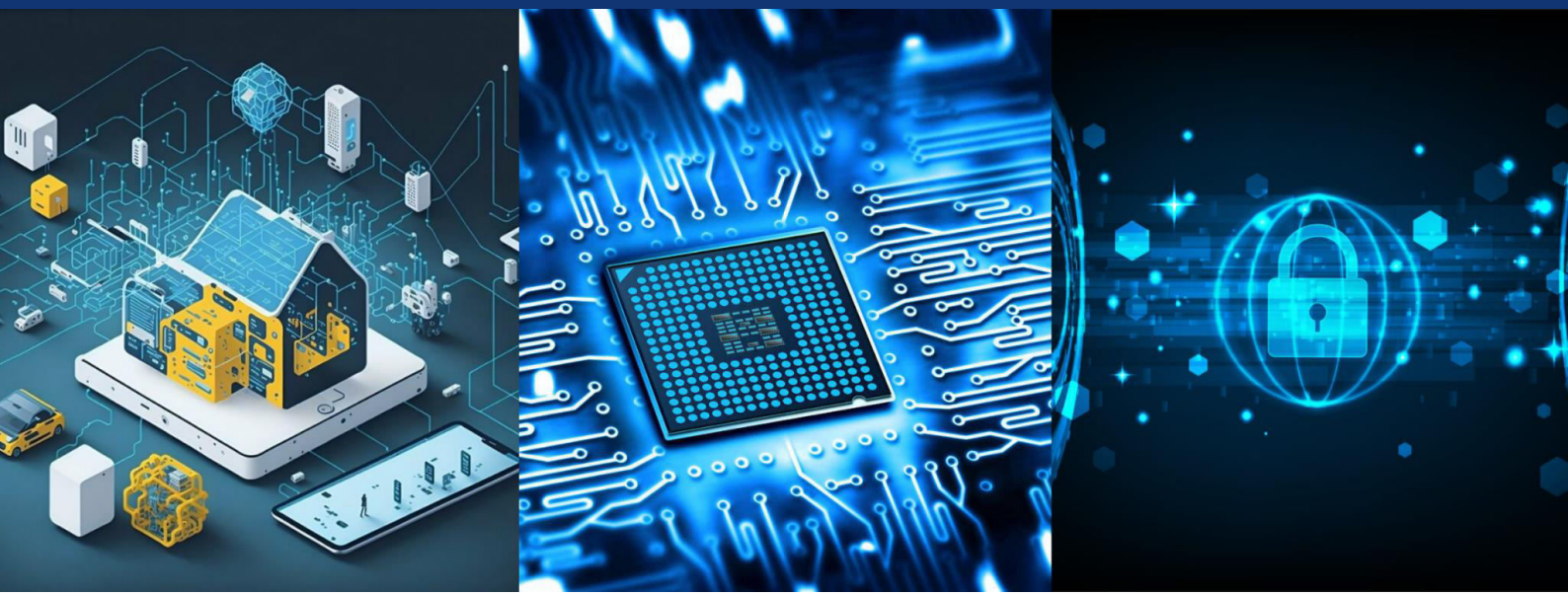
IJIRCCE

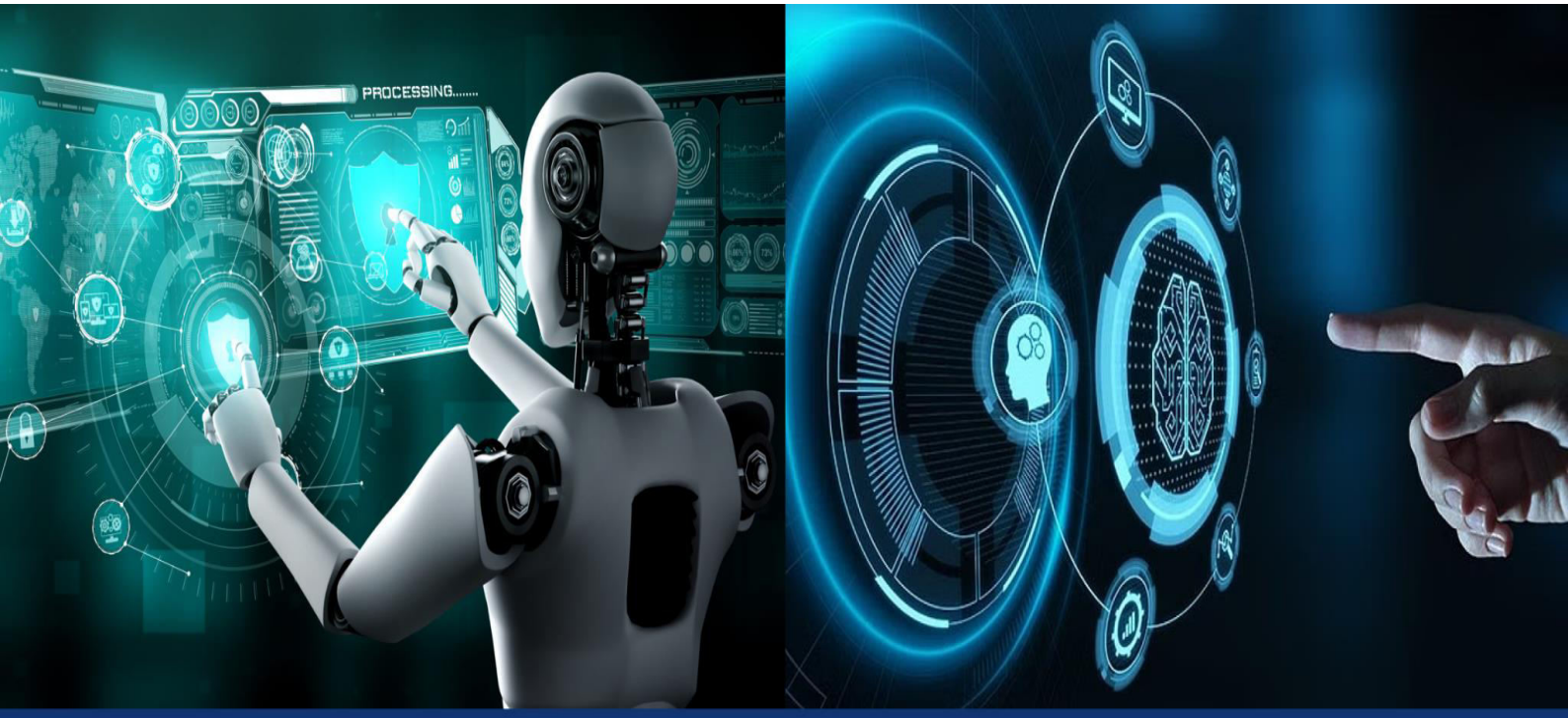
ISSN(O): 2320-9801

ISSN(P): 2320-9798



International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.771

Volume 13, Issue 5, May 2025

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305189

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Indian Traffic Sign Detection Recognition using Deep Learning

V. Vijayakumari

Assistant Professor, Dept. of CSE, The Kavery Engineering College, Salem,Tamil Nadu, India

S. Loganathan, R.V. SanjayKumar, K. Sathish, V. Ragul Gandhi

UG Student, Dept. of CSE, The Kavery Engineering College, Salem, Tamil Nadu, India

ABSTRACT: Deep learning (DL) methods have proved highly effective in predicting road traffic in comparison to ML or statistical techniques. Deep learning algorithms are based on neural networks. The detection and recognition of traffic signs is an important topic in intelligent transportation systems. The automatic detection and recognition of traffic signs during driving is the basis for realizing the unmanned driving. There are many different traffic signs, training a good model is usually time consuming. A TSR system can make the driver more aware of the road situation and condition, and thus can reduce traffic accidents. To overcome this problem, we propose an YOLOv3 (You Only Look Once, Version 3) is a real-time object detection algorithm that identifies specific objects method for detecting traffic sigh with advance features. The YOLO algorithm uses features learned by a deep convolutional neural network to detect an object.Versions 1-3 of YOLO were created by third version of the YOLO machine learning algorithm is a more accurate version of the original DL algorithm. First the image will be pre-processed and get the features from the images, after classify the images and produce the optimized result. By using the proposed method, the driver can easily detect the traffic sign and reduce the occurrence of road accidents. Experiment results show that, the average accuracy of YOLO-v3 approach is very high compare to another previous existing algorithm.

I. INTRODUCTION

The rapid advancement of deep learning algorithms has revolutionized the field of object detection, enabling accurate and efficient identification of objects in images and videos. Convolutional Neural Networks (CNNs) have emerged as a powerful tool for object detection tasks, with applications in various domains, including autonomous vehicles, surveillance, and robotics. This paper focuses on the application of CNNs in traffic sign detection, a critical component of intelligent transportation systems. We explore the use of YOLOv3, a state-of-the-art object detection algorithm, for detecting traffic signs and evaluate its performance in real-world scenarios.

Objective

This research aims to develop a real-time deep learning-based system for Indian traffic sign detection and recognition, leveraging cutting-edge architectures like YOLOv3, to enhance road safety, reduce accidents, and support the development of intelligent transportation systems in India.

Specific Objectives

1. Real-time Detection: Design and implement a deep learning-based system that can detect and recognize Indian traffic signs in real-time, with high accuracy and low latency.
2. Optimized Performance: Optimize the system's performance for real-time applications, ensuring efficient processing and minimal computational overhead.
3. Robustness to Variations: Develop a system that is robust to variations in lighting, weather, and sign conditions, ensuring reliable performance in diverse real-world scenarios.
4. Evaluation and Validation: Evaluate the system's performance in real-world settings, using metrics such as accuracy, precision, recall, and processing speed.

By focusing on real-time performance, this objective emphasizes the importance of developing a system that can be deployed in practical applications, such as driver assistance systems or autonomous vehicles.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305189

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

II. RELATED WORK

Refined Mask R-CNN-based approach: This method utilizes a CNN-based end-to-end learning framework, Refined Mask R-CNN,Todetect and recognize Indian traffic signs. The model was evaluated on a dataset comprising 6480 images with 7056 instances of traffic signs grouped into 87 categories.

Convolutional Neural Network (CNN)-based approach: Researchers have employed CNNs to develop autonomous schemes for traffic sign detection and recognition in India. These models have shown promising results in detecting and recognizing traffic signs.

Deep learning-based method: A recent study introduced a new deep learning-based method for identifying Indian traffic signs, highlighting the significance of automatic traffic sign detection, particularly with the advent of self-driving cars.

These studies demonstrate the potential of deep learning techniques in improving the accuracy and efficiency of Indian traffic sign detection and recognition systems. When publishing a paper on this topic, consider exploring the following :

Dataset creation: Developing a comprehensive dataset of Indian traffic signs to evaluate the performance of deep learning models.

Model evaluation: Assessing the performance of different deep learning architectures, such as YOLOv3, Faster R-CNN, or Refined Mask R-CNN, for traffic sign detection and recognition.

Real-world applications: Investigating the potential applications of Indian traffic sign detection and recognition systems in real-world scenarios, such as driver assistance systems or autonomous vehicles.

III. SYSTEM ARCHITECTURE AND METHODOLOGY

1.1 System Overview

System Components

- Data Collection Module: Gather images of Indian traffic signs, covering various types, lighting conditions and occlusions.

- Data Preprocessing Module: Resize images, normalize pixel values and apply data augmentation techniques to enhance model robustness.

- Deep Learning Model: Utilize Convolutional Neural Networks (CNNs) like Refined Mask R-CNN (RMR-CNN) or other architectures such as YOLOv3 or Faster R-CNN for detection and recognition.

- Model Training Module: Train the model on preprocessed dataset, fine-tuning hyperparameters for optimal performance.

- Detection and Recognition Module: Detect traffic signs in images or video streams and classify them into specific categories.

Key Considerations:

- Pre-processing steps: Implement shape finding, region of interest (ROI) and color probability to enhance model accuracy.

- Model evaluation: Assess performance using metrics like accuracy, precision, recall and F1-score

- Real-world applications: Explore potential uses in autonomous driving technologies and intelligent transportation system.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305189

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

BLOCK DIAGRAM

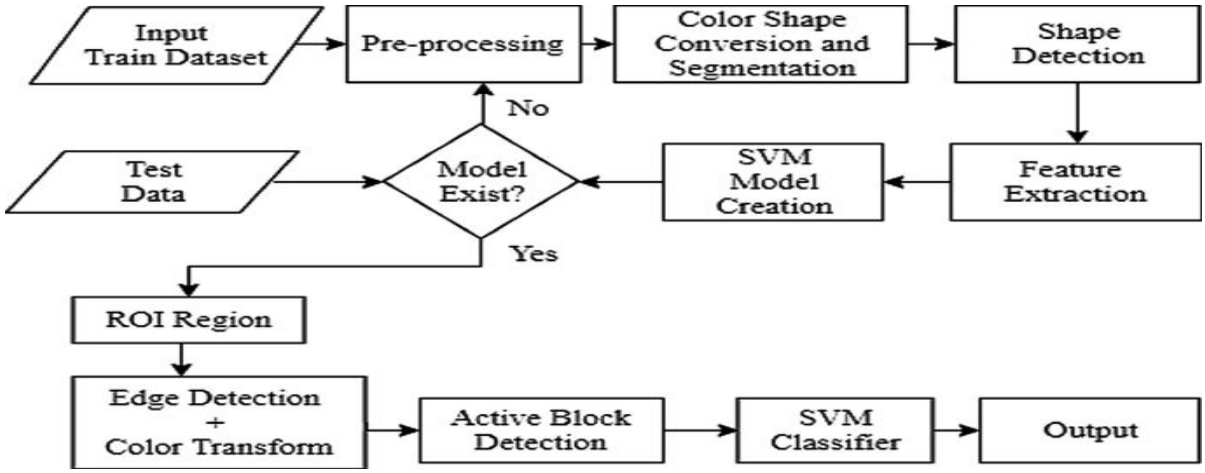


Figure 2: Methodology of Detection and deployment

Detection Methodology

1. **Image/Video Input:** Capture or collect images/video streams of traffic signs.
2. **Preprocessing**: Apply techniques like resizing, normalization and data augmentation.
3. **Object Detection:** Utilize deep learning models (e.g., YOLOv3, Faster R-CNN) to detect traffic signs.
4. **Sign Recognition**: Classify detected signs into specific categories.

Deployment Methodology

1. **Model Optimization:** Optimize trained model for deployment on target platforms (e.g., edge devices, servers).
2. **Integration:** Integrate the model with a larger system (e.g., autonomous vehicle, traffic monitoring system).
3. **Testing:** Conduct thorough testing to ensure accurate detection and recognition in real-world scenarios.
4. **Maintenance:** Continuously monitor and update the model to adapt to changing traffic sign designs, lighting conditions and other environmental factors.

Methodology for Indian Traffic Sign Detection and Recognition using Deep Learning

1.Data Collection:

-Gather a diverse dataset of Indian traffic signs, including various types, lighting conditions and orientations.

2. Data Preprocessing:

- Resize images to a uniform size
- Normalize pixel values
- Apply data augmentation techniques (rotation, flipping, etc.)

3. Model Selection: Choose a suitable deep learning architecture, such as:

- Convolutional Neural Networks (CNNs)
- You Only Look Once (YOLO)
- Faster Region-based CNN (Faster R-CNN)

4. Model Training:

- Train the model on the preprocessed dataset
- Fine-tune hyperparameters for optimal performance

5. Model Evaluation:

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305189

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

- Assess the model's performance using metrics such as accuracy, precision, recall and F1-score
- Validate the model on a test dataset

6. Deployment:
- Integrate the trained model into a system for real-time detection and recognition
- Optimize the model for deployment on target platforms (e.g., edge devices, servers)

Data collection involves gathering images of Indian traffic signs, covering:
1. Variety of signs: Different types (e.g., speed limit, stop, warning, directional).
2. Lighting conditions: Day, night, rain, fog, etc.
3. Angles and orientations: Various perspectives and rotations.
4. Occlusions: Partially obstructed signs.
5. Environmental factors: Weather, road conditions, etc.

Sources
1. Camera captures: Images from cameras mounted on vehicles or fixed locations.
2. Existing datasets: Utilize publicly available datasets or create your own.
3. Crowdsourcing: Collect images from various sources, ensuring diversity.

Annotation
1. Labeling: Annotate images with sign type, location and other relevant information.
2. Bounding boxes: Draw boxes around signs to facilitate object detection.

Quality and Quantity
1. Sufficient data: Collect a large, diverse dataset to ensure model robustness.
2. Data quality: Ensure images are clear, well-labeled and relevant.

This comprehensive dataset enables training accurate deep learning models for Indian traffic sign detection and recognition.

V. ARCHITECTURE SYSTEM

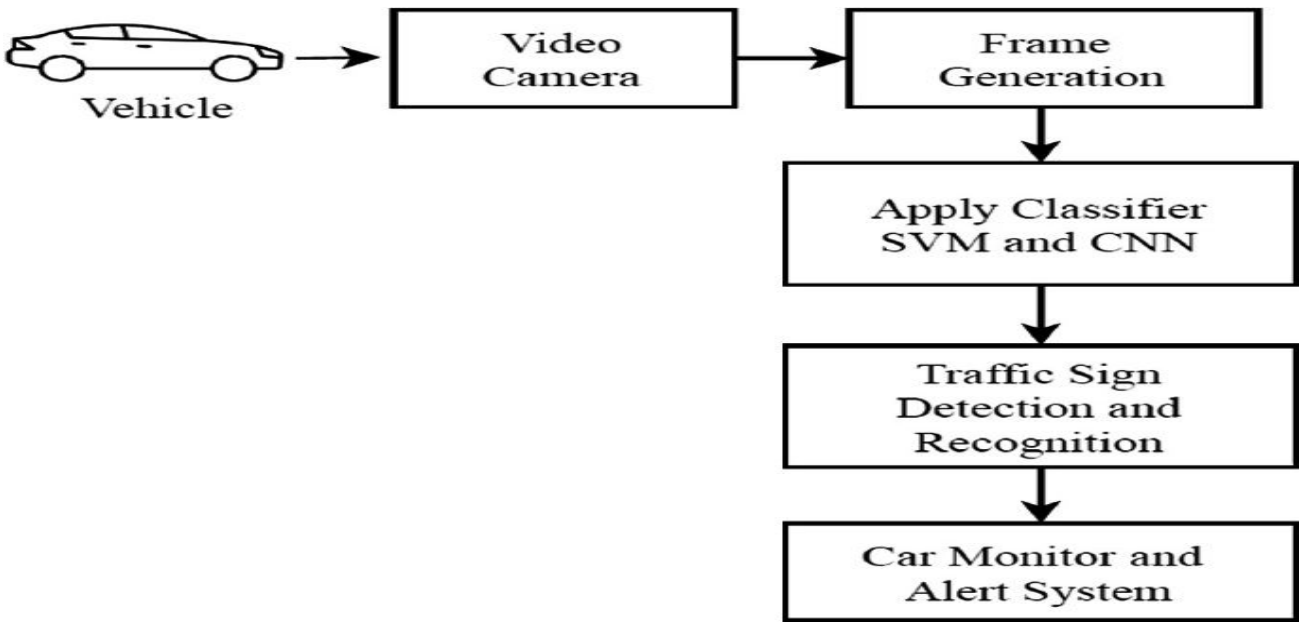


Figure 3: Classification model architecture

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305189

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

2. Implementation Details

2.1 Development Environment

Hardware Requirements

• CPU type	:	Intel core i5 processor
• Ram size	:	8 GB
• Hard disk capacity	:	500 GB

Software Requirement

• Operating System	:	Windows 10
• Language	:	Python
• Tool Software Description	:	Anaconda

Following are important characteristics of Python Programming:

- It supports functional and structured programming methods as well as OOP.
- It can be used as a scripting language or can be compiled to byte-code for building large applications.
- It provides very high-level dynamic data types and supports dynamic type checking.
- It supports automatic garbage collection.
- It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

2.2 Traffic Symbols/Sign:

Figure 5: Traffic signs

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305189

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Figure 5: Samples

Fig.1 Mandatory signs Fig. 2 Warning signs Fig. 3 Informative signs

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

VI. CONCLUSION

Conclusion for Indian Traffic Sign Detection and Recognition using Deep Learning Project Paper Publishing
"In conclusion, our proposed system for Indian traffic sign detection and recognition using deep learning demonstrates promising results, with high accuracy and robustness in detecting and classifying traffic signs. The system's potential applications in autonomous vehicles and intelligent transportation systems make it a valuable contribution to the field. Future research directions include expanding the dataset and improving model robustness. This work highlights the effectiveness of deep learning techniques in addressing the challenges of Indian traffic sign detection and recognition, paving the way for further advancements in this area."

VII. FUTURE WORK

Future research directions include:
Future Work for Indian Traffic Sign Detection and Recognition using Deep Learning

1. Dataset Expansion: Collect more diverse data, including rare or newly introduced traffic signs.
2. Model Optimization: Fine-tune models for better performance, exploring techniques like transfer learning and ensemble methods.
3. Real-time Implementation: Develop a real-time system for traffic sign detection and recognition on edge devices or in-vehicle systems.
4. Multi-camera Fusion: Integrate data from multiple cameras for improved detection and recognition.
5. Adverse Weather Conditions: Enhance model robustness for detection in challenging weather conditions (e.g., fog, rain, snow).
6. Integration with Autonomous Vehicles: Integrate the system with autonomous vehicle platforms for enhanced safety and navigation.

These future directions can further improve the accuracy, efficiency and applicability of Indian traffic sign detection and recognition systems.

REFERENCES

1. Traffic Sign Detection and Recognition Based on Convolutional Neural Network," 2019 Chinese Automation Congress (CAC), 2020, pp. 2851-2854, doi: 10.1109/CC. Dewi, R. -C. Chen, Y. -T. Liu, X. Jiang and K. D. Hartomo, "Yolo V4 for Advanced Traffic Sign Recognition With Synthetic Training Data Generated by Various GAN," in IEEE Access, vol. 9, pp. 97228-97242, 2021, doi: 10.1109/ACCESS.2021.3094201.
2. J. Yu, X. Ye and Q. Tu, "Traffic Sign Detection and Recognition in Multiimages Using a Fusion Model With YOLO and VGG Network," in IEEE Transactions on Intelligent Transportation Systems, vol. 23, no. 9, pp. 16632-16642, Sept. 2022, doi: 10.1109/TITS.2022.3170354.
3. M. -H. Hsieh and Q. Zhao, "A Study on Two-Stage Approach for Traffic Sign Recognition: Few-to-Many or Many-to-Many?," 2020 International Conference on Machine Learning and Cybernetics (ICMLC), 2020, pp. 76-81, doi: 10.1109/ICMLC51923.2020.9469574.
4. S. J. Rani, S. U. Eswaran, A. V. V. Mukund and M. Vidul, "Driver Assistant System using YOLO V3 and VGGNET," 2022 International Conference on Inventive Computation Technologies (ICICT), 2022, pp. 372-376, doi: 10.1109/ICICT54344.2022.9850535.
5. D. Mijić, M. Brisinello, M. Vranješ and R. Grbić, "Traffic Sign Detection Using YOLOv3," 2020 IEEE 10th International Conference on Consumer Electronics (ICCE-Berlin), 2020, pp. 1-6, doi: 10.1109/ICCE-Berlin50680.2020.9352180.
6. R. Gopal, S. Kuinthodu, M. Balamurugan and M. Atique, "Tiny Object Detection:Comparative Study using Single Stage CNN Object Detectors," 2019 IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE), 2019, pp. 1-3, doi: 10.1109/WIECON-ECE48653.2019.9019951.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details