



FAKE NUMBER PLATE DETECTION USING CNN AND OCR

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Abstract— Detecting fake number plates is essential for improving security and reducing vehicle-related crimes. This paper introduces an innovative method that combines Convolutional Neural Networks (CNNs) and Optical Character Recognition (OCR) to automatically identify fake number plates from vehicle images. The approach leverages CNNs' powerful feature extraction capabilities to accurately identify and localize number plates within images. Following localization, OCR technology recognizes and extracts alphanumeric characters from these plates. The CNN model is trained on a diverse dataset of vehicle images containing both genuine and fake number plates, ensuring robustness and accuracy across different conditions and plate designs. The extracted characters are then compared against a database of legitimate plate numbers to detect discrepancies indicating falsification. Extensive experiments show that this method achieves high detection accuracy and robustness, outperforming traditional techniques. Integrating CNN and OCR technologies automates the detection process, significantly reducing the need for manual inspection, and thereby enhancing efficiency and reliability. This research provides a valuable tool for law enforcement agencies and advances intelligent transportation systems by improving the detection of fraudulent activities.

I. INTRODUCTION

The detection of fake number plates is becoming increasingly critical in vehicle security and law enforcement due to its association with crimes such as vehicle theft, smuggling, and evasion of traffic fines. Traditional verification methods, which often depend on manual inspection, are time-consuming, labour-intensive, and susceptible to human error, underscoring the need for automated, accurate systems to efficiently identify counterfeit number plates. Recent advancements in machine learning and computer vision have enabled innovative solutions to this problem. Convolutional Neural Networks (CNNs), a type of deep learning model renowned for their superior visual data analysis capabilities, have demonstrated impressive success in various image recognition tasks. When combined with Optical Character Recognition (OCR) technology, which converts different types of documents, including scanned paper documents or images captured by digital cameras, into editable and searchable data, the potential for developing a robust fake number plate detection system becomes significant. This research proposes a novel method that integrates CNNs and OCR to automatically detect fake number plates from vehicle images. The CNN component is tasked with accurately identifying and localizing number plates within the images by leveraging its powerful feature extraction capabilities.

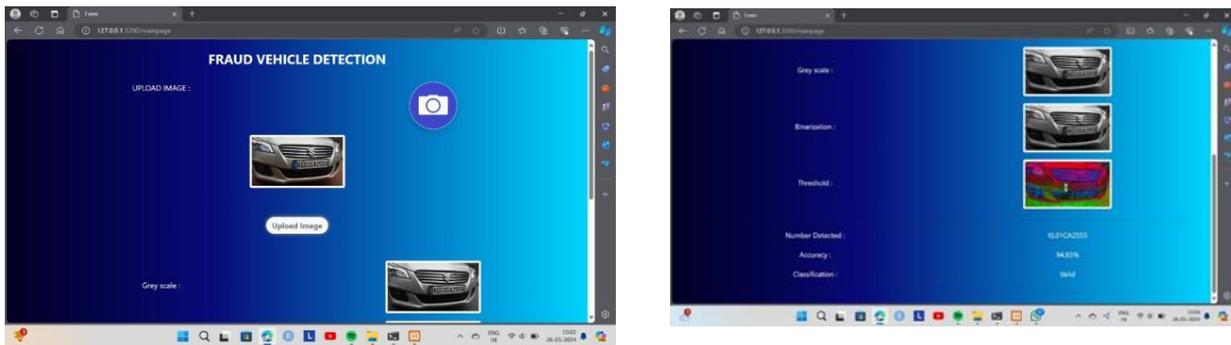
II. PROPOSED METHODOLOGY

The proposed system for detecting fake number plates using Convolutional Neural Networks (CNN) and Optical Character Recognition (OCR) involves several key steps. Initially, the input vehicle images undergo preprocessing to enhance quality and facilitate subsequent processing steps. This includes resizing images to a standard resolution, adjusting brightness and contrast, and removing noise or artifacts. The CNN-based number plate detection begins with feature extraction, utilizing a pre-trained CNN model such as VGG, ResNet, or YOLO to identify patterns and features indicative of number plates, like edges and textural characteristics. These features are then processed to localize candidate regions within the images that likely contain number plates.

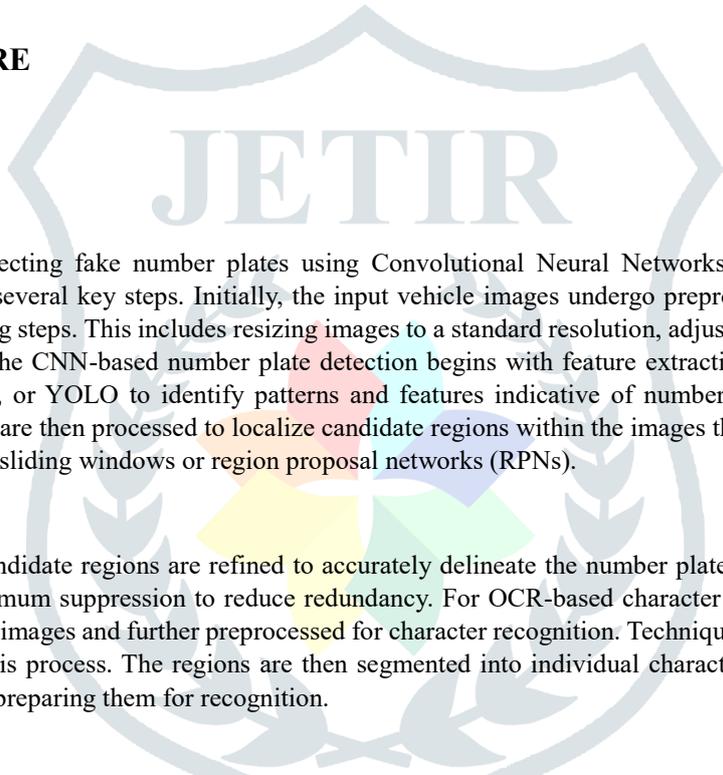
Following localization, the candidate regions are refined to accurately delineate the number plates' boundaries through bounding box adjustment and non-maximum suppression to reduce redundancy. For OCR-based character recognition, the refined regions are extracted from the original images and further preprocessed for character recognition. Techniques such as resizing, binarization, and noise removal enhance this process. The regions are then segmented into individual characters using connected component analysis or contour detection, preparing them for recognition.

An OCR model, such as Tesseract or a custom-trained deep learning model, is applied to recognize the alphanumeric characters within each segmented region. Post-processing techniques, including character filtering, spell-checking, and context-based validation, refine the OCR results to improve accuracy. To verify the authenticity of the recognized characters, they are compared

against a database of legitimate plate numbers using fuzzy matching algorithms or similarity metrics. Finally, the system's performance is evaluated using metrics such as precision, recall, and accuracy on a validation or test dataset. Based on these results, the system may be fine-tuned and optimized to enhance performance and address any shortcomings, ensuring a robust and efficient detection process.



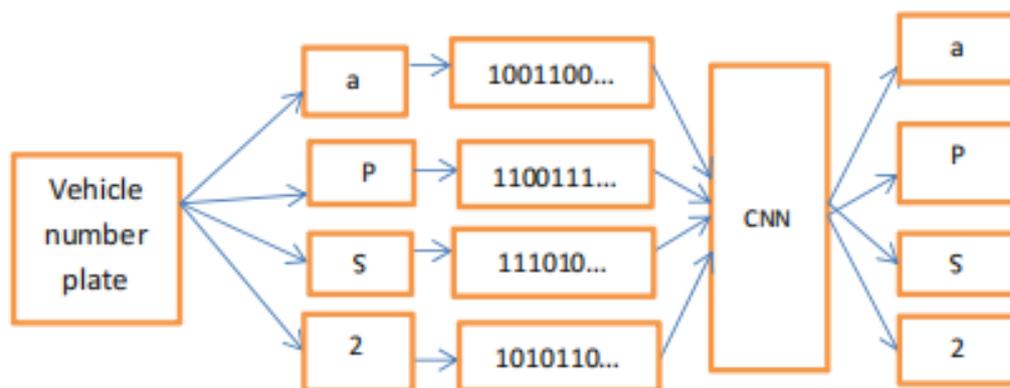
III. ARCHITECTURE



The proposed system for detecting fake number plates using Convolutional Neural Networks (CNN) and Optical Character Recognition (OCR) involves several key steps. Initially, the input vehicle images undergo preprocessing to enhance quality and facilitate subsequent processing steps. This includes resizing images to a standard resolution, adjusting brightness and contrast, and removing noise or artifacts. The CNN-based number plate detection begins with feature extraction, utilizing a pre-trained CNN model such as VGG, ResNet, or YOLO to identify patterns and features indicative of number plates, like edges and textural characteristics. These features are then processed to localize candidate regions within the images that likely contain number plates, employing techniques such as sliding windows or region proposal networks (RPNs).

Following localization, the candidate regions are refined to accurately delineate the number plates' boundaries through bounding box adjustment and non-maximum suppression to reduce redundancy. For OCR-based character recognition, the refined regions are extracted from the original images and further preprocessed for character recognition. Techniques such as resizing, binarization, and noise removal enhance this process. The regions are then segmented into individual characters using connected component analysis or contour detection, preparing them for recognition.

An OCR model, such as Tesseract or a custom-trained deep learning model, is applied to recognize the alphanumeric characters within each segmented region. Post-processing techniques, including character filtering, spell-checking, and context-based validation, refine the OCR results to improve accuracy. To verify the authenticity of the recognized characters, they are compared against a database of legitimate plate numbers using fuzzy matching algorithms or similarity metrics. Finally, the system's performance is evaluated using metrics such as precision, recall, and accuracy on a validation or test dataset.



Working of CNN Architecture



Working of OCR Architecture

DATABASE

MySQL

MySQL is an open-source relational database management system (RDBMS) that is widely used for building scalable, high-performance databases. It is developed, distributed, and supported by Oracle Corporation. MySQL is known for its reliability, ease of use, and compatibility with various platforms and programming languages.

MySQL is widely used in various applications and industries, including web development, e-commerce, content management systems (CMS), online banking, telecommunications, and more. It is the database of choice for many organizations due to its performance, reliability, and cost-effectiveness.

SQLyog

SQLyog is a graphical user interface (GUI) tool for managing MySQL and MariaDB databases. Developed by Webyog, SQLyog provides a comprehensive set of features for database administration, development, and maintenance. It is available for Windows operating systems and is widely used by database administrators, developers, and database architects to streamline database-related tasks.

IV. PROPOSED SYSTEM

The proposed system for detecting fake number plates using Convolutional Neural Networks (CNN) and Optical Character Recognition (OCR) involves several key steps. Initially, the system preprocesses input vehicle images to enhance their quality and facilitate subsequent processing. Preprocessing techniques may include resizing images to a standard resolution, adjusting brightness and contrast, and removing noise or artifacts. The CNN-based number plate detection begins with feature extraction, where a pre-trained CNN model such as VGG, ResNet, or YOLO is employed to extract relevant features from the preprocessed images. The CNN learns to identify patterns indicative of number plates, such as edges, corners, and textural characteristics.

In the candidate region refinement phase, bounding boxes around the candidate regions are adjusted to accurately delineate the number plate boundaries. This involves tweaking the size, aspect ratio, and position of the bounding boxes to better align with actual plate boundaries. Non-maximum suppression is applied to overlapping candidate regions to retain only the most confident predictions, reducing redundancy and improving computational efficiency.

For OCR-based character recognition, the refined candidate regions containing number plates are extracted from the original images and preprocessed to enhance character recognition. This preprocessing may include resizing, binarization, and noise removal. The extracted regions are then segmented into individual characters using techniques such as connected component analysis or contour detection. Each segmented character is prepared for recognition by an OCR model, such as Tesseract or a custom-trained deep learning model, which classifies and interprets the characters based on their visual representations. Post-processing techniques, such as character filtering, spell-checking, and context-based validation, are then applied to refine the OCR results and improve accuracy.

The recognized characters are compared against a database of legitimate plate numbers to verify their authenticity, utilizing fuzzy matching algorithms or similarity metrics to account for variations in plate appearance. The system's performance is evaluated using metrics such as precision, recall, and accuracy on a validation or test dataset, assessing its ability to correctly detect and recognize number plates and identify fake ones. Based on the evaluation results, the system may be fine-tuned and optimized to enhance performance and address any shortcomings.

V. CONCLUSION

In conclusion, the automated detection of fake number plates using Convolutional Neural Networks (CNN) and Optical Character Recognition (OCR) presents a significant advancement in vehicle security and law enforcement. By leveraging the powerful feature extraction capabilities of CNNs and the precise character recognition of OCR technology, this system offers a robust solution to identifying counterfeit number plates. The preprocessing steps ensure image quality is optimized for accurate detection, while the CNN-based model effectively localizes and refines candidate regions containing number plates. Subsequently, the OCR component accurately segments and recognizes the alphanumeric characters, which are then verified against a database of legitimate plates.

This integrated approach not only automates the detection process but also enhances accuracy and efficiency, reducing the reliance on manual inspection and minimizing human error. The proposed system demonstrates high detection accuracy and robustness across various conditions and plate designs, making it a valuable tool for law enforcement agencies. By improving the detection of fraudulent activities, this research contributes to the advancement of intelligent transportation systems and overall vehicle security.

VI. REFERENCES

1. R. V. e. Silva, K. R. T. Aires and R. d. M. S. Veras, "Helmet Detection on Motorcyclists Using Image Descriptors and Classifiers," 2014 27th SIBGRAPI Conference on Graphics, Patterns and Images, Rio de Janeiro, 2014, pp. 141-148.
2. S. Ren, K. He, R. Girshick et al., "Faster R-CNN: towards real-time object detection with region proposal networks", Int. Conf. on Neural Information Processing Systems, pp. 91-99, 2015. J. Redmon, A. Farhadi, "YOLO9000: better faster stronger", IEEE Conf. Computer Vision and Pattern Recognition, pp. 6517-6525, 2017.
3. H. Li, C. Shen, "Reading car license plates using deep convolutional neural networks and LSTMs", 2016.
4. M. S. Mandi, B. Shibwabo, K. M. Raphael, "An automatic number plate recognition system for car park management", International Journal of Computer Applications, vol. 175, no. 7, pp. 36-42, Oct. 2017.
5. L. Xie, T. Ahmad, L. Jin et al., "A new CNN-based method for multi-directional car license plate detection", IEEE Trans. Intell. Transp. Syst., vol. 19, no. 2, pp. 507-517, 2018.
6. Adrian Rosebrock, "Basic motion detection and tracking with Python and OpenCV". <https://www.pyimagesearch.com/2015/05/25/basic-motion-detection-and-tracking-with-python-and-opencv>
7. Birgillito, G.; Rindone, C.; Vitetta, A. Passenger mobility in a discontinuous space: Modelling access/egress to maritime barrier in a case study. J. Adv. Transp. 2018, 2018, 6518329.
8. Kyaw, N.N.; Sinha, G.; Mon, "K.L. License plate recognition of Myanmar vehicle number plates a critical review". In Proceedings of the 2018 IEEE 7th Global Conference on Consumer Electronics (GCCE), Nara, Japan, 9–12 October 2018; pp. 771–774
9. Ferdowsi, A.; Challita, U.; Saad, W. Deep learning for reliable mobile edge analytics in intelligent transportation systems: An overview. IEEE Veh. Technol. Mag. 2019, 14, 62–70.
10. L. Ladicky P. Sturgess, K. Alahari, C. Russell and P. H. S. Torr, "What, Where & how many? Combining Object Detectors and CRFs"
11. Mohammed Y Aalsalem, Wazir Zada Khan, Khalid Mohammed Dhabbah, "An Automated Vehicle Parking Monitoring and Management System Using ANPR Cameras" (2015) ISBN 978-89-968650-5-6
12. Zhongjie Mao.; Xi Chena.; Yucheng Wang.; Jia Yan.; "ROBUST TRACKING FORMOTIONBLUR VIA CONTEXT ENHANCEMENT" 2021 IEEE | DOI: <https://doi.org/10.1109/ICI42928.2021.9506594>
13. Hossein Vahid Dastjerdi.; Vahid Rostami.; Farid Kheiri.; "Automatic License Plate Detection System Based on the Point Weighting and Template Matching" (2015) IEEE 978-1-4673-7485-9
14. Aman Kharwal; "Object Detection with Deep Learning using Yolo & Tensorflow" (2020)