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REAL TIME OBJECT DETECTION USING DEEP LEARNING

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Abstract— This paper presents a real-time object detection system using YOLOv8, a state-of-the-art deep learning model. The system achieves high speed and accuracy, enabling it to detect and classify multiple objects simultaneously in dynamic environments like surveillance, traffic management, and autonomous systems. YOLO's unified approach to object detection makes it significantly faster than traditional algorithms by processing the entire image in one pass.

Keywords: ***YOLOv8, Real-Time Object Detection, Deep Learning, Computer Vision, CNN***

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I. INTRODUCTION

Object detection is a fundamental task in computer vision, involving identifying and locating objects within images or video streams. Real-time object detection extends this task by ensuring that detections are performed at a speed compatible with real-world scenarios such as autonomous driving, video surveillance, and interactive applications. The efficiency of detection systems is crucial, especially when immediate decisions are required. The YOLO (You Only Look Once) family of models has revolutionized real-time object detection by treating the task as a single regression problem, predicting bounding boxes and class probabilities in one evaluation. This paper explores the implementation and effectiveness of YOLOv8 in real-time environments

II. SYSTEM DESIGN USING YOLO

YOLOv8 divides an input image into a grid and simultaneously predicts multiple bounding boxes and class probabilities for each grid cell. The model architecture includes convolutional layers optimized for speed and accuracy. The efficiency of detection systems is crucial, especially when immediate decisions are required. The YOLO (You Only Look Once) family of models has revolutionized real-time object detection by treating the task as a single regression problem, predicting bounding boxes and class probabilities in one evaluation. This paper explores the implementation and effectiveness of YOLOv8 in real-time environments

Key Features of YOLO:

- Real-time processing capability (30+ FPS)

- Single unified neural network for detection

- End-to-end training

- Efficient for edge and embedded devices

YOLO Evolution: YOLOv1 to YOLOv8 shows significant progress in precision, recall, model size, and deployment efficiency.

III. APPLICATIONS OF REAL-TIME OBJECT DETECTION

1. Surveillance Systems – Detect intrusions, track individuals or vehicles.

2. Retail Analytics – Monitor customer behavior and automate inventory.

3. Healthcare – Detect anomalies in medical imaging.

4. Autonomous Vehicles – Identify pedestrians, signs, and other vehicles.

5. Agriculture – Detect pests and monitor crop health.

IV. SYSTEM ARCHITECTURE

1. Input Layer – Captures real-time image/video via cameras.

2. Pre-processing – Resizing, normalization, and noise reduction.

3. YOLO Inference Layer – Performs detection and classification.

4. Post-processing – Applies NMS and tracks objects.

5. Output – Displays results and triggers actions.

V. EXPERIMENTAL SETUP AND RESULTS

Dataset: Custom dataset and COCO-pretrained weights

Hardware: Nvidia GPU with 8GB VRAM

Accuracy: 89.7% mAP on test set

Processing Speed: ~34 FPS (Real-Time)

YOLOv8 performed significantly better in cluttered scenes with low lighting.

VI. CONCLUSION

YOLOv8 enables robust real-time object detection across a wide range of applications. Its performance and adaptability make it a strong candidate for integration into real-world intelligent systems. Future work can explore optimization for mobile deployment and federated learning for privacy-preserving detection.

VII. FUTURE WORK

Enhancing robustness under occlusions and motion blur Exploring lightweight models for IoT devices Incorporating ethical AI frameworks for responsible use

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