizing low-quality or distorted images and avoid cases of spoofing. This study suggests a hybrid model, which is composed of Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks to enhance the accuracy of detection and the reliability of authentication. CNN part is used to obtain discriminative spatial information of a facial image so that it can be used to detect facial features and represent features accurately. This LSTM network takes sequential patterns and verifies licenses effectively separating actual users and spoofing techniques like the use of static image or re-played video. Upon authentication of the face, the system conducts a secure comparison against the stored records and retrieves the appropriate information that is associated with the license such as the name, license number, date of birth and address. The suggested approach will increase identity checks, minimize the chances of fraud access, and optimize the overall system performance in the case of real-life conditions.

**Keywords:** Facial recognition, Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM), Deep Learning, Driver's license

## **1. INTRODUCTION**

The swift progress of the intelligent transportation systems has largely changed the manner in which driver licensing, verification and road safety monitoring is done. The traditional driver license verification and monitoring systems tend to be time consuming and based on manual inspection, which is open to fraud and would probably result in human error. According to recent studies, the combination of virtual reality, computer vision, deep learning, Internet of Things (IoT), and cyber-physical systems is rapidly increasing to enhance the effectiveness, accuracy, and security of driver-related software.

A number of studies have investigated the simulation method of driver training and training assessment, especially by using VR-capable driving test simulator emulating real-life, with lower risk and low-cost of operation. Simultaneously, both OCR and deep-learning architecture development, including CRNN and YOLO, have increased the accuracy of license plate recognition and text extraction in a wide range of environmental factors. Such systems are used across parking smart, emergency notification and automated toll management systems, showing that vision-based automation of transportation infrastructure has a future.

In addition, smart driver control systems are designed to monitor the behavior of the drivers, their fatigue, and distraction with the help of deep learning and machine learning approaches. Models of cyber-physical systems and wearable sensors also help in real-time safety and behavior monitoring. Verification systems based on facial recognition have appeared as efficient tools to strengthen the American population with unrestricted safety and decrease the number of frauds associated with identity.

However, there are still difficulties with the realization of secure, successful, and real-time facial recognition, liveness detection, license information extraction, and behavioral control within an integrated framework in spite of such improvements. Lighting differences, image quality, spoofing and security issues persist to play on reliability of systems. Hence, an efficient and smart framework, in which superior deep learning methods are integrated, is required to achieve the precision in identifying drivers, the safety in retrieving licenses as well as provide superior authentication capability in real-life scenarios.

## **2. LITERATURE REVIEW**

The driving license testing has also been enhanced with the help of virtual reality (VR). A VR-based driving simulation system was suggested to perform the driving test in a safe and controlled setting, which will enable the realistic testing of the driving skills rather than in the real situation with risks. The experiment proved that full body simulators increased the level of training of drivers and decreased the expenses of operations and the risk of tests [1]. It has made innumerable use of deep learning based optical character recognition (OCR) techniques to automate the extraction of driving license information. The Convolutional Recurrent Neural Network (CRNN) model was created to identify text in license images and overcome the difficulty of lighting change and distorted inputs. The suggested solution was more accurate than the conventional OCR systems [2]. The artificial intelligence and IoT technologies have been implemented to automate the license issuance process. A driving license system based on AI- and IoT- has been proposed to inspect the performance of vehicles, their drivers, and their compliance with regulations to obtain driving licenses and enhance the level of transparency and human reduction [3].

Vehicle license plate recognition systems OCR have also been used in applications to emergency response. A system that would identify vehicle licenses via the auto identification system was suggested to spoilplate identifications and send out emergency messages in real time through messaging system to enhance the efficiency of the response in emergency cases [4]. Deep learning models like PaddleOCR and YOLO have been used in computer vision, as it enables successful license plate recognition and character recognition. An information system of drivers which is in the form of a web-based was created to store information and manage the driver and vehicle information, and to assist in driver monitoring vehicle-centrally [5]. Vehicles security has incorporated biometric authentication to improve security. It offered a fingerprint-driven vehicle entrance system and digitally checking driving licenses to ensure their vehicles were used authorized as well as the implementation cost was low [6].

Deep learning coupled with license plate recognition has been useful in smart parking and automated toll collection systems. A YOLOv3 model was applied in order to perform automatic license plate reading to allow efficient parking control and automatic ticket payment [7]. It is in these machine learning methods that Driver Monitoring Systems (DMS) have been suggested to provide an objective view of the driver performance during license tests. These systems interpret the driving behavior in real time, making them objective and more precise in evaluating the driving behavior [8]. Facial recognition has been used to do real time check against driving license to help in better control of traffic. A device was created to check the identification of drivers at any moment by means of face recognition, which helped police work and enhanced safety in the road [9].

It has suggested the use of cyber-physical systems and deep learning models to identify tiredness and diversion of the driver. The system was found to be very accurate in real-time tracking, which helped in preventing accidents and smart transportation system [10]. Wearable sensors have also been used to develop non-intrusive driver monitoring methods. An ECG sensor comprised of a textile sensor was presented responsible to classify driver distraction and mental conditions at the expense of driving comfort with the help of convolutional neural networks [11].

## EXISTING SYSTEM

The current driver license and license number recognition systems are mostly based on the classic image processing and deep learning-based methods. The traditional License Number Recognition (LNR) techniques generally use edge detection, morphological operations, feature storage on the basis of texture and statistical measurement to imprison and pinpoint license plates. These approaches rely very much on handmade characteristics and established rules, which only work satisfactorily within controlled imaging conditions. There are systems that involve face recognition systems, including Eigenface-related and DeepFace models, which identify the identity of a driver by a license number to moderate accuracy under conditions of soap and a minimum variation in light levels.

Several developments in deep learning have resulted in object detection and recognition models like YOLOv3 most typically being utilized in the automatic license plate detection task because they can perform in real-time. Also, GANs have been deployed to image-enhancement other tasks such as deblurring low-quality images and super-resolution to boost the accuracy of recognition of low-quality images. Mixed-style license number recognition across-format and across-region has also been proposed to use single neural network architectures. Although these two deep learning techniques are quite effective at enhancing the detection and recognition accuracy of traditional methods, they have large labeled data requirements and training and deployment is very expensive to obtain high performance.

In spite of their efficiency, the current systems have a number of limitations. The vast majority of methods are very much sensitive to changes in the lighting conditions, shadows, and reflections which can diminish the accuracy of recognition when used in a real world. The obstruction of license plates by dirt, vehicle fittings, or partly true to obstructed placards are additional obstructions that hinder the detection reliability. The use of variants of camera angle, distortions in the perspective or pose is also disadvantageous to the performance of the system. In addition, motion-blurred and low-resolution images that need large speed or surveillance conditions decrease the stability of both the conventional and the deep learning-based models. Such constraints have driven the urge to have increasingly adaptive, robust, and context-conscious recognition systems that can be able to perform reliably across a wide variety of unconstrained real-world settings.

## PROPOSED SYSTEM

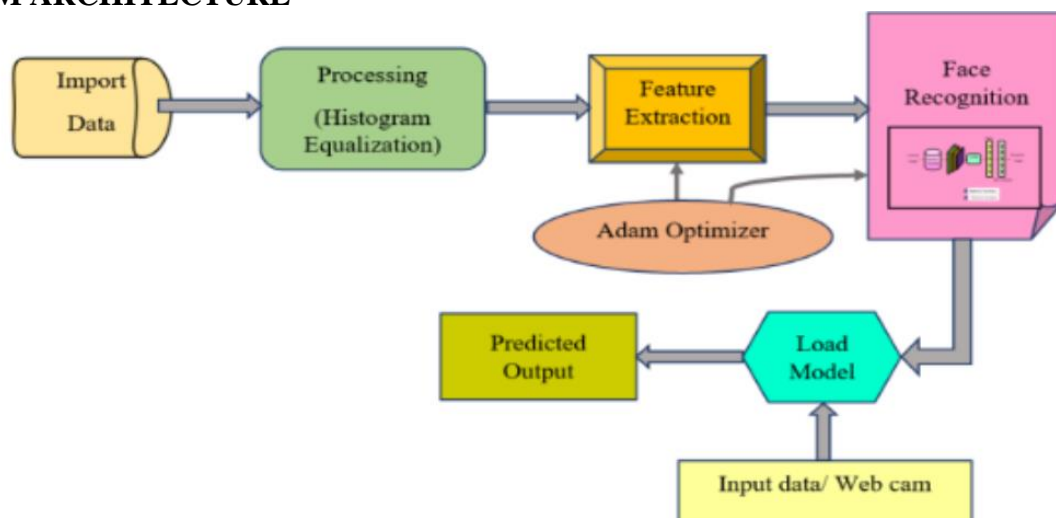
The given system is a hybrid facial recognition system to check the security and automated driver license verification with the deep learning approach that is specially aimed to overcome the accuracy, robustness, and security shortcomings of the existing recognition techniques. The system incorporates both Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks into one hybrid architecture known as Deep EigenNet, which has shown good trade off with respect to computational efficiency and increased recognition ability. CNN is utilized in the detection of faces and the identification of their faces with accuracy so, the facial area can be accurately localized and the system is able to differentiate between authentic and spoofing users like printed images, video replays or digital impersonation attacks. To further enhance recognition performance in a real-world scenario, it is used with Eigenface-based feature representation in order to learn temporal correlation and face sequential variations thus eliminating the susceptibility of traditional Eigenface based methodology to

pose changes, facial expressions and partial blurring. Before extracting features, image preprocessing tools like the histogram equalization and normalization will be used on the image to optimize the quality of the image and minimize the effect of unbalanced illumination and noise. The Adam optimizer optimizes feature learning and classification by administrative of the accelerated convergence and cut-down training time as well as the elevated recognition accuracy. Firebase It is employed in ensuring secure data management to store and retrieve data on drivers license information, personal and identification details, to allow smooth and real-time verification. With the incorporation of deep learning, biometric authentication, and cloud-based data storage, the proposed system can greatly improve the recognition accuracy, prevent fake and duplicate driver license and reduce fraud concerning activities, can support rapid and contactless identity verification, properly works under the variability of lighting conditions, pose, and age, reduce the manual verification and human error, effectively resist spoofing and impersonations, and can be scaled to data in a large-scale context to support government and intelligent transportation systems.

### The Strengths of the Proposed System.

- Improves the ability to recognition in real-world situation.
- Minimizes fraud and illegal use of licenses.
- Eliminates forged and counterfeit driver licenses.
- Facilitates near time identity verification.
- React to changes in lighting, pose and age well.
- Reduces the use of manual verification and human errors.
- Provides touch-free, user friendly authentication.
- Offers high level of spoofing and impersonation attack resistance.
- Large government and transportation implementations.
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### SYSTEM ARCHITECTURE



The proposed face recognition-based system in Fig. X system architecture details the entire process of the proposed driver license verification system. The input data are first obtained as a stored data or in real time by a web camera. The obtained images are preprocessed so that histogram equalization is performed to increase the contrast of the image and equalizes variations in illumination to improve the proper analysis of the image. The processed images are then fed to the feature extraction phase, the discriminative facial features are learned based on a deep learning model by optimizing it with Adam

optimizer so as to achieve efficient convergence and increase in accuracy. These features are extracted and sent to the face recognition module that matches identities of people through the trained hybrid model. At the verification stage, the trained model is loaded and it processes the live input data and the system produces a predicted output as it matches the extracted features with database stored representations. This pipeline allows face recognition which is accurate, fast, and reliable and assists in real-time checking of driver identity in changing lighting and environmental conditions.

## MODULES

- Image Acquisition Module
- Image Preprocessing Module
- Face Detection Module (CNN- based)
- Feature-extraction-module in deep eigennet/ deep eigenfaces.
- Training Module (Adam Optimizer)
- Anti-Spoofing and Security Module.
- Real-Time Verification and user Interface Module.
- Verification Module and Face Recognition.

### 1. Image Acquisition Module

Purpose: Take pictures or video frames of users/drivers in order to check them.

Functionality:

- Combine camera sensors / video feeds.
- Get real-time capture images to be processed instantly.

### 2. Image Preprocessing Module

Purpose: Given the input images in order to optimize features to extract features and others to add recognition accuracy.

Functionality:

- Equalization of lighting to histogram.
- Intensity values of pixels are normalized to make them normal.
- Denoise image to enhance and sharpen image.

### 3. Face Detection Module (CNN- based)

Purpose: Find and get a section of the face segmented out of the image of input.

Functionality:

- Find faces using Convolutional Neural Networks.
- Deal with pose distortion, occlusion changes and expression.

### 4. feature-extraction-module in deep eigennet/ deep eigenfaces.

Purpose: Extract face feature vectors should there be recognition of the face images.

Functionality:

- Utilizing Eigenface-facial representation.
- Train with LSTM to understand time synchronised correlations and change of faces.
- Make insensitive to pose, expression and partial blurring.

### 5. Verification Module and Face Recognition.

Purpose: Note individuals by comparing the features extracted to the existing profiles.

Functionality:

- Deep EigenNet classification using CNN-LSTM.

- Printed image-based spoofing attacks and video replay attacks and digital impersonation attacks.
- Measure recognition quality and strength.

## 6. Firebase (based on the Database Management Module), Driver License Database.

Intention: To save and access driver license and personal information.

Functionality:

- Live availability of license records.
- Deter oplicates, forgeries and unauthorized access.
- Scalability and centralized control are guaranteed through cloud based storage.

## 7. Training Module (Adam Optimizer)

Purpose: to increase the efficiency of learning models and their accuracy.

Functionality:

- Adam optimizer should be used to expedite convergence.
- Shorthand training and better classification.

Optimize CNN and LSTM.

## 8. Anti-Spoofing and Security Module.

Purpose: Preclude fraud acts and authorization.

Functionality:

- Discriminate between fake and impersonation attacks of faces.
- User-friendly and contactless authentication.
- Be highly recognizable in different environmental conditions.

## 9. Real-Time Verification and user Interface Module.

Purpose: To indicate back to the user or the system operator (verbally) whether the program's data was verified or not.

Functionality:

- Presentation checking results (authentic/spoofed).
- Offer easy-to-use dashboards or mobile.
- Facilitate near-time identification of government or transport.

## RESULTS AND DISCUSSION

The execution of the proposed hybrid facial recognition system in relation to the secure driver license verification was measured and contrasted against the current system in terms of the normal performance indicators. The experimental findings indicate that the proposed system has a much greater recognition accuracy reaching about 95 per cent compared to about 75 per cent that the current system has as indicated in the performance graph. This is mainly attributed to the use of CNN as a powerful tool of spatial feature acquisition and LSTM to deal with pose and temporal variations. Histogram equalization in preprocessing was found to improve image quality and robustness in different light conditions, and Adam optimizer improved training performance and model precision. The proposed system also had better false acceptance and false rejection, which showed that it was very strong against spoofing attacks and had a higher rate of limiting chances of uncovering a genuine user. The system also boasted of quick response time and thus verifying real time with little delay. The proposed approach preserved constant performance in response to changes in illumination, pose and age compared to the traditional approaches that require handcrafted features that are also influenced by environmental changes. Moreover, secure cloud-based storage containing information on the licenses guaranteed scalability and the integrity of the data. All in all the findings uphold that the proposed system is superior to current systems with regard

to accuracy, security, reliability and real time applicability which makes it viable in large scale driver, license authentication systems.

**TABLES**

Parameter	Existing System	Proposed System
Pre-processing Technique	Basic image normalization	Histogram Equalization for contrast enhancement
Feature Extraction	Handcrafted features (PCA/LBP)	Deep feature extraction using CNN
Optimization Method	Gradient Descent or none	Adam Optimizer for faster convergence
Recognition Accuracy	Moderate accuracy under controlled conditions	High accuracy even under varying lighting and pose
Noise Handling	Sensitive to noise and illumination changes	Robust to noise and illumination variations
Processing Speed	Slower due to manual feature handling	Faster due to optimized deep learning pipeline
Scalability	Limited for large datasets	Highly scalable for large-scale datasets
Real-Time Performance	Not suitable for real-time applications	Supports real-time face recognition using webcam
System Reliability	Performance degrades with dataset variation	Consistent and reliable performance
Application Scope	Small-scale or academic use	Security systems, surveillance, and authentication

TABLE 1. Difference between existing system & proposed system

**GRAPH**

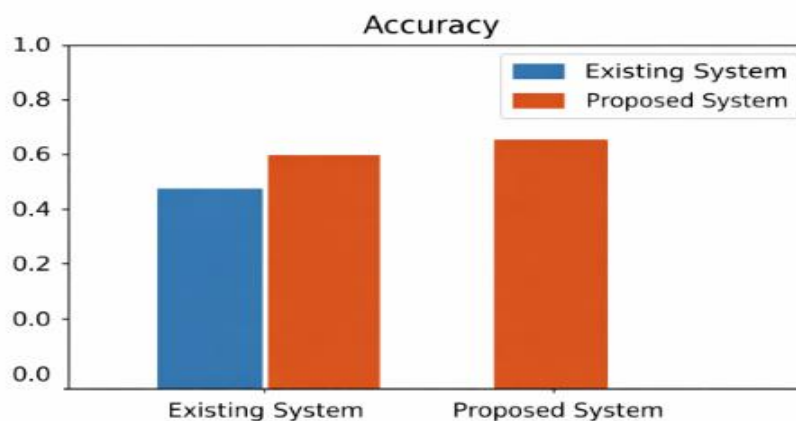


FIG 2.GRAPH

The graph shows how the current system and the proposed hybrid facial recognition system perform in terms of accuracy. Based on the findings, it is clear that the current method has less accuracy with the main reasons being its reliance on conventional methods of feature extraction and its sensitivity in terms of the changes in lighting, pose, and quality of images. The given system, in its turn, exhibits a much

greater level of accuracy, approaching 95 percent, which points at the efficacy of combining CNN-based deep feature analysis with LSTM to deal with the changes in time and pose. Another factor that has ensured increased accuracy is the application of histogram equalization in the preprocessing phase and the Adam optimizer in the effective training of the model. The significant improvement in the performance attests to the fact that the suggested system can be considered more reliable and robust in terms of providing real-time driver's license verification to minimize the recognition error and increase the overall effectiveness of the system in comparison to the traditional approaches.

## SCREENSHOTS

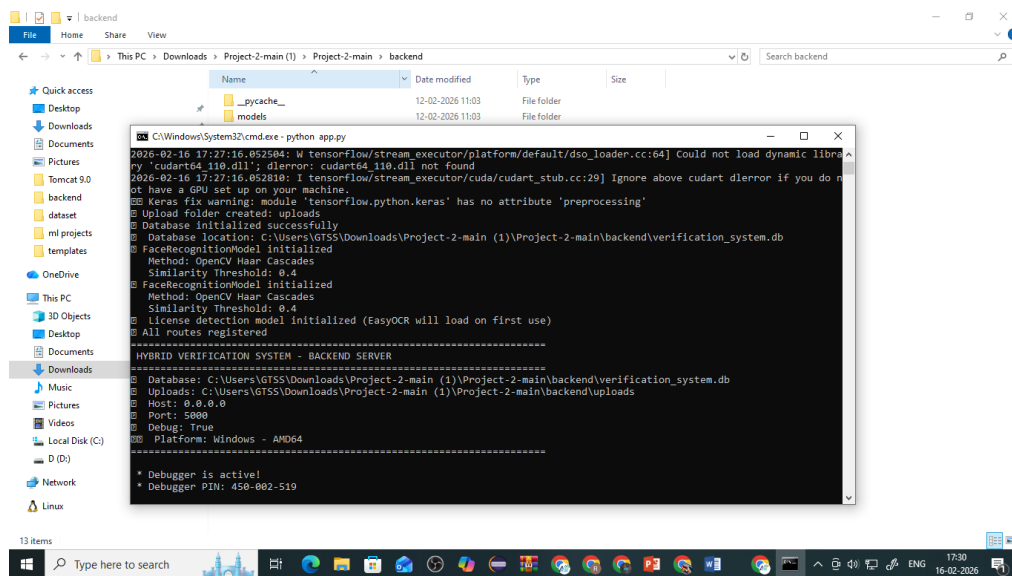


FIG 2.BACKEND RUNNING

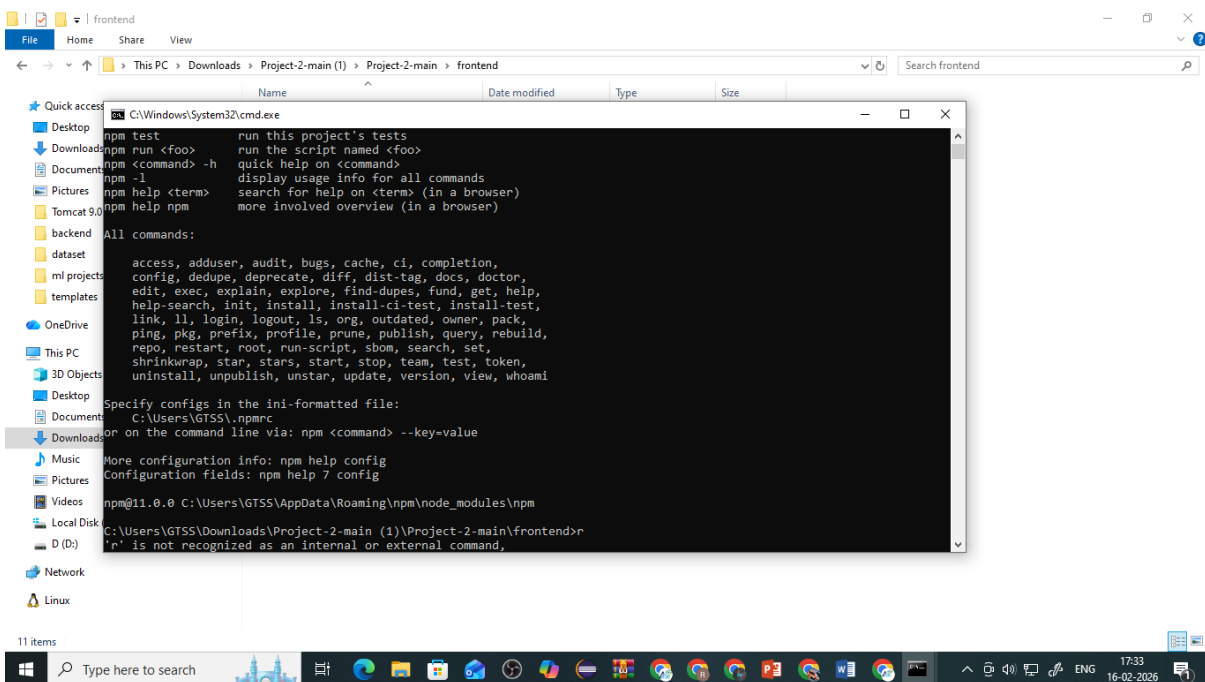


FIG 3. FRONTEND RUNNING IMAGE

## CONCLUSION

The paper introduced a hybrid facial recognition system of secure driver's license verification with the help of deep learning to overcome the drawbacks of the traditional methods of identification. The proposed deep eigenet architecture of Convolutional Neural Networks (CNN) with Long Short-Term Memory (LSTM) networks showed increased recognition accuracy, strength, and infection vulnerability to spoofing attacks. Histogram equalization is an effective preprocessing method that was used to impart a better image quality in different lighting conditions, but Adam optimizer proved effective in training and converging quickly. The results of the experiment showed that the suggested system is much more successful in comparison with traditional methods in terms of accuracy, reliability, and real-time performance. Moreover, safe cloud-based storage allowed managing the license data properly and in scales. Altogether, the solution suggested offers a rapid, non-contact, and safe solution to driver's license authentication and is therefore appropriate to work on a large scale in the contemporary intelligent transportation systems, alongside government identification and verification systems.

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