iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VI **Month of publication:** June 2023

DOI: https://doi.org/10.22214/ijraset.2023.53896

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Automatic License Plate Recognition

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Abstract: ***In current situations many advancements have been made in License Plate (LP) recognition techniques to enhance accuracy, they are often limited to ideal scenarios with accurately annotated training data and restricted situations. Furthermore, monitoring systems frequently employ low-resolution (LR) images or videos. Our project focuses on addressing the challenge of LP detection in digital images captured in naturalistic environments. We aim to improve the quality of LP images by combining character segmentation and recognition with adversarial Super-Resolution (SR) methods. Specifically, we utilize the SRGAN approach, which is capable of processing tiny 72 × 72 LP images. This research investigates the performance of SRGAN across various aspects, including peak signal-to-noise ratio (PSNR) and structural similarity index (SSIM). By leveraging these methodologies, we aim to overcome the limitations of existing LP recognition techniques, especially in scenarios where training data is not perfectly annotated and LR images are prevalent. Our approach integrates character segmentation and recognition with SRGAN-based super-resolution techniques to enhance the quality and accuracy of LP images.***

I. INTRODUCTION

Automatic License Plate Recognition (ALPR) is an advanced computer vision technology that enables efficient identification of vehicle registration plates from images, eliminating the need for manual intervention. Over the years, ALPR applications have predominantly focused on real-time detection and recognition of license plates. However, these approaches often come with certain limitations, particularly when it comes to short-range availability of the vehicles. Despite the specific methodologies employed in ALPR systems, the task itself remains challenging. Variables such as high vehicle speeds and non-uniform vehicle registration plates significantly impact the overall recognition rate. Environmental conditions, including smoke, haze, varying illumination, color variations, dirt, and a wide variety of registration plates, pose primary concerns in the license plate recognition problem. Efforts are being made to address these challenges and enhance the performance of ALPR systems. Researchers are developing sophisticated algorithms and techniques that can handle dynamic environmental conditions and improve recognition accuracy. Additionally, advancements in deep learning and computer vision algorithms have opened up new avenues for ALPR, enabling robust and reliable license plate recognition even in complex scenarios. In this project, we aim to tackle these challenges by implementing an ALPR system that addresses issues related to varying environmental conditions and non-uniform license plate characteristics. By leveraging cutting-edge computer vision techniques and deep learning algorithms, we seek to enhance the recognition capabilities of the system, ensuring accurate and efficient identification of license plates. By developing an ALPR system that can handle diverse environmental conditions, such as smoke, haze, and variations in illumination, we aim to contribute to the advancement of license plate recognition technology. Through rigorous experimentation and evaluation, we will assess the system's performance and analyze its effectiveness in real-world scenarios.

II. RELATED WORK

1) "Number Plate Recognition using CNN-RNN"

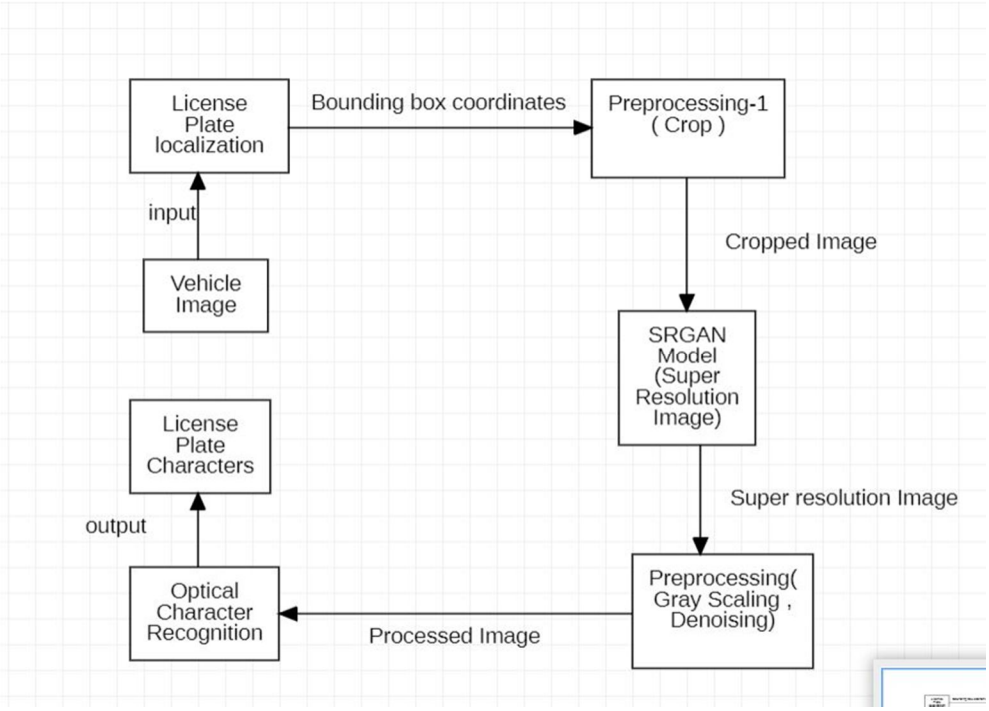
The research focuses on exploring the combination of Convolutional Neural Networks and Recurrent Neural Networks, particularly Bidirectional Long Short-Term Memory (BLSTM), for license plate recognition. CNN is utilized for feature extraction, while BLSTM is capable of capturing contextual information based on past observations. For classification purposes, the study takes the help of Dense Cluster based Voting, which successfully discriminates background and foreground, also classifies private and public plates.

2) "Mixed Style License Plate Detection and Recognition using a single neural network"

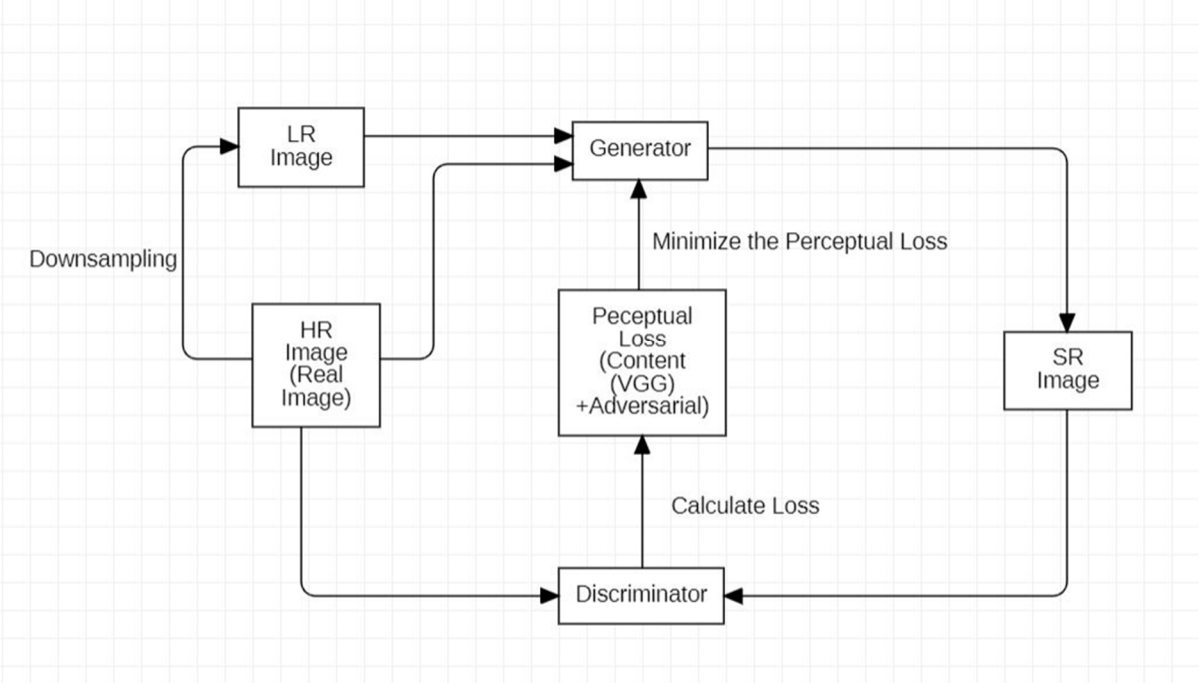
Most existing automatic license plate recognition methods concentrate on specific license plate types, while neglecting multiple LPs. This project introduces ALPRNet, a unified neural network designed for the detection and recognition of license plates of different model and design. ALPRNet utilizes two fully convolutional one-stage object detectors to accurately detect license plates with various styles.

III. METHODOLOGY

A. *Proposed Architecture*



B. *Internal Architecture Of Srgan*



IV. PROPOSED SYSTEM

1) To enhance the quality of license plate images, Super-Resolution (SR) methods are utilized, transforming low-resolution (LR) images into high-resolution (HR) counterparts.

2) This project focuses on addressing the challenge of detecting license plates in digital images captured in naturalistic environments, which closely resemble real-world scenarios.

3) Additionally, the system conducts a comprehensive analysis of the performance of SRGAN across various datasets, considering multiple aspects such as peak signal-to-noise ratio (PSNR) and structural similarity index (SSIM).
4) By utilizing an SRGAN-based approach, high-resolution images are generated, resulting in improved accuracy during the license plate recognition stage. This approach demonstrates superior performance compared to other existing systems.

A. Advantages

1) Expandable to multiple vehicles.
2) Automation.
3) Enhanced Efficiency.

V. PROPOSED ALGORITHM

A. SRGAN

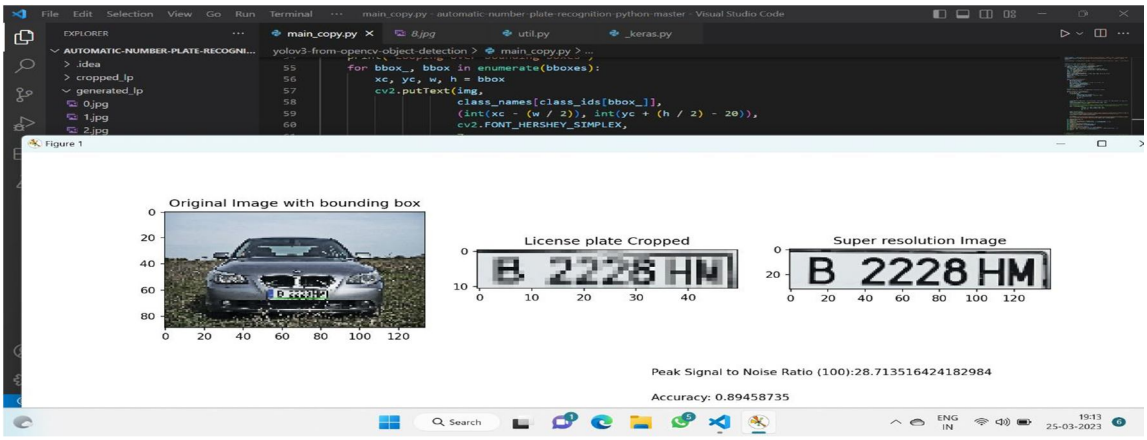
SRGAN, an abbreviation for Super-Resolution Generative Adversarial Network, is an advanced deep learning architecture developed inorder to improve the resolution and visual quality of low-resolution images to high-resolution images. It combines generative adversarial networks (GANs), perceptual loss, and adversarial loss functions to generate high-quality super-resolution images that closely resemble the original high-resolution images. The core components of SRGAN is comprised of two main components: a generator network and a discriminator network. The role of the generator network is to take low-resolution input images and generate corresponding high-resolution images. On the other hand, the discriminator network is responsible for differentiating between the generated high-resolution images and the actual ground truth high-resolution images.
During training, SRGAN employs an adversarial learning framework. The generator network is iteratively trained to generate visually pleasing and realistic HD images, while the discriminator network learns to accurately discriminate between the produced images and the ground truth images. By incorporating perceptual loss and adversarial loss functions, SRGAN encourages the generator to provide super-resolution images with high visual fidelity and fine details.

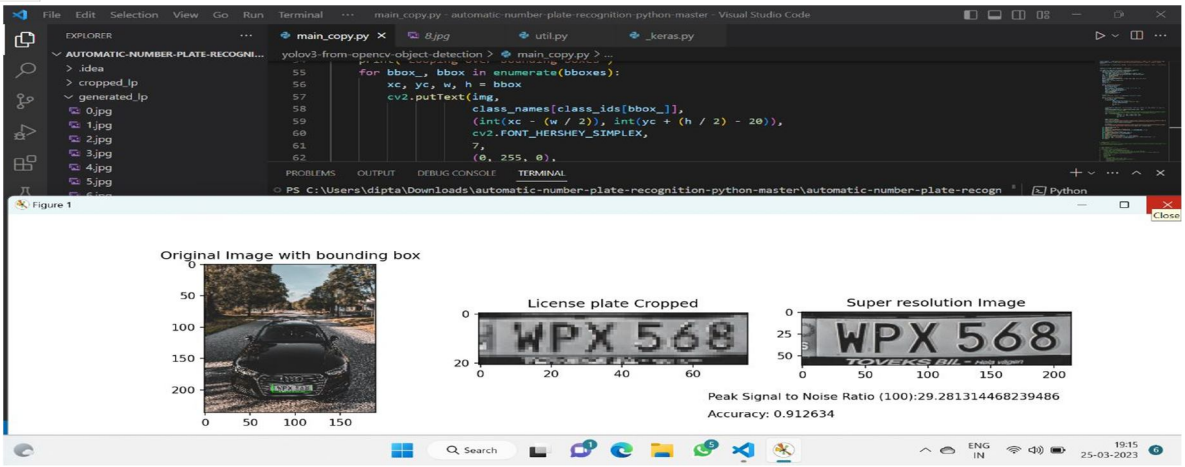
B. YOLO

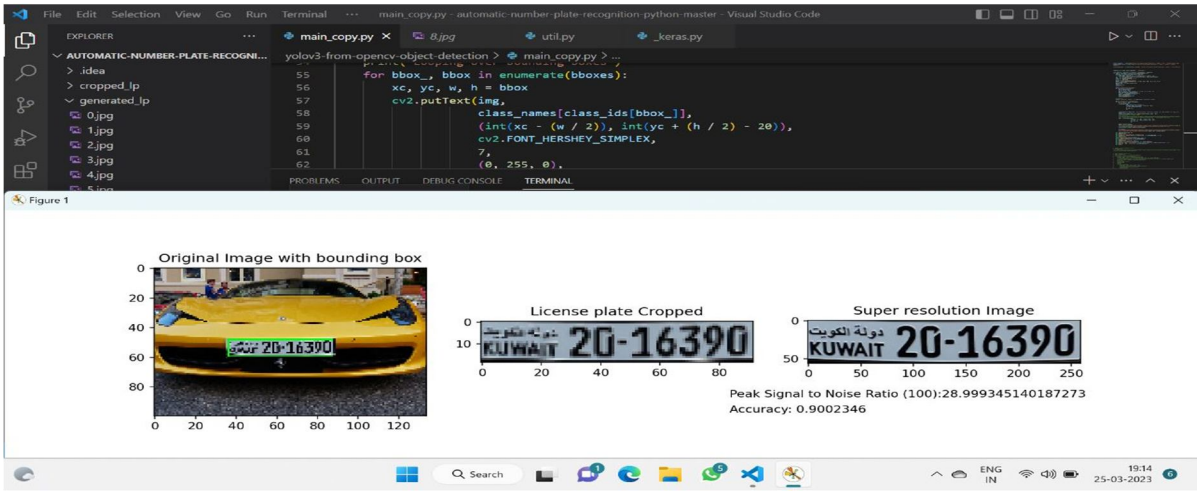
YOLO (You Only Look Once) is an advanced object detection algorithm that has gained attention in the field of computer vision. It stands out from traditional approaches by adopting a unified strategy that directly predicts bounding boxes and class probabilities in a single pass. This unique characteristic enables YOLO to achieve real-time object detection with impressive accuracy and efficiency.
The fundamental principle behind YOLO involves dividing the input image is divided into a grid, and within each grid cell, predictions are generated for bounding boxes and class probabilities.. This approach eliminates the need for complex region proposal techniques and subsequent refinement steps, resulting in faster processing. YOLO employs a deep neural network to simultaneously predict both the class probabilities and the coordinates of the bounding boxes, enabling efficient and precise object detection.

VI. RESULT

A. Output Screens







VII. CONCLUSION

In conclusion, the proposed system presents a significant advancement in traffic violation detection and enforcement. By automating the process of detecting violations related to helmet non-compliance and extracting license plate numbers, the system offers an efficient and time-saving solution. The real-time monitoring capabilities enable immediate identification and response to violations, contributing to enhanced road safety. The system has a comprehensive approach for license plate recognition, ensures a thorough enforcement process. Furthermore, the potential for integration with existing traffic management systems opens up possibilities for seamless implementation and improved overall traffic control. The proposed system holds promise in revolutionizing traffic regulation and enforcement, providing a more effective and streamlined approach to managing violations on the roads.

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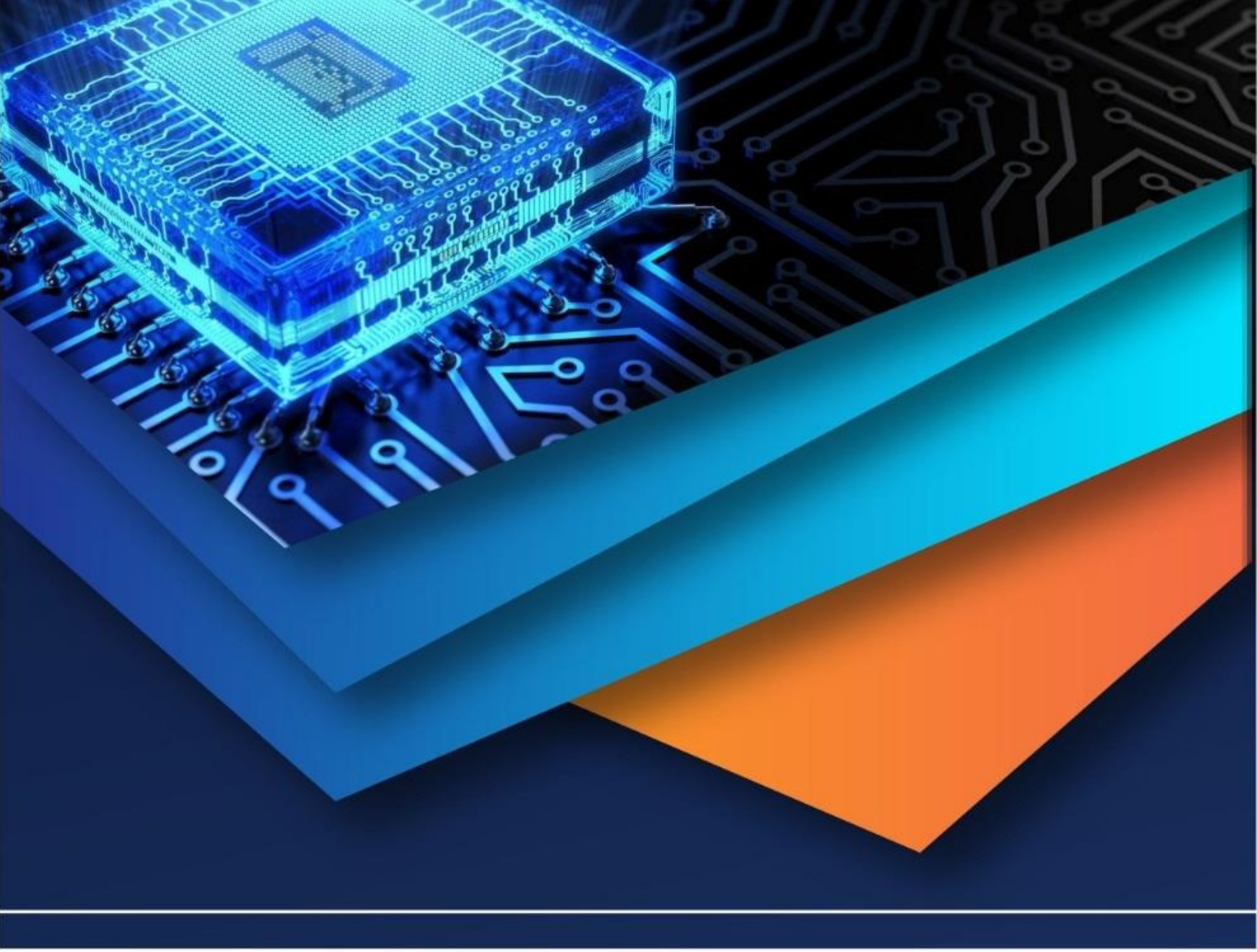

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