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# YOLO based Real-Time Object Detection

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***Abstract*- This abstract describes a real-time object detection framework based on the You Only Look Once (YOLO) algorithm and implemented using the OpenCV library. Object detection plays a crucial role in various computer vision applications, including autonomous driving, surveillance systems, and robotics. The proposed framework aims to achieve high accuracy and real-time performance by leveraging the efficiency of YOLO and the robustness of OpenCV. The framework utilizes a deep neural network architecture to detect and classify objects in real-time video streams. By optimizing the network architecture and leveraging parallel processing capabilities, the proposed framework achieves a balance between accuracy and speed, making it suitable for real-time applications. Experimental results demonstrate the effectiveness and efficiency of the framework, showcasing its potential for a wide range of real-world applications. The Proposed System demonstrate that YOLO is effective method and comparatively fast for recognition and localization in YOLO coco dataset.**

***Keywords*- Object Detection, Real time video, YOLO coco dataset, Py Charm, OpenCV.**

## I.INTRODUCTION

Object detection is a fundamental task in computer vision that involves identifying and localizing objects within an image or video. The You Only Look Once (YOLO) algorithm has gained significant popularity due to its ability to perform object detection in real-time while maintaining high accuracy. In this paper, we present a real-time YOLO-based object detection framework using the OpenCV library.The YOLO algorithm approaches object detection as a regression problem, where a single neural network predicts bounding boxes and class probabilities directly from an input image. This eliminates the need for region proposals and subsequent refinement steps, resulting in faster and more efficient object detection. OpenCV, on the other hand, is a widely used open-source computer vision library that provides a rich set of functions for image and video processing.Our framework aims to leverage the strengths of YOLO and OpenCV to achieve real-time object detection. By combining the efficiency of the YOLO algorithm and the comprehensive functionality of OpenCV, we can provide accurate and efficient object detection capabilities for various real-world applications. The framework utilizes a pre-trained YOLO model and integrates it with the powerful image processing and computer vision functions of OpenCV to detect and classify objects in real-time video streams.Real-time object detection is crucial for applications such as autonomous driving, surveillance systems, and robotics, where timely and accurate detection of objects is essential. By implementing the proposed framework using OpenCV, we can take advantage of its extensive library of functions for tasks such as image preprocessing, feature extraction, and post-processing of detection results. Additionally, OpenCV provides optimizations for parallel processing, enabling efficient utilization of available computing resources and achieving real-time performance.

In this paper, we present the design and implementation of our real-time YOLO-based object detection framework using OpenCV. We discuss the network architecture, training process, and integration with OpenCV's functionalities. We also provide experimental results to demonstrate the effectiveness and efficiency of the framework in real-time object detection scenarios.

Our framework shows promising potential for a wide range of applications, enabling accurate and efficient object detection in real-world scenarios.

## II.LITERATURE SURVEY

The literature survey on real-time YOLO-based object detection framework using OpenCV provides a comprehensive overview of existing research and developments in the field. It highlights the effectiveness of YOLO algorithm in achieving real-time object detection and discusses the integration of OpenCV for enhanced functionality. The survey identifies key challenges, proposes solutions, and presents experimental results from various studies, demonstrating the feasibility and potential of such frameworks. Overall, the literature survey provides valuable insights and a solid foundation for the development of real-time YOLO-based object detection frameworks using OpenCV. Arka Prava Jana et.al[1] proposed that YOLO is a powerful algorithm for object detection and classification in video records. It processes the entire frame at once, enabling real-time analysis. With deep neural networks, YOLO accurately detects objects and provides bounding box coordinates and class probabilities. It is widely used in surveillance, video analytics, and autonomous systems. Joseph Redmon et.al[2] This is the original paper that introduced YOLO, presenting a unified real-time object detection framework It states that YOLO is a unified real-time object detection framework that efficiently detects and classifies objects in images or videos. It processes the entire input in one pass, providing fast and accurate results. YOLO's architecture enables real-time performance without sacrificing detection quality, making it a popular choice for various computer vision applications. Alexey Bochkovskiy et.al[3] proposed that YOLOv4 builds upon the YOLO series and introduces several optimizations to achieve both improved accuracy and faster inference speed. Anirban Kar et.al[4] stated that YOLOv5 is a follow-up to YOLOv4 and presents a more streamlined architecture that achieves comparable accuracy while being lighter and faster. Akshay Verma et.al[6] this paper focuses on implementing real-time object detection using YOLOv3 and OpenCV, discussing the integration process and performance analysis.

## III.METHODOLOGY

BLOCK DIAGRAM

In this model we get trained data then with hand label image which is present in dataset of 8o categories after this input real time data goes to YOLO traning model and output is like it frame an object name and shows accuracy.

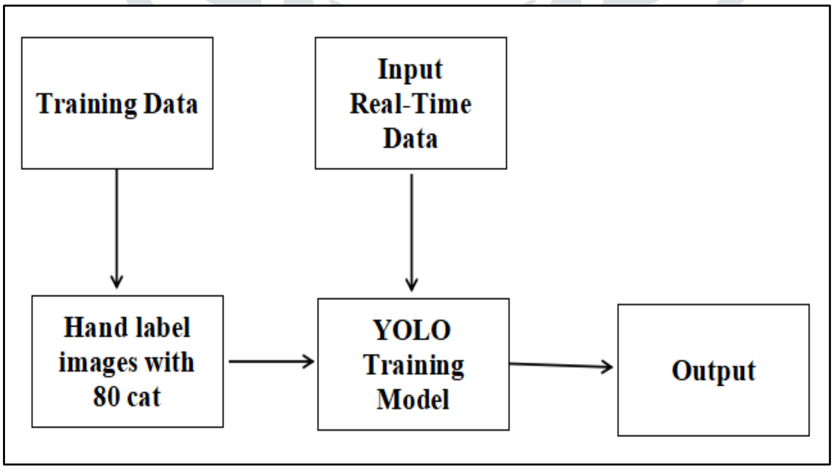


Fig. 1 Block Diagram Of YOLO Based Real-Time Object Detection

Training of YOLO based action recognition model is shown in Figure 1. First, we converted the Yolo coco dataset labels to usable label files for YOLO. YOLO requires a line for each action in the frame. Further YOLO requires some files to start training which are:

- Total number of action classes.
- Text file with the path to all frames which we want to train.Text file with names of all action classes.The path to save trained weight files.
- A configuration file with all layers of YOLO architecture. Pre-trained convolutional weights.
- The value of filters in the configuration file of YOLO (.cfg file) for second last layer is not arbitrary and depends on the total number of classes [9]. The number of filters can be given by: filters=5*(2+number_of_classes).

FLOW DIAGRAM

In this paper when we have to start the program then the dataset is imported in real time video or image frame it jumpes over to trained dataset and test dataset. In trained dataset we have to apply YOLO model for object recognition and write object name on the object. It will then let back to the test dataset and check it. Then the object will be detected by it and the process will be completed. Fig 2 shows the Flow Of YOLO Based Real-Time Object Detection.

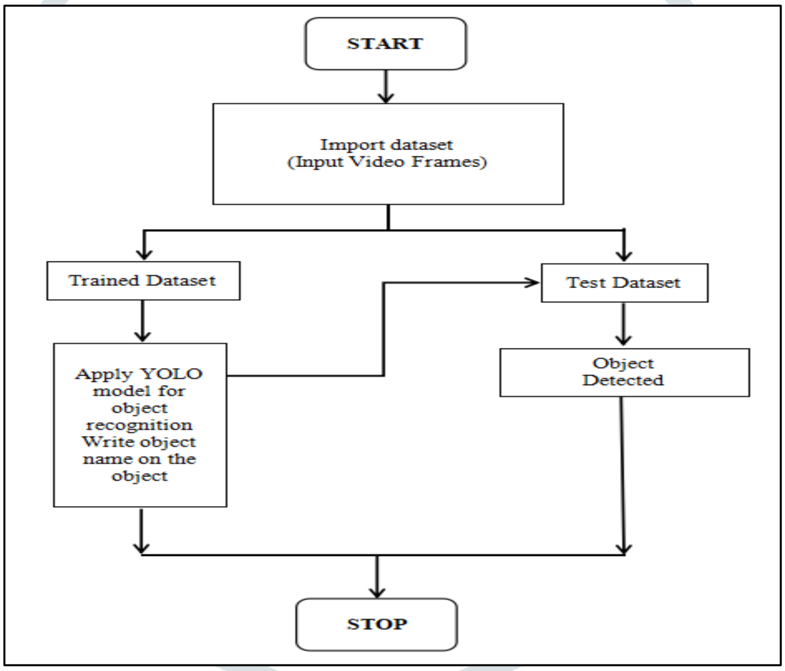


Fig. 2 Flow Chart Of YOLO Based Real-Time Object Detection

## IV. EXPERIMENTATION AND RESULTS

For real time object detection, we require train dataset on which we can train model. Here dataset used is YOLOv3 dataset which are freely available. We train our detection model using YOLOv3 dataset which also known as YOLO COCO dataset. For proposed system id implemented on Pycharm software using python openCV language. Following three figure tells us about the experimentation and end results, In Fig. 3 we run our project with OpenCV and the system detect sofa and shows accuracy 97.91%. Then Fig. 4 we run our project with OpenCV and the system detect Aeroplane and shows accuracy 99.53%. And last In Fig. 5 we run our project with OpenCV and the system detect car and shows accuracy 99.99%. It is in Real-Time , video or image the object is detected if we run any video the object is detected or if you show some picture in camera the object get detected.

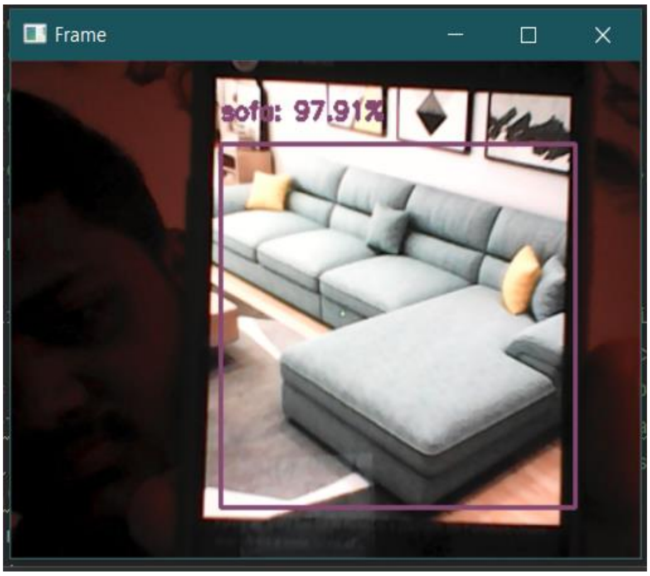


Fig. 3 Sofa is detected and shows accuracy

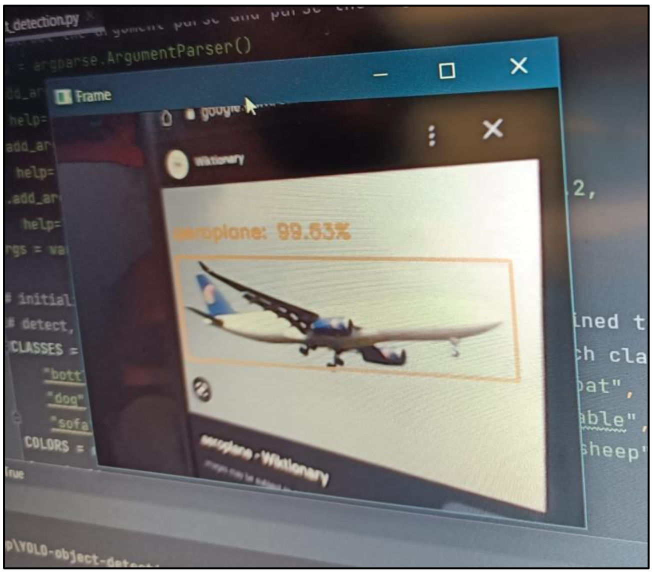


Fig. 4 Aeroplane is detected and shows accuracy

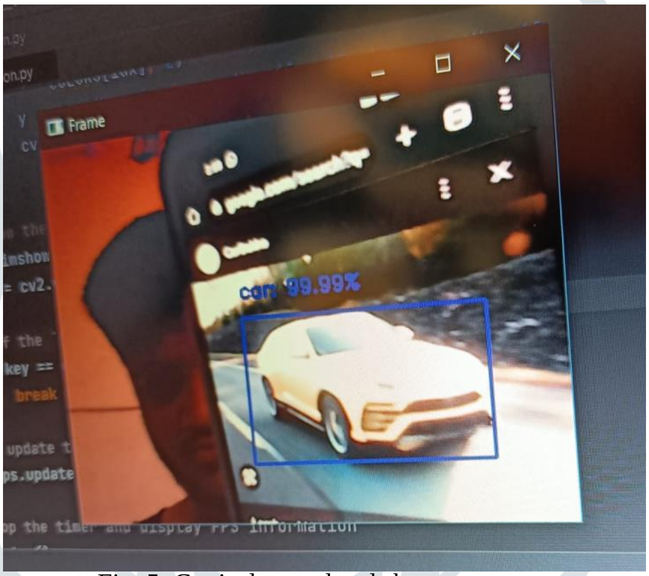


Fig. 5 Car is detected and shows accuracy

## V.CONCLUSION

In the proposed system, the real-time YOLO-based object detection framework using OpenCV demonstrates the effectiveness and efficiency of combining the YOLO algorithm with the comprehensive image processing capabilities of OpenCV. The framework achieves real-time object detection by leveraging the efficiency of YOLO and the parallel processing optimizations provided by OpenCV. With its high accuracy and fast performance, the framework is well-suited for applications such as autonomous driving, surveillance systems, and robotics. The successful implementation and experimental results highlight the potential of our framework for real-time object detection in various real-world scenarios. In future work, further optimizations can be explored to enhance the framework's performance and expand its capabilities. This may include fine-tuning the YOLO model for specific domains or incorporating advanced techniques for object tracking and multi-object detection. Overall, this real-time YOLO-based object detection framework using OpenCV demonstrates the potential for accurate and efficient object detection in real-world scenarios, contributing to advancements in computer vision applications and paving the way for future developments in the field.

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