IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, November 2024

Object Detection for Autonomous Vehicles Using YOLO Algorithm

Thrupthi C P[1], Dr. Chitra K[2], Mrs Harilakshmi V M[3]
Student MCA, IVth Semester[1]
Associate Professor, Department of MCA[2]
Assistant Professor, Department of MCA[3]
Dayananda Sagar Academy of Technology and Management, Udaypura, Bangalore, Karnataka, India
thrupthicp2001@gmail.com

Abstract*: The YOLO (You Only Look Once) algorithm is a real-time object recognition system that classifies objects as regression problems and predicts bounding boxes and class probabilities directly from the whole image in analysis. It is known for its speed and accuracy in real-time object detection. One of the best detection systems in autonomousvehicles is YOLO (You Only Look Once). It predicts bounding box and class probabilities from the entire image in a single evaluation using the same convolutional neural network. It works well in real-time applications such as autonomous driving dueto its high-speed capability. YOLO's one-step detection pipeline streamlines the process and reduces the computational burden. As a result, drivers and other road usersare safer and have better situational awareness and decision-making skills.*

Keywords: YOLO algorithm, Autonomous driving, Bounding box, Objectidentification

I. INTRODUCTION

YOLO (You Only Look Once) is a real-time object recognition system[7] that segments images into grids and predicts boundary boxes and probabilities for each grid cell Searching in a single neural grid pass provides accuracy and speed spike. Autonomous vehicles rely on YOLO, a deep learning-based object recognition system, to detect and understand their surroundings in real-time. It allows for faster navigation and decision- making by processing images simultaneously. YOLO improves safety and reliability by breaking up images into strings in dynamic driving situations, predicting bounding boxes, and detecting multiple objects simultaneously. Understanding the environment is just as important for autonomous vehicles as it is for a child learning to walk. Among the sensors, optical cameras are the most effective for this purpose. They are particularly useful for object tracking, although it becomes difficult when there are many objects and classes in the model. Companies like Nvidia and Vinosion have developed sensors used by automotive leaders like Tesla. It allows for more precise handling and faster detection to avoid catastrophic results. Deep learning object recognition algorithms fall into two groups: multi-step detectors, which first identify local shapes and then identify boundary boxes, and one-shot detectors, which perform both tasks simultaneously and provide results quickly.

1.1 PROBLEM STATEMENT

To develop an automatic vehicular object recognition system powered by the YOLO algorithm that can detect and identify vehicles, bicycles, pedestrians, and traffic signs in real-time. The goal is to develop a functional automotive object recognition system powered by the YOLO (You Look Once) algorithm. The system aims to detect and identify vehicle, bicycle, pedestrian, and traffic signals in real-time. Ensuring the accuracy of detection and control speed is a major challenge for seamless integration into autonomous vehicle systems. To reliably detect identify and enhance the safety and performance of autonomous vehicles, the system must be robust enough to deal with a variety of environments and factors function Additionally, it can process information from camera sensors in real-time, providing immediate and accurate detection to support dynamic vehicle environments.

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.53

Volume 4, Issue 6, November 2024

II. LITERATURE SURVEY

Ross Girshick[1] presented an enhanced object search model that provides smooth operation with dramatic speed gains and integrated the field model networks, which resulted in faster computation and training results, multi-factor data success is also highlighted in the research published.

Jeff Heaton[2] presented the nature of the intensive course which covered the aspects of theory and practice. The authors' success highlighted the ideal foundational text for beginners and experts in this field. The review shows that the book thoroughly covered mathematical foundations, neurons, and practical applications.

The paper by Peiyuan Jiang, Daji Ergu, Fangyao Liu, Ying Cai, and Bo Ma[3] reviewed Yolo's versions and highlighted their similarities despite significant differences. They suggest future research should focus on situational analysis and address the limited research on YOLO V1.

Nivetha S and Kavita R[4] presented a comprehensive method for self-driving car search. This method detected a wide range of objects such as cars, pedestrians, trucks, buses, ditches, canals, traffic lights, and motorcycles preregistered images from TensorFlow and PASCAL VOC image libraries types are used to train the algorithm.

Joseph Redman, Santosh Divala, Ross Girshik, and Ali Farhadi[5] present YOLO, an integrated search engine that is easy to build, fast, and highly interactive, making it ideal for real-time.

Shaoqing Ren, Caming He, Ross Girshick, and Jian Sun [6] proposed a regional pattern network (RPN) for efficient feature recognition, which is the resolution and accuracy in field Improvement.

The Yolo Pattern Recognition in Autonomous Driving Scenarios Abhishek Sarada, Drs. Anupamabhan, Dr. in the paper "YOLO-Based Object Recognition for Autonomous Driving Using Camera Sensors" by Shubhra Dixit [7], the authors emphasized the importance of complete data and robust training methods.

High accuracy and short run time are achieved by Ning Zhang and Jiaho Fan's[8] Lightweight YOLOv3 method for vehicle and pedestrian detection, which combines channel-level pruning, MergeSoft-NMS, and anchor boxes.

III. METHODOLOGY

Existing Method

The efficient real-time capability of the YOLO algorithm makes it desirable for object detection in autonomous vehicles. To predict possible boundary boxes and classes, the picture is split up into grids, and features are extracted using transformation root networks.

Proposed Method

The proposed system uses the YOLOv5 model to accurately display objects on the screen. It can recognize a wide variety of objects in images and videos, including people, cars, bottles, and mobile phones. The sophisticated YOLOv5 Convolutional Neural Network (CNN) algorithm provides fast and accurate detection by accurately processing the entire image. This algorithm divides the input image into a grid, which then assigns confidence scores, bounding boxes, and class probabilities to each cell. The model has strong detection skills when trained on big datasets to identify common features. The YOLO (You Look Once) algorithm is a real-time feature search algorithm that rearranges features as regression problems, directly from image pixels to bounding box coordinates to class probabilities, Unlike traditional methods that reuse classifiers or localizations. This network divides the image into regions and simultaneously predicts bounding boxes and probabilities for each region. YOLO's integrated architecture makes it very fast and allows for end-to-end training and optimization. The capacity to effectively generalize to new locations and see objects in different views makes it perfect for uses that call for fast and accurate discovery. The YOLO algorithm for object detection. First, their features were extracted, and expanded to 416 and 416 pixels, then using a convolutional neural network; the detections obtained after non- maximum suppression remove unnecessary bounding boxes and track in the frame from the source.

Steps for object detection:

1. Uploading the dataset of images/video.
2. We are providing the classes of objects to identify and classify the detected objects with their names.
3. Training the YOLO model using weights then custom training the model.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, November 2024

4. By opening the Anaconda prompt by giving the path to identify its destination for detecting the confidence score and bounding box.
5. In another folder the results are saved and the detected image has a bounding box with the confidence score.

The algorithm detects the objects in the given figure. The input figure considered has 4 persons and 1 bus. It also shows the path where the outcomes are stored.

IV. RESULTS AND DISCUSSIONS

The discern suggests a terminal screen displaying Python code, probably associated with picture processing or deep mastering version prediction, with the discussion of the YOLO set of rules and code fragments such as file paths, image embedding, and model prediction functions. It appears to require the evaluation or manipulation of pictorial statistics, perhaps for object popularity responsibilities. The resulting system uses the YOLOv5 model to accurately display items on the screen. It can recognize a wide variety of objects in pictures and films, including people, cars, and mobile phones. The sophisticated YOLOv5 architecture of a convolutional neural network (CNN) provides swift and precise recognition by processing the entire image in one session This algorithm divides the input images into a grid, which then generates a confidence score, bounding boxes, as well as class probabilities for each cell. The model has strong detection skills when trained on large data sets to identify common features. This shows the utilization of the YOLO object detection system in a street environment, where bounding boxes are used to identify and label objects. The method uses labels to identify the classes and confidence scores of objects and uses colored bounding boxes to distinguish between multiple objects Observed objects include buses and people, with confidence levels ranging from 0 to 1. Can be displayed role in real-time object detection. The technology has been used for monitoring and autonomous driving. The Figure[3] color coding and labeled boxes make it easy To differentiate between different types. Individuals are identified by blue boxes, while buses are identified by a different color. Most of the indicators have high-reliability values, such as "person 0.87" and "bus 0.85," indicating how well the system performs in identifying and classifying objects across an assortment of assets and conditions. Compared to current observed challenges, YOLO showed better speed than Faster R-CNN and other multiphase detectors, albeit with smaller features for slightly less accuracy. Future work will focus on particle detection, continuous learning, and hardware optimization to improve performance. Overall, YOLO's speed and accuracy make it ideal for autonomous commercial vehicle systems, providing timely and reliable detection.

Figure 1 shows how the algorithm works with the confidence score, bounding boxes, and the item detected in the specified output image. It uses Python libraries to get the results very accurately in a single shot. Figure 2 tells about how the output is saved in another folder when the algorithm runs and in the previous figure the path is specified. In Figure 3 we can see that the output we see is the images are specified with the bounding boxes the confidence score and the number of objects identified.

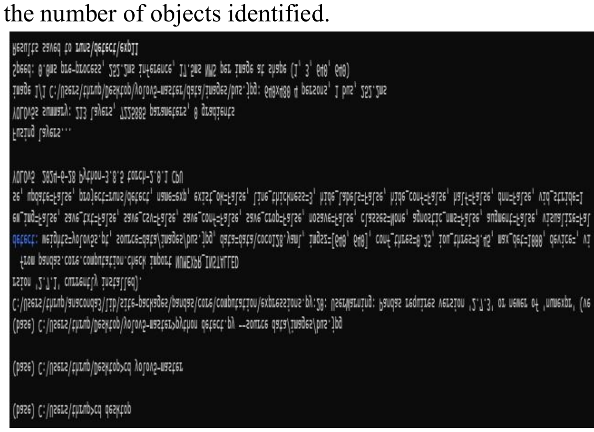

Figure 1. Displaying the identified objects.

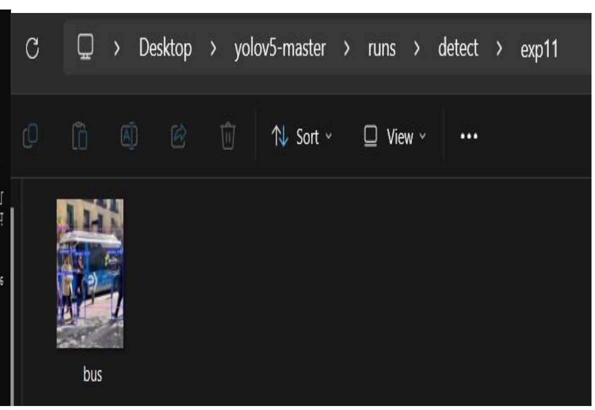

Figure 2 .Displaying the folder where the output store

DOI: 10.48175/IJARSCT-22539

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, November 2024

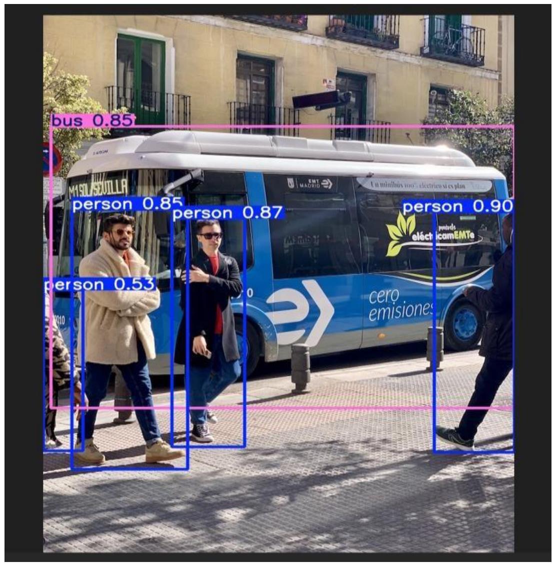

Figure 3. Identifying the class of objects with the confidence score

V. CONCLUSION

The YOLO algorithm is an effective instrument for real-time street environment detection, and for rapidly identifying people and buses. Single sensing techniques excel in applications such as multimedia systems, autonomous driving, and monitoring, improving user experience, operational efficiency, and safety. In autonomous driving, high accuracy and fast acceleration are crucial for error-free visibility. We created bounding boxes and class labels and successfully trained YOLO models using camera sensors to detect road objects. Despite the fact that our model operates well, it still encounters some false positives and negatives, which may dangerous. Reducing these errors is crucial since erroneous positive results may fatal accidents. We aim to reduce these issues by providing comprehensive training and appropriate psychological information. YOLO introduction to the joint pattern recognition system. Our model is straightforward to perform directly in all the images. Unlike classification-based methods, YOLO is directly trained on standardized loss activities to detect performance and is used to train the entire model in an integrated manner. Fast Yolo is the fastest detector in the books and pushes Yolo past real-time detection. In the end, applying the YOLO algorithm for item recognition in autonomous automobiles gives large gains in pace and accuracy. YOLO's integrated approach, which procedures the complete photograph simultaneously, enables the actual-time detection vital for independent driving scenarios. Its multi-object detection and spatial positioning abilities permit the car to securely navigate tough avenue conditions Furthermore, YOLO's capability to calibrate on multiple datasets ensures performance reliability in lots of actual-world conditions. In summary, the application of YOLO algorithms for object recognition in autonomous vehicles provides fast, accurate, and robust performance, which is necessary for real-time decision-making and navigation in complex environments YOLO's ability to handle all situations further ensures reliable and safe internal autonomous vehicle systems.

REFERENCES

[1] Girshick, R. (2015). Fast r-cnn. In Proceedings of the IEEE international conference on computer vision (pp. 1440-1448).
[2] Heaton, J. (2018). Ian goodfellow, yoshua bengio, and aaron courville: Deep learning: The mit press, 2016, 800 pp, isbn: 0262035618. Genetic programming and evolvable machines, 19(1), 305-307.
[3] Jiang, P., Ergu, D., et al., (2022). A Review of Yolo algorithm developments. Procedia computer science, 199, 1066-1073.
[4] Kavitha, R., & Nivetha, S. (2021, May). Pothole and object detection for an autonomous vehicle using yolo. In 2021 5th international conference on intelligent computing and control systems (ICICCS) (pp. 1585-1589). IEEE.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, November 2024

[5] Redmon, J., Divvala, S., et al., (2016). You only look once: Unified, real-time object detection. In Proceedings of the IEEE conference on computer vision and pattern recognition (pp. 779-788).

[6] Ren, S., He, K., et al., (2016). Faster R-CNN: Towards real-time object detection with region proposal networks. IEEE transactions on pattern analysis and machine intelligence, 39(6), 1137-1149

[7] Sarda, A., Dixit, S., et al., (2021, February). Object detection for autonomous driving using yolo [you only look once] algorithm. In 2021 Third international conference on intelligent communication technologies and virtual mobile networks (ICICV) (pp. 1370-1374). IEEE.

[8] Zhang, N., & Fan, J. (2021, April). A lightweight object detection algorithm based on YOLOv3 for vehicle and pedestrian detection. In 2021 IEEE Asia-Pacific Conference on Image Processing, Electronics and Computers (IPEC) (pp. 742-745). IEEE.