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A

REAL-TIME/FIELD BASED RESEARCH PROJECT

Report

On

Object Prediction using YOLO

Submitted in partial fulfillment of the
Requirements for the award of the degree
of

Bachelor of Technology
In
COMPUTER SCIENCE AND ENGINEERING-
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
By

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

2022-2026

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING-

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

CERTIFICATE

This is to certify that the project entitled **"Object Prediction using YOLO"** has been submitted by **K. HARSHA-22R21A6695** in partial fulfillment of the requirements for the award of degree of Bachelor of Technology in Computer Science and Engineering-Artificial Intelligence & Machine Learning from Jawaharlal Nehru Technological University, Hyderabad. The results embodied in this project have not been submitted to any other University or Institution for the award of any degree or diploma.

Internal Guide **Project-Coordinator**

Head of the Department

COMPUTER SCIENCE AND ENGINEERING-

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

DECLARATION

We hereby declare that the project entitled **"Object Prediction using YOLO"**is the work done during the period from **Feb 2024 to July 2024** and is submitted in partial fulfillment of the requirements for the award of degree of Bachelor of Technology in **Computer Science and Engineering- Artificial Intelligence & Machine Learning** from Jawaharlal Nehru Technology University, Hyderabad. The results embodied in this project have not been submitted to any other university or Institution for the award of any degree or diploma.

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The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people who made it possible, whose constant guidance and encouragement crowned our efforts with success. It is a pleasant aspect that we now have the opportunity to express our guidance for all of them.

First of all, we would like to express our deep gratitude towards our internal guide**, Mr. SK. GOUSE PASHA, Assistant Professor, Computer Science and Engineering- Artificial Intelligence & Machine Learning** for support in the completion of our dissertation. We wish to express our sincere thanks to **Dr. K. Sai Prasad, HOD, Department of Computer Science and Engineering- Artificial Intelligence & Machine Learning** for providing the facilities to complete the dissertation.

We would like to thank all our faculty and friends for their help and constructive criticism during the project period. Finally, we are very much indebted to our parents for their moral support and encouragement to achieve goals.

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ABSTRACT

This project aims to develop a user-friendly website that leverages the advanced YOLOv8 model for image classification, object detection, and human pose estimation. Users will be able to upload images, videos, or specify video sources like YouTube, RTSP, or webcam for real-time processing. YOLOv8, or "You Only Look Once" version 8, is an innovative algorithm known for its superior performance, accuracy, and speed. The website will integrate this model to accurately identify and localize multiple objects within images or video frames and estimate human poses. Built on deep learning and convolutional neural networks (CNNs), YOLOv8 represents significant advancements in computer vision. The project will involve integrating the model into a web application framework, creating an intuitive user interface, and implementing components to handle various input sources. Users can customize detection parameters such as confidence thresholds, object classes, and output formats. Detection results will be overlaid on the input media, showing bounding boxes around objects and skeletons for human poses, with options to download or share the processed outputs. Overall, this project aims to create a powerful platform that combines YOLOv8's capabilities with an accessible web interface, enabling advanced object detection and pose estimation for applications in surveillance, security, robotics, augmented reality, and human-computer interaction.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

This overview provides a concise yet comprehensive exploration of a website that leverages the advanced YOLOv8 model for image classification, object detection, and human pose estimation. The document aims to demystify the integration of this cutting-edge model into a web-based application for a broad audience, from beginners to those seeking a quick understanding of the subject. The abstract introduces the fundamental concepts of object detection and pose estimation and outlines how the YOLOv8 model enhances these processes with superior performance, accuracy, and speed. Core components of the system, including real-time processing, customizable detection parameters, and support for various input sources (images, videos, and streams), are succinctly explained.

1.2 PURPOSE OF THE PROJECT

The purpose of developing this website with the YOLOv8 model encompasses various objectives and potential benefits. Here are some key purposes:

1. **Operational Efficiency:**
   Automate object detection and pose estimation processes for efficiency.
2. **User Experience:**
   Provide a user-friendly interface for seamless interaction and customization.
3. **Technological Advancement:**
   Utilize state-of-the-art algorithms to push the boundaries of computer vision applications.

1.3 MOTIVATION

The motivation behind this project revolves around improving object detection and pose estimation capabilities, enhancing user experiences, leveraging technological advancements, and exploring diverse applications in various sectors. This project aims to create a powerful platform that combines YOLOv8's capabilities with an accessible web interface, enabling advanced computer vision techniques for applications in surveillance, security, robotics, augmented reality, and human-computer interaction. The integration of YOLOv8 ensures accurate and efficient detection, even in complex scenarios, making it a valuable tool for numerous applications.

CHAPTER 2

LITERATURE SURVEY

We conducted a thorough literature survey by reviewing existing systems and techniques for object detection, pose estimation, and web-based computer vision applications. Research papers, journals, and publications in the fields of computer vision, deep learning, and web development were referred to in order to prepare this survey.

2.1 EXISTING SYSTEM

- **Exploring the Frontier of Object Detection: A Deep Dive into YOLOv8 and the COCO Dataset**

  Piyush Kumar, Vimal Kumar

  DOI: 10.1109/CVMI59935.2023.10464837

- **YOLOv8-CAB: Improved YOLOv8 for Real-time object detection**

  Moahaimen Talib, A. Al-Noori, Jameelah Suad

  DOI: 10.33640/2405-609x.3339

- **Object Detection Using Coco Dataset**

  Swasti Jain, S. Dash, Rajesh Deorari, Kavita

  DOI: 10.1109/ICCR56254.2022.9995808

- **Improved YOLOv8 Model for a Comprehensive Approach to Object Detection and Distance Estimation**

  ZU JUN KHOW , YI-FEI TAN , HEZERUL ABDUL KARIM , HAIRUL AZHAR ABDUL RASHID

  DOI:10.1109/ACCESS.2024.3396224

- **You Only Look Once: Unified, Real-Time Object Detection**

  Joseph Redmon; Santosh Divvala; Ross Girshick; Ali Farhadi

  DOI: 10.1109/CVPR.2016.91

2.2 LIMITATIONS OF EXISTING SYSTEM

In the context of object detection and pose estimation, existing systems exhibit several limitations despite advancements in technology. Understanding these limitations is essential to identify areas where further improvements are needed. Here are some common limitations of current object detection and pose estimation systems:

Accuracy and Reliability

The accuracy of object detection and pose estimation systems, including those using advanced models like YOLOv8, can be affected by various factors:

- **Environmental Variations:** Changes in lighting conditions, occlusions, and complex backgrounds can significantly impact the accuracy of detection and pose estimation.
- **Pose Variability:** Unusual or dynamic poses that deviate from the training data can reduce the effectiveness of the model.
- **Object Overlapping:** Multiple objects overlapping within a scene can lead to detection errors or missed detections.

Resource Constraints

Deep learning models, particularly those based on convolutional neural networks (CNNs), demand substantial computational resources:

- **Hardware Requirements:** High-resolution or high-frame-rate video processing requires powerful CPUs, GPUs, and sufficient memory. Limited hardware resources can hinder real-time processing capabilities.
- **Energy Consumption:** Intensive computations can lead to high energy consumption, making it challenging to deploy in resource-constrained environments.

Network Constraints

For systems relying on real-time video streams, network performance plays a crucial role:

- **Bandwidth and Latency:** High network bandwidth and low latency are essential for seamless real-time processing. Poor network conditions can cause delays, buffering, or frame drops, affecting the user experience.
- **Data Transfer Limits:** Large volumes of data transferred over the network can be restricted by bandwidth limitations, impacting the system's performance.

Model Limitations

The YOLOv8 model and similar systems face inherent limitations:

- **Training Data:** The performance of these models depends on the diversity and quality of the training data. Models trained on limited datasets may struggle with unfamiliar objects or poses.

- **Class Limitations:** Pre-trained models are restricted to detecting object classes included in their training datasets, limiting their applicability to other classes.

User Interface Constraints

Developing a user-friendly interface that caters to both novice and advanced users poses several challenges:

- **Complexity:** Configuring detection parameters and interpreting results can be complex for users without technical expertise.
- **Customization:** Advanced users may require more detailed control over settings, complicating the interface design.

Scalability Limitations

As user demand grows, maintaining performance and responsiveness becomes challenging:

- **Concurrent Requests:** Handling a high volume of concurrent user requests can lead to performance bottlenecks without adequate infrastructure.
- **Server Load:** Intensive processing tasks can overwhelm server capabilities, requiring robust load balancing and resource management strategies.

Data Privacy and Security Concerns

The handling and storage of user-uploaded media files introduce significant privacy and security considerations:

- **Secure File Uploads:** Ensuring secure transmission and storage of files to prevent unauthorized access or data breaches.
- **Access Controls:** Implementing robust authentication and access control mechanisms to safeguard user data.

CHAPTER 3

PROPOSED SYSTEM

3.1 PROPOSED SYSTEM

The proposed system aims to develop a user-friendly website that leverages the advanced YOLOv8 model for image classification, object detection, and human pose estimation. This system seeks to integrate the powerful capabilities of YOLOv8 into a web application, enabling users to upload images, videos, or specify video sources like YouTube, RTSP, or webcam for real-time processing. The objective is to provide a robust and accessible platform for diverse applications, including surveillance, security, robotics, augmented reality, and human-computer interaction.

3.2 OBJECTIVES OF PROPOSED SYSTEM

The objectives of the proposed system include the following:

Real-time Object Detection and Pose Estimation

- **Accuracy and Speed:** Ensure accurate and fast detection of multiple objects and human poses using YOLOv8.
- **Customizable Parameters:** Allow customization of detection parameters such as confidence thresholds and object classes.

Enhanced User Experience

- **User-Friendly Interface:** Develop an intuitive interface for easy media upload and viewing of detection results.
- **Output Options:** Provide options to download or share processed outputs.

Broad Application Scope

- **Surveillance and Security:** Use in surveillance to monitor public spaces and enhance safety measures.
- **Human-Computer Interaction:** Improve interactions based on real-time object and pose detection.

Technical Implementation

- **Web Application Framework:** Integrate YOLOv8 into a web application for seamless real-time processing.
- **Diverse Input Sources:** Handle various input sources, including images, videos, and live streams.

This proposed system aims to create a versatile and powerful platform that leverages YOLOv8's capabilities to meet the needs of multiple industries and applications.

.3.3 SYSTEM REQUIREMENTS

Here are the requirements for developing and deploying the application.

3.3.1 SOFTWARE REQUIREMENTS

Below are the software requirements for the application development:

Programming Language: Python

Development Environment: Visual Studio Code (VSCode)

Framework: Flask for web development

Machine Learning Libraries: PyTorch, OpenCV, NumPy, and YOLOv8

Web Libraries: Flask, HTML, CSS, JavaScript

Package Manager: Anaconda or pip

3.3.2 HARDWARE REQUIREMENTS

Below are the hardware requirements for the application development:

Operating System: Windows 10 or higher

Processor: Intel i5 (minimum) or AMD equivalent

RAM: 8 GB (minimum), 16 GB recommended

Hard Disk: 500 GB (minimum), SSD recommended for faster performance

GPU: NVIDIA GPU with CUDA support (e.g., GTX 1060 or higher) for model training and inference

3.3.3 FUNCTIONAL REQUIREMENTS

The functional requirements of the YOLOv8-based web application outline the specific features and capabilities that the system must possess to meet its objectives effectively. Here are the key functional requirements for the application:

Object Detection:

The system should be able to detect multiple objects in images or video streams, accurately identifying their locations and boundaries using YOLOv8.

Image Classification:

Implement image classification capabilities to categorize objects detected within images or video frames, providing accurate and real-time results.

Human Pose Estimation:

The system should accurately estimate human poses in images and video streams, identifying key body joints and overlaying skeletons on the detected individuals.

Input Source Handling:

Support various input sources such as image files, video files, webcam feeds, YouTube links, and RTSP streams for real-time processing.

Customizable Detection Parameters:

Allow users to customize detection parameters, including confidence thresholds, object classes, and output formats, to tailor the detection results to specific needs.

Result Visualization:

Display detection results by overlaying bounding boxes around detected objects and skeletons for human poses on the input media. Provide options to download or share the processed outputs.

Model Integration:

Seamlessly integrate the YOLOv8 model within the web application framework, ensuring efficient and effective utilization of the model's capabilities.

User Interface:

Develop an intuitive and user-friendly interface that enables users to easily upload media, configure detection parameters, and view results.

Performance Optimization:

Ensure the application performs efficiently, providing real-time or near-real-time processing capabilities without significant latency.

Security and Privacy:

Implement security measures to protect user data and ensure the privacy of uploaded media. Incorporate privacy-preserving techniques to safeguard sensitive information.

These functional requirements ensure that the YOLOv8-based web application meets its objectives effectively, providing advanced object detection, image classification, and human pose estimation capabilities through a user-friendly and secure platform.

3.3.4 NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements specify the quality attributes and constraints of a system, defining how well the system performs its functions rather than what functions it performs. For the YOLOv8-based web application, non-functional requirements play a crucial role in determining aspects such as performance, usability, security, and maintainability. Here are some non-functional requirements for the application:

Performance:

- **Response Time:** The system should have low latency, providing quick and responsive object detection, image classification, and pose estimation results.
- **Throughput:** It should be capable of handling multiple concurrent detection requests per unit of time to meet the demands of the application.

Accuracy and Reliability:

- **Detection Accuracy:** The system should achieve a high level of accuracy in detecting objects, classifying images, and estimating human poses to ensure reliable performance.
- **Robustness:** It should be resilient to variations in input quality, such as changes in lighting conditions, object sizes, and angles, maintaining accuracy in diverse scenarios.

Scalability:

- **Capacity:** The system should be scalable to handle an increasing number of users and detection queries without significant degradation in performance.

Security:

- **Adversarial Attack Resistance:** The system should be designed to resist adversarial attacks, preventing unauthorized access or manipulation of detection results.
- **Data Encryption:** Ensure that all data, including media uploads and detection outputs, is encrypted during storage and transmission to maintain the confidentiality of sensitive information.

Usability:

- **User Interface:** The application should have an intuitive and user-friendly interface that enables users to easily navigate and utilize the system's features.
- **Accessibility:** The system should be accessible to users with varying levels of technical expertise, providing clear instructions and feedback.

Maintainability:

- **Code Quality:** The system should be developed using best practices in coding standards, making it easy to maintain and extend.
- **Documentation:** Comprehensive documentation should be provided for both users and developers, detailing the system's functionalities, usage, and maintenance procedures.

Privacy:

- **Data Minimization:** Only collect and store the necessary data for object detection, image classification, and pose estimation, adhering to privacy principles.
- **User Consent:** Implement a user-friendly consent mechanism that enables individuals to control how their data is utilized, ensuring transparency and user empowerment.

These non-functional requirements ensure that the YOLOv8-based web application not only performs its intended functions effectively but also provides a high-quality user experience, maintains security and privacy, and is scalable and maintainable.

3.4 CONCEPTS USED IN THE PROPOSED SYSTEM

The proposed system for image classification, object detection, and human pose estimation incorporates several advanced concepts and techniques to achieve its objectives. Here are the key concepts used in the proposed system:

YOLOv8 Architecture

Concept: A state-of-the-art object detection system that uses a single neural network to predict bounding boxes and class probabilities directly from full images in one evaluation. YOLOv8 enhances the accuracy and speed of previous YOLO versions.

Application: Enables fast and accurate object detection, allowing the system to identify and locate multiple objects in an image simultaneously.

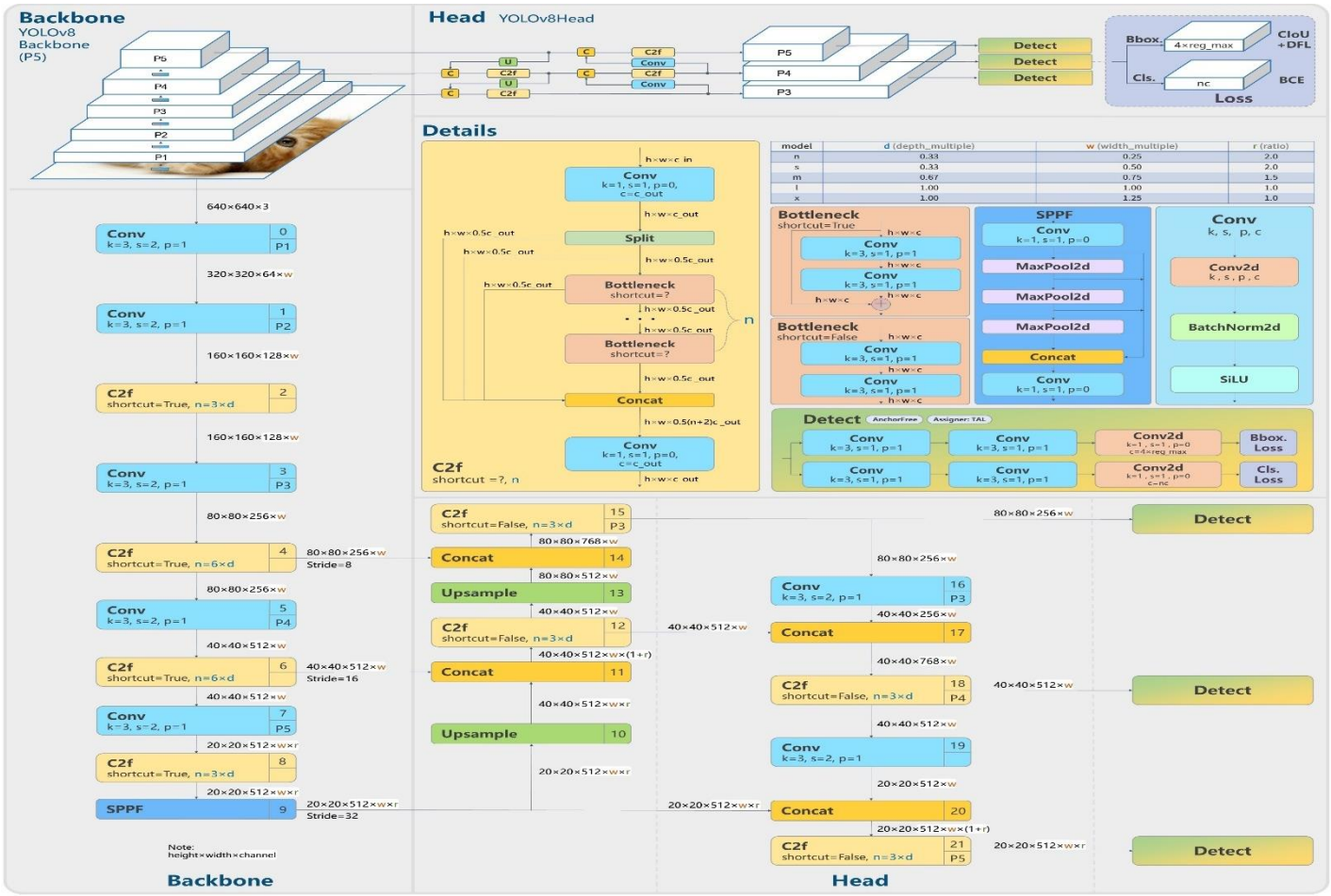


Fig 1: YOLOv8 Architecture

Feature Pyramid Networks (FPN)

Concept: A framework that enhances the feature extraction process by combining low-resolution, semantically strong features with high-resolution, semantically weak features through a top-down pathway and lateral connections.

Application: Improves the accuracy of object detection across different scales, making the system more robust to variations in object size.

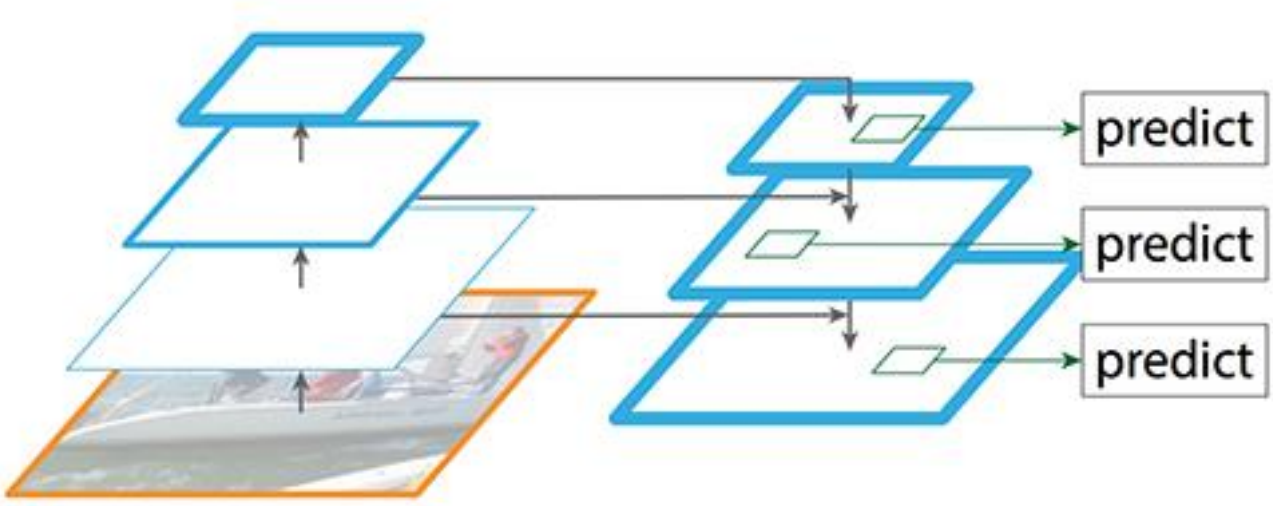


Fig 2: Feature Pyramid Networks (FPN)

Convolutional Neural Networks (CNNs)

Concept: A class of deep neural networks that have proven highly effective in tasks like image recognition and classification. CNNs use convolutional layers to automatically learn spatial hierarchies of features from input images.

Application: Essential for extracting features from images in both image classification and object detection tasks.

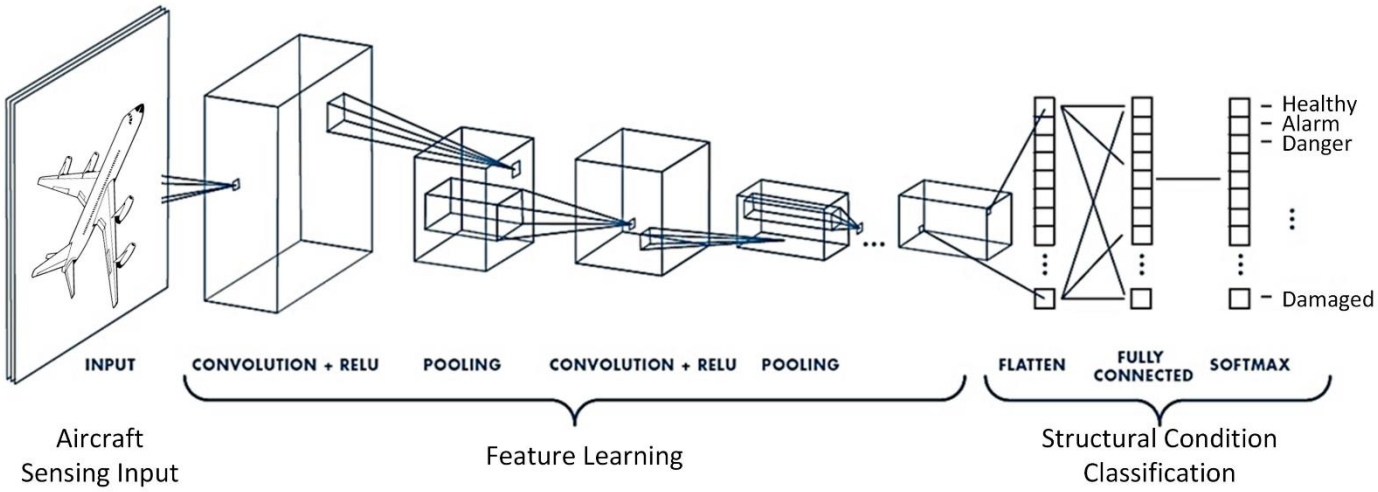


Fig 3: Convolutional Neural Networks (CNNs)

Keypoint Estimation

Concept: A technique used to identify and locate specific points of interest (keypoints) on objects, particularly useful in human pose estimation.

Application: Allows the system to accurately determine the positions of body parts, enabling precise pose estimation.

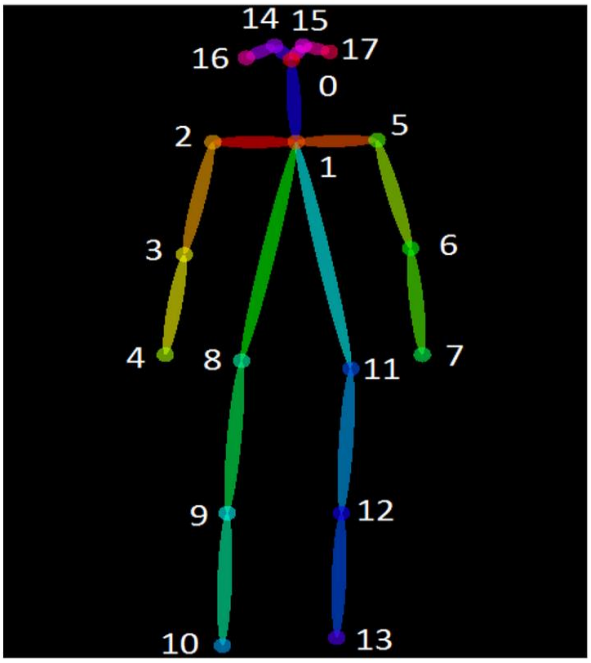


Fig 4: Keypoint Estimation

Data Augmentation

Concept: Techniques used to artificially expand the size of a training dataset by creating modified versions of images in the dataset. This includes transformations like rotation, scaling, cropping, and flipping.

Application: Enhances the generalization capability of the model by exposing it to a wider variety of image conditions.

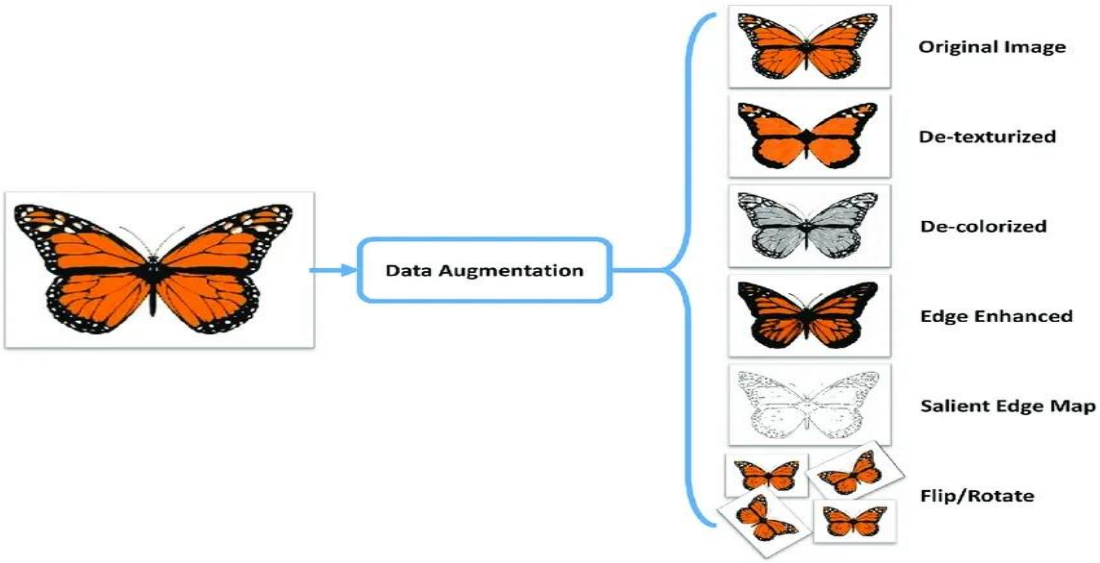


Fig 5: Data Augmentation

Transfer Learning

Concept: A method where a pre-trained model on a large dataset is fine-tuned on a smaller, task-specific dataset. This leverages the knowledge acquired by the model during its initial training phase.

Application: Improves the efficiency and effectiveness of training the model on specific tasks like image classification and object detection.

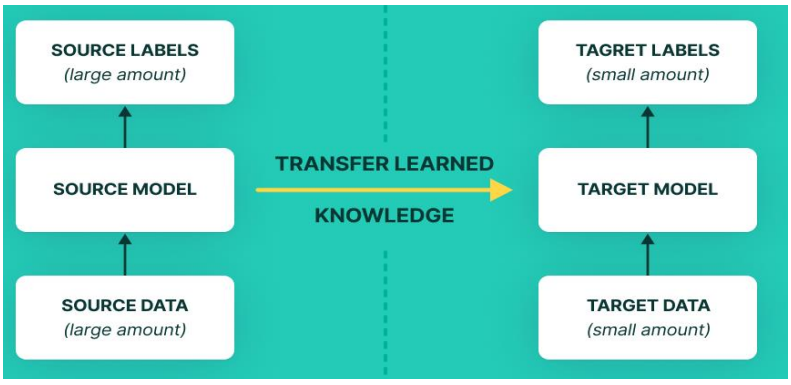


Fig 6: Transfer Learning

Non-Maximum Suppression (NMS)

Concept: A technique used to eliminate redundant bounding boxes by selecting the highest scoring box and suppressing boxes with significant overlap.

Application: Ensures that each detected object is represented by a single, most confident bounding box, improving the clarity of detection results.

Fig 7: Non-Maximum Suppression (NMS)

3.5 DATA SET USED IN THE PROPOSED SYSTEM

The dataset used in the proposed image classification, object detection, and human pose estimation system is crucial for its development and performance. Leveraging a pre-trained YOLOv8 model on the COCO dataset, we ensure robust and reliable results. Here's an overview of the key elements in the data setup for the proposed system:

Training Data:

Composition: The COCO (Common Objects in Context) dataset comprises over 330,000 images, containing more than 200,000 labeled images and 80 object categories. This dataset includes a wide range of scenes with varying levels of complexity and diversity.

Annotation: Each image is annotated with bounding boxes, segmentation masks, and keypoints for objects and human poses, providing comprehensive labels for training the model.

Validation Data:

Purpose: A separate subset of the COCO dataset is used during the development phase to fine-tune the model and optimize hyperparameters.

Composition: The validation set mirrors the diversity of the training set, ensuring the model can generalize

well to new images and objects.

Testing Data:

Purpose: An independent dataset from COCO, not used during training or validation, is employed to evaluate the final performance of the trained model.

Composition: Diverse images, representing real-world scenarios with different lighting conditions, backgrounds, and object interactions, to simulate actual application environments.

Preprocessing Techniques:

Normalization: Standardizing images to a common resolution and format to ensure consistency in input data.

Augmentation: Applying transformations such as rotation, scaling, cropping, and flipping to increase the diversity of the training set and improve the model's robustness.

Data Cleaning: Removing any noisy or mislabeled data to enhance training quality.

Addressing Imbalances:

Class Balancing: Ensuring a balanced representation of different object categories and poses to prevent biases and improve model performance across all classes.

Handling Biases:

Bias Analysis: Evaluating and addressing biases in the training data to avoid discrimination and ensure fair detection and recognition across diverse demographic groups.

Privacy Considerations:

Anonymization: Ensuring that any personally identifiable information in the dataset is removed or anonymized.

Consent: Verifying that images in the dataset are sourced from publicly available datasets like COCO, which adhere to ethical data collection practices.

Adversarial Examples:

Adversarial Training: Including examples of adversarial attacks (e.g., manipulated images) during training to make the model resilient against such attempts.

Dataset Size:

Sufficiency: Ensuring the dataset size is large enough to capture necessary variations in object appearances, human poses, and environmental conditions.

Real-World Scenarios:

Simulation: Incorporating images captured in diverse real-world scenarios to improve the model's robustness and applicability.

Diversity in Demographics:

Representation: Ensuring the dataset includes images with diverse scenes, objects, and human activities to avoid biased performance.

Continuous Updating:

Adaptability: Regularly updating the dataset with new images and categories to keep the model current with changing trends and requirements.

NOTE: By carefully curating and preparing the dataset, the proposed system can be trained to generalize well, accurately performing image classification, object detection, and human pose estimation across a wide range of conditions. Regular updates and adherence to ethical and privacy considerations are essential for maintaining the system's effectiveness and responsible deployment.

CHAPTER 4

SYSTEM DESIGN

4.1 COMPONENTS OR USERS IN THE PROPOSED SYSTEM

Admin

The admin is responsible for managing the backend of the website, including data preprocessing and integration of the YOLOv8 model. The admin collects datasets, preprocesses them, and uses the YOLOv8 pre-trained model on the COCO dataset for image classification, object detection, and human pose estimation. They ensure that the system is optimized for performance and accuracy.

ML Model/Classifier

The YOLOv8 model, a state-of-the-art object detection algorithm, is utilized for multiple tasks:

- **Image Classification:** Identifies and categorizes objects within images.
- **Object Detection:** Detects and localizes multiple objects within images or video frames, providing bounding boxes.
- **Human Pose Estimation:** Estimates human poses by identifying and marking keypoints to form a skeletal model.

The YOLOv8 model processes the input data and delivers results by overlaying detection outputs on the original media.

End User

The end users of this system interact with the website for various purposes, such as object detection and pose estimation in uploaded media. Categories of end users include:

General Users:

- **Role:** Individuals using the system to upload images or videos for object detection and pose estimation. They can specify video sources, view processed outputs, and download or share results.
- **Use Cases:** Surveillance, security, personal projects, and academic research.

4.2 PROPOSED SYSTEM ARCHITECTURE

An architectural diagram outlines the system's components, their relationships, and system functionality. The proposed system leverages a modular design for image classification, object detection, and human pose estimation using the YOLOv8 pre-trained model on the COCO dataset. This ensures robustness, scalability, and user-friendliness. Users can upload media, specify video sources, configure detection parameters, and view processed outputs. The system evaluates the media, performs detection and estimation, and provides results for viewing, downloading, or sharing.

System Architecture Overview

The architecture consists of several key components that interact to provide seamless image processing capabilities. The main components are:

- **User Interface:** Allows users to interact with the system by uploading media, configuring detection parameters, and viewing results.
- **Web Application:** Acts as the central hub, managing media processing, interfacing with the YOLOv8 model, and coordinating data flow between components.
- **YOLOv8 Model:** Performs object detection and human pose estimation on the input media.
- **Image/Video Processor:** Handles preprocessing tasks such as normalization and augmentation before passing data to the YOLOv8 model.
- **Database:** Stores processed data, results, and user information for future retrieval and analysis.
- **Media Source:** The origin of the media files, which can be uploaded by the user or specified as an external video source.
- **Output Viewer:** Displays the processed results to the user, allowing for further actions such as downloading or sharing the output.

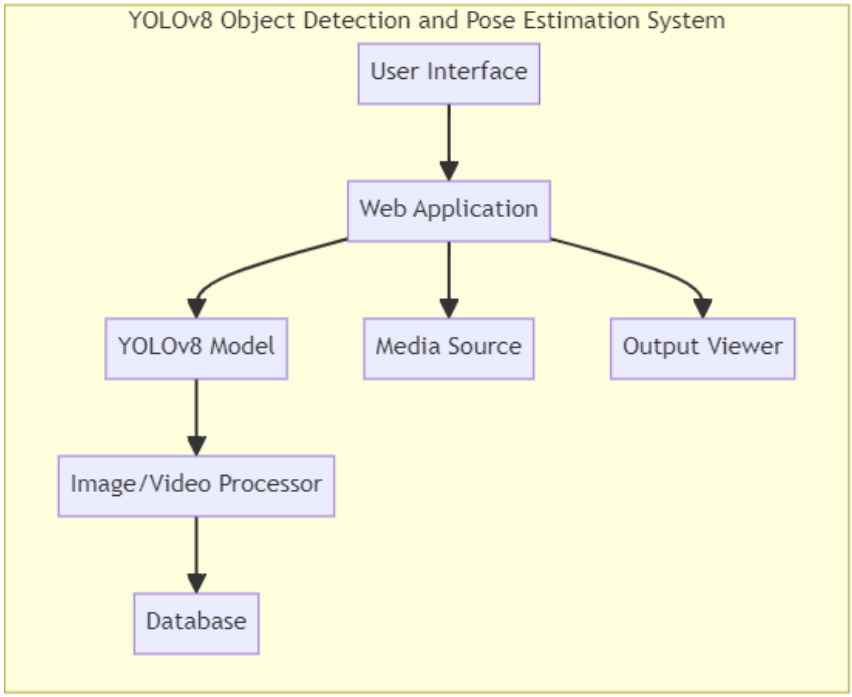


Fig 8: System Architecture

4.3 UML DIAGRAMS:

Creating UML (Unified Modeling Language) diagrams helps visualize the system's structure, behavior, and interactions. Below are the diagrams applied to the YOLOv8-based detection and estimation system.

4.3.1 Use Case Diagram:

- **Upload Media:** User uploads images or videos for processing.
- **Specify Video Source:** User specifies an external video source for processing.
- **Configure Detection Parameters:** User configures parameters for object detection and pose estimation.
- **View Processed Output:** User views the processed detection results.
- **Download/Share Output:** User downloads or shares the processed output.

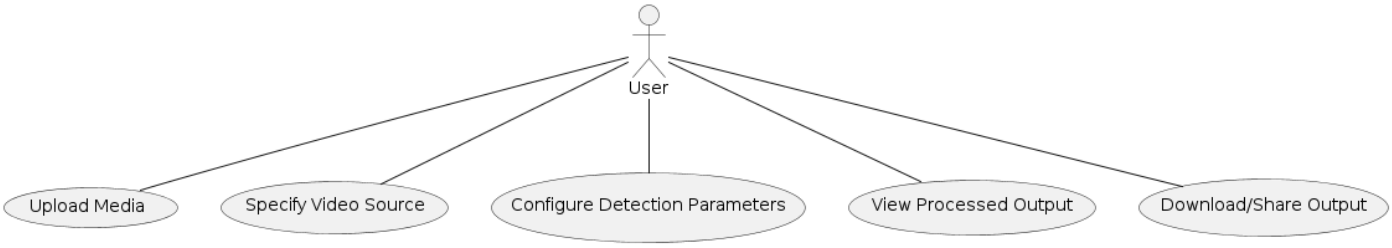


Fig 9: Use Case Diagram

4.3.2 Class Diagram

- **User:** Manages media uploads, specifies video sources, configures detection parameters, views outputs, and downloads results.
- **Web Application:** Processes media, interfaces with the YOLOv8 model, saves results to the database, and displays results to the user.
- **YOLOv8 Model:** Detects objects and estimates human poses.
- **Database:** Stores and retrieves data, including processed results and user information.

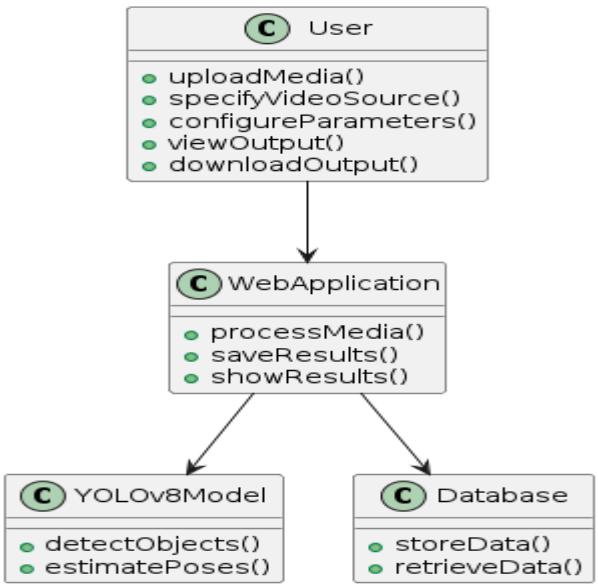


Fig 10: Class Diagram

4.3.3 Activity Diagram

- **User Uploads Media:** The workflow starts with the user uploading media.
- **Specify Detection Parameters:** User specifies the parameters for detection.
- **Process Media:** The web application processes the uploaded media.
- **Detect Objects and Poses:** YOLOv8 model detects objects and estimates poses.
- **Show Detection Results:** The processed results are displayed to the user.
- **Download or Share Results:** User can download or share the results if desired.

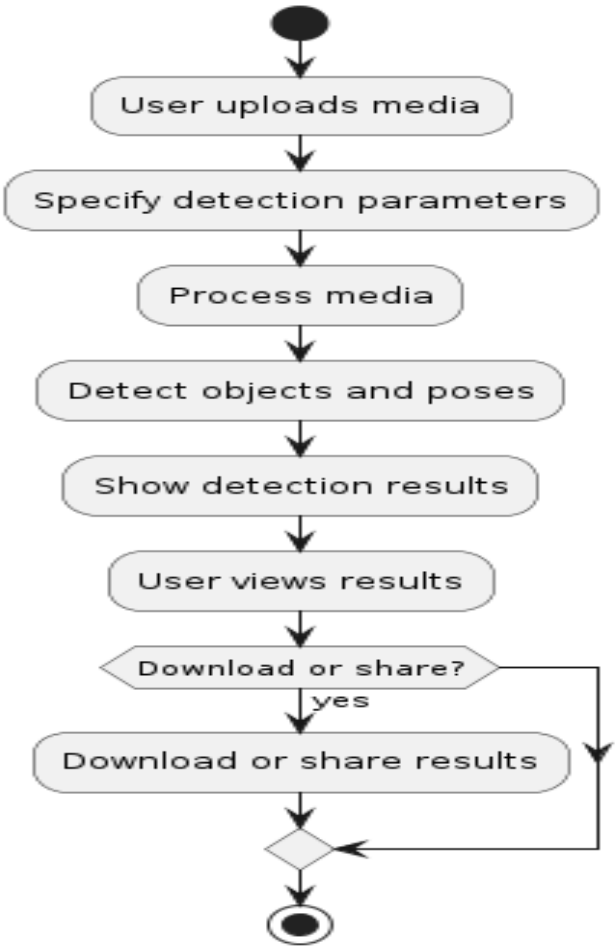


Fig 11: Activity Diagram

4.3.4 Sequence Diagram

- **Upload Media:** User uploads media to the web application.
- **Process Media:** Web application processes the media with the YOLOv8 model.
- **Detection Results:** YOLOv8 model returns the detection results to the web application.
- **Save Results:** Web application saves the results to the database.
- **Show Results:** Web application displays the results to the user.
- **Download/Share Results:** User downloads or shares the results.

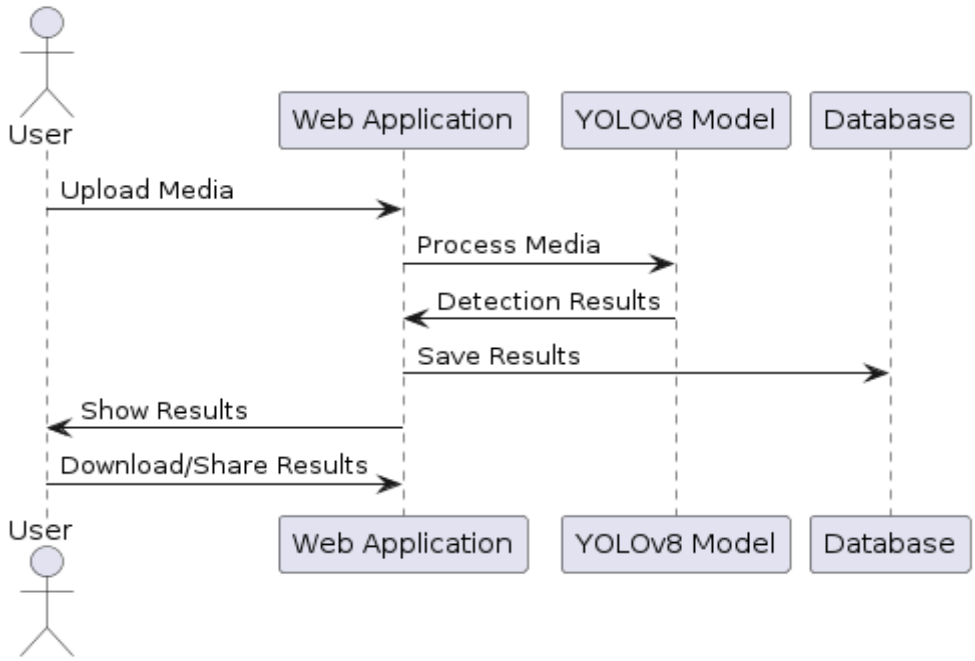


Fig 12: Sequence Diagram

4.3.5 Data Flow Diagram

- **User Uploads Media:** The user uploads images or videos to the web application.
- **Process Media:** The web application preprocesses the media and sends it to the YOLOv8 model for processing.
- **Detection Results:** The YOLOv8 model processes the media and sends detection results back to the web application.
- **Save Results:** The web application saves the processed results to the database.
- **Show Results:** The web application displays the results to the user.

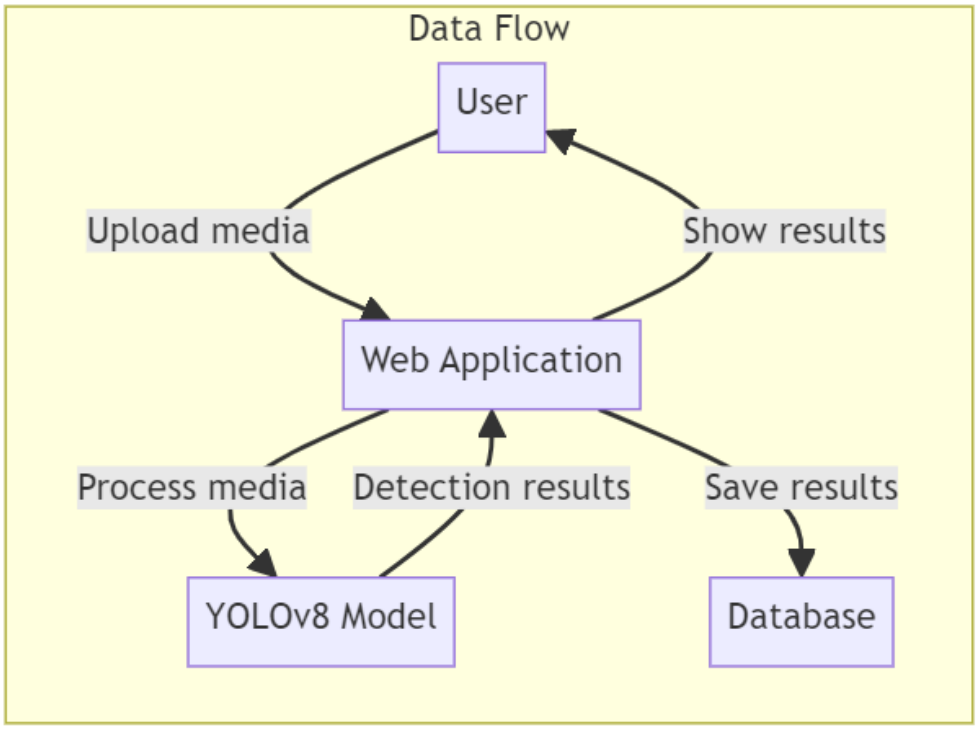


Fig 13: Data Flow Diagram

CHAPTER 5

IMPLEMENTATION

This chapter provides a comprehensive guide to implementing an image classification, object detection, and human pose estimation system using the YOLOv8 model. The system will use a web interface, created with Flask, allowing users to upload images, videos, or stream from a webcam. The YOLOv8 models, pre-trained on the COCO dataset, will be utilized for this purpose.

DATASET

For this project, you are using the pre-trained YOLOv8 model on the COCO dataset. Therefore, you don't need to perform data collection or data preprocessing steps, as the model is already trained on the COCO dataset.

Environment Setup

First, ensure all necessary packages and dependencies are installed.

pip install flask opencv-python ultralytics

MODEL

The YOLOv8 model is a powerful and efficient object detection model that can perform various tasks, including image classification, object detection, and human pose estimation. The model is pre-trained on the COCO dataset, which means it can detect and classify a wide range of objects, such as people, vehicles, animals, and everyday objects.

The project utilizes four different variants of the YOLOv8 model:

- **yolov8s.pt:** This is the standard YOLOv8 model for object detection.
- **yolov8s-seg.pt:** This model is trained for instance segmentation, which means it can detect objects and segment them from the background.
- **yolov8s-cls.pt:** This model is specialized for image classification tasks.
- **yolov8s-pose.pt:** This model is trained for human pose estimation, which can detect and estimate the positions of various body parts.

Application Setup

Implement the main application using Flask to create a web interface for uploading images and videos and performing predictions.

User Interface

The project provides a user-friendly interface through HTML templates, allowing users to interact with the application and select different input sources and tasks. The main templates are:

- **index.html:** The landing page that provides options to choose from different input sources(local files, YouTube links, RTSP streams, or webcam).
- **local.html:** Allows users to upload local image or video files for processing.
- **yt.html:** Enables users to enter a YouTube video link for analysis.
- **rtsp.html:** Allows users to enter an RTSP stream URL for processing.
- **cams.html:** Provides access to the user's webcam for real-time analysis.

Model Usage

The project allows users to choose the specific task they want to perform by selecting the appropriate pre-trained YOLOv8 model:

- For object detection, use the command: python app.py --weights yolov8s.pt
- For instance segmentation, use the command: python app.py --weights yolov8s-seg.pt
- For image classification, use the command: python app.py --weights yolov8s-cls.pt
- For human pose estimation, use the command: python app.py --weights yolov8s-pose.pt

Additionally, the project supports running the models on CPU by using the --device cpu argument.

DEPLOYMENT

The project can be deployed locally by running the app.py script with the desired model and input source. The Flask application will start running on the specified port (default is 5000), and users can access the application through their web browser.

5.1 Source Code

app.py

```
from flask import Flask, render_template, Response, request, jsonify
import json
import argparse
import os
import sys
from pathlib import Path
from ultralytics import YOLO
from ultralytics.utils.checks import cv2, print_args
from utils.general import update_options
FILE = Path(__file__).resolve()
ROOT = FILE.parents[0]
if str(ROOT) not in sys.path:
    sys.path.append(str(ROOT))
ROOT = Path(os.path.relpath(ROOT, Path.cwd()))
app = Flask(__name__)
def predict(opt):
    results = model(**vars(opt), stream=True)
    for result in results:
        if opt.save_txt:
            result_json = json.loads(result.tojson())
            yield json.dumps({'results': result_json})
else:
            im0 = cv2.imencode('.jpg', result.plot())[1].tobytes()
            yield (b'--frame\r\n'
                   b'Content-Type: image/jpeg\r\n\r\n' + im0 + b'\r\n')
@app.route('/')
def index():
    return render_template('index.html')
@app.route('/local')
def locals():
    return render_template('local.html')
@app.route('/yt')
def yt():
    return render_template('yt.html')
@app.route('/rtsp')
def rtsp():
    return render_template('rtsp.html')
@app.route('/webcam')
def cams():
    return render_template('cams.html')
@app.route('/predict', methods=['GET', 'POST'])
def video_feed():
    if request.method == 'POST':
        uploaded_file = request.files.get('myfile')
          save_txt = request.form.get('save_txt', 'F')
        if uploaded_file:
 source = Path(__file__).parent / raw_data / uploaded_file.filename
            uploaded_file.save(source)
```

```
            opt.source = source
        else:
            opt.source, _ = update_options(request)
```



```
        opt.save_txt = True if save_txt == 'T' else False
    elif request.method == 'GET':
        opt.source, opt.save_txt = update_options(request)
    return Response(predict(opt), mimetype='multipart/x-mixed-replace;
boundary=frame')
if __name__ == '__main__':
    parser = argparse.ArgumentParser()
    parser.add_argument('--model','--weights', type=str, default=ROOT /
'yolov8s.pt', help='model path or triton URL')
    parser.add_argument('--source', type=str, default=ROOT / 'data/images',
help='source directory for images or videos')
    parser.add_argument('--conf','--conf-thres', type=float, default=0.25,
help='object confidence threshold for detection')
    parser.add_argument('--iou', '--iou-thres', type=float, default=0.7,
help='intersection over union (IoU) threshold for NMS')
    parser.add_argument('--imgsz', '--img', '--img-size', nargs='+', type=int,
default=[640], help='image size as scalar or (h, w) list, i.e. (640, 480)')
  parser.add_argument('--half', action='store_true', help='use half precision
(FP16)')
    parser.add_argument('--device', default='', help='device to run on, i.e. cuda
device=0/1/2/3 or device=cpu')
    parser.add_argument('--show','--view-img', default=False,
action='store_true', help='show results if possible')
    parser.add_argument('--save', action='store_true', help='save images with
results')
    parser.add_argument('--save_txt','--save-txt', action='store_true',
help='save results as .txt file')
    parser.add_argument('--save_conf', '--save-conf', action='store_true',
help='save results with confidence scores')
    parser.add_argument('--save_crop', '--save-crop', action='store_true',
help='save cropped images with results')
    parser.add_argument('--show_labels','--show-labels', default=True,
action='store_true', help='show labels')
    parser.add_argument('--show_conf', '--show-conf', default=True,
action='store_true', help='show confidence scores')
    parser.add_argument('--max_det','--max-det', type=int, default=300,
help='maximum number of detections per image')
    parser.add_argument('--vid_stride', '--vid-stride', type=int, default=1,
help='video frame-rate stride')
    parser.add_argument('--stream_buffer', '--stream-buffer', default=False,
action='store_true', help='buffer all streaming frames (True) or return the
most recent frame (False)')
    parser.add_argument('--line_width', '--line-thickness', default=None,
type=int, help='The line width of the bounding boxes. If None, it is scaled to
the image size.')
   parser.add_argument('--visualize', default=False, action='store_true',
help='visualize model features')
    parser.add_argument('--augment', default=False, action='store_true',
```

```
help='apply image augmentation to prediction sources')
 parser.add_argument('--agnostic_nms', '--agnostic-nms', default=False,
action='store_true', help='class-agnostic NMS')
    parser.add_argument('--retina_masks', '--retina-masks', default=False,
action='store_true', help='whether to plot masks in native resolution')
```



```
    parser.add_argument('--classes', type=list, help='filter results by class, i.e.
classes=0, or classes=[0,2,3]') # 'filter by class: --classes 0, or --classes 0 2 3')
    parser.add_argument('--show_boxes', default=True, action='store_false',
help='Show boxes in segmentation predictions')
    parser.add_argument('--exist_ok', '--exist-ok', action='store_true',
help='existing project/name ok, do not increment')
    parser.add_argument('--project', default=ROOT / 'runs/detect', help='save
results to project/name')
    parser.add_argument('--name', default='exp', help='save results to
project/name')
    parser.add_argument('--dnn', action='store_true', help='use OpenCV DNN
for ONNX inference')
    parser.add_argument('--raw_data', '--raw-data', default=ROOT / 'data/raw',
help='save raw images to data/raw')
    parser.add_argument('--port', default=5000, type=int, help='port
deployment')
    opt, unknown = parser.parse_known_args()
    print_args(vars(opt))
    port = opt.port
    delattr(opt, 'port')
    raw_data = Path(opt.raw_data)
    raw_data.mkdir(parents=True, exist_ok=True)
    delattr(opt, 'raw_data')
    model = YOLO(str(opt.model))
    app.run(port=port, debug=False)
```

index.html:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Harsha</title>
    <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css
">
    <style>
        .container {
            margin-top: 50px;
        }
        .hover-container {
            transition: transform 0.2s;
        }
  .hover-container:hover {
            transform: scale(1.1);
        }
    </style>
```

```
</head>
<body>
  <div class="container">
    <h1 class="text-center mb-5">Welcome to the App</h1>
    <div class="row">
      <div class="col-md-6 mb-4">
        <a href="/local" class="text-decoration-none">
          <div class="card hover-container">
            <div class="card-body">
```



```
              <h5 class="card-title">Local</h5>
              <p class="card-text">Process local images or videos.</p>
            </div>
          </div>
        </a>
      </div>
      <div class="col-md-6 mb-4">
        <a href="/yt" class="text-decoration-none">
          <div class="card hover-container">
            <div class="card-body">
              <h5 class="card-title">YouTube</h5>
              <p class="card-text">Process YouTube videos.</p>
            </div>
          </div>
        </a>
      </div>
      <div class="col-md-6 mb-4">
        <a href="/rtsp" class="text-decoration-none">
          <div class="card hover-container">
            <div class="card-body">
              <h5 class="card-title">RTSP</h5>
              <p class="card-text">Process RTSP streams.</p>
            </div>
          </div>
        </a>
      </div>
      <div class="col-md-6 mb-4">
        <a href="/webcam" class="text-decoration-none">
          <div class="card hover-container">
            <div class="card-body">
              <h5 class="card-title">Webcam</h5>
              <p class="card-text">Process webcam feed.</p>
            </div>
          </div>
        </a>
      </div>
    </div>
  </div>
  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.5.1/jquery.min.js">
</script>
  <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js"><
/script>
```

```
</body>
</html>
```

cam.html:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Webcam Stream Analysis</title>
    <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css
```



```
" rel="stylesheet">
    <style>
        body {
            overflow: hidden;
        }
    </style>
</head>
<body>
    <div class="container my-5">
        <h1 class="text-center mb-4">Webcam Stream Analysis</h1>
 <div class="row justify-content-center">
            <div class="text-center">
                <button type="button" class="btn btn-primary" id="analyze-
btn">Analyze</button>
            </div>
        </div>
    </div>
    <script
src="https://ajax.googleapis.com/ajax/libs/jquery/2.1.3/jquery.min.js"></scri
pt>
    <script>
        "use strict";
        const analyzeBtn = document.getElementById('analyze-btn');
        const previewVideo = document.getElementById('preview-video');
        if (navigator.mediaDevices && navigator.mediaDevices.getUserMedia)
{
            navigator.mediaDevices.getUserMedia({ video: true })
                .then(function (stream) {
                    const webcamUrl = window.URL.createObjectURL(stream);
                    previewVideo.srcObject = stream;
                })
                .catch(function (error) {
                    console.error('Error accessing webcam:', error);
                });
        } else {
     console.error('getUserMedia is not supported by this browser.');
        }
        analyzeBtn.addEventListener('click', function () {
            const local_server_url =
`${window.location.protocol}//${window.location.hostname}:${window.loc
ation.port}`;
            const redirectUrl = `${local_server_url}/predict?source=0`;
```

```
        window.location.href = redirectUrl;
      });
    </script>
</body>
</html>
```

local.html:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Image Analysis</title>
  <link
```



```
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css
" rel="stylesheet">
  <style>
    body {
      overflow: hidden;
    }
    .upload-area {
      border: 2px dashed #ccc;
      border-radius: 10px;
      padding: 40px 20px;
      text-align: center;
      margin-bottom: 20px;
      transition: all 0.3s ease;
    }
    .upload-area:hover {
      border-color: #999;
    }
    .upload-area input[type="file"] {
      display: none;
    }
    .upload-label {
      display: block;
      font-size: 18px;
      font-weight: 500;
      color: #555;
      cursor: pointer;
    }
    .upload-label:hover {
      color: #333;
    }
    .btn-container {
      display: flex;
      justify-content: center;
    }
    #preview {
      display: flex;
      justify-content: center;
}
    #preview img {
      max-width: 100%
```

```
    }
    .preview-container {
      text-align: center;
      margin-bottom: 20px;
    }
    .preview-container img {
      max-width: 100%;
      max-height: 400px;
      border-radius: 5px;
      box-shadow: 0 0 10px rgba(0, 0, 0, 0.2);
    }
  </style>
</head>
<body>
```



```
  <div class="container my-5">
    <h1 class="text-center mb-4">Image Analysis</h1>
    <div class="row justify-content-center">
      <div class="col-md-8">
        <form id="upload-form" class="upl-container" method="POST"
action="predict" enctype="multipart/form-data">
<div class="upload-area">
          <input type="file" onChange="dragNdrop(event)" name="myfile"
ondragover="drag()" ondrop="drop()" id="myfile"
            accept="image/*, video/*">
          <label for="myfile" class="upload-label">
            <i class="bi bi-upload"></i> Drag and drop or click to select a file
          </label>
        </div>
        <div id="preview" class="preview-container">
          <img id="preview-img" src="" alt="Preview">
        </div>
        <div class="btn-container">
          <input type="submit" id="upload-btn" value="Upload File"
class="btn btn-primary" style="display: none;">
        </div>
      </form>
    </div>
  </div>
  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/2.1.3/jquery.min.js"></scri
pt>
  <script>
    "use strict";
const uploadBtn = document.getElementById('upload-btn')
    var fileName,
      preview = document.getElementById("preview"),
      previewImg = document.getElementById("preview-img");
    previewImg.style.display = 'none';
    function dragNdrop(event) {
      let file = event.target.files[0];
```

```
      if (!file)
        return;
      fileName = URL.createObjectURL(file);
      if (file.type.startsWith('image')) {
        previewImg.setAttribute("src", fileName);
        previewImg.style.display = 'block';
      } else {
        previewImg.style.display = 'none';
      }
      uploadBtn.style.display = 'block';
      document.querySelector('.upload-area').style.display = 'none';
    }
    function drag() {
      document.getElementById('myfile').parentNode.className = 'draging
dragBox';
    }
function drop() {
      document.getElementById('myfile').parentNode.className = 'dragBox';
```



```
    }
    function handleUpload() {
      uploadBtn.disabled = true;
      const local_server_url =
`${window.location.protocol}//${window.location.hostname}:${window.loc
ation.port}`;
    }
  </script>
</body>
</html>
```

rtsp.html:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>RTSP Stream Analysis</title>
  <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css
" rel="stylesheet">
  <style>
    body {
       overflow: hidden;
    }
  </style>
</head>
<body>
  <div class="container my-5">
    <h1 class="text-center mb-4">RTSP Stream Analysis</h1>
    <div class="row justify-content-center">
      <div class="col-md-8">
        <form id="rtsp-form">
          <div class="mb-3">
            <label for="rtsp-link" class="form-label">Enter RTSP URL</label>
```

```
            <input type="text" class="form-control" id="rtsp-link"
      placeholder="rtsp://example.com/stream">
          </div>
          <div class="text-center">
            <button type="submit" class="btn btn-primary" id="analyze-btn"
      disabled>Analyze</button>
          </div>
        </form>
          </div>
        </div>
      </div>
      <script
src="https://ajax.googleapis.com/ajax/libs/jquery/2.1.3/jquery.min.js"></script>
      <script>
        "use strict";
        const rtspLink = document.getElementById('rtsp-link');
        const analyzeBtn = document.getElementById('analyze-btn');
        const previewVideo = document.getElementById('preview-video');
        rtspLink.addEventListener('input', function () {
          const rtspUrl = rtspLink.value;
          if (rtspUrl) {
```



```
            previewVideo.src = rtspUrl;
            previewVideo.style.display = 'block';
            analyzeBtn.disabled = false;
          } else {
            previewVideo.style.display = 'none';
            analyzeBtn.disabled = true;
          }
        });
        const form = document.getElementById('rtsp-form');
        form.addEventListener('submit', function (event) {
         event.preventDefault();
          const rtspUrl = rtspLink.value;
          const local_server_url =
      `${window.location.protocol}//${window.location.hostname}:${window.loc
      ation.port}`;
          const redirectUrl =
      `${local_server_url}/predict?source=${encodeURIComponent(rtspUrl)}`;
          window.location.href = redirectUrl;
        });
      </script>
      </body>
      </html>
```

yt.html:

```
      <!DOCTYPE html>
      <html lang="en">
      <head>
        <meta charset="UTF-8">
        <meta name="viewport" content="width=device-width, initial-scale=1.0">
        <title>YouTube Analysis</title>
        <link
      href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css
      " rel="stylesheet">
```

```
  <style>
    body {
      overflow: hidden;
    }
    .preview-container {
      text-align: center;
  margin-bottom: 20px;
    }
    .preview-container img {
      max-width: 100%;
      max-height: 400px;
      border-radius: 5px;
      box-shadow: 0 0 10px rgba(0, 0, 0, 0.2);
      display: block;
      margin: 0 auto;
    }
  </style>
</head>
<body>
  <div class="container my-5">
    <h1 class="text-center mb-4">YouTube Analysis</h1>
    <div class="row justify-content-center">
      <div class="col-md-8">
                                        30
        <form id="youtube-form">
          <div class="mb-3">
            <label for="youtube-link" class="form-label">Enter YouTube
Link</label>
    <input type="text" class="form-control" id="youtube-link"
placeholder="https://www.youtube.com/watch?v=...">
          </div>
          <div id="preview" class="preview-container">
          <img id="preview-img" src="" alt="Preview" style="display: none;">
          </div>
          <div class="text-center">
            <button type="submit" class="btn btn-primary" id="analyze-btn"
disabled>Analyze</button>
          </div>
        </form>
      </div>
    </div>
  </div>
  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/2.1.3/jquery.min.js"></scri
pt>
  <script>
    "use strict";
    const youtubeLink = document.getElementById('youtube-link');
    const analyzeBtn = document.getElementById('analyze-btn');
    const previewImg = document.getElementById('preview-img');
    youtubeLink.addEventListener('input', function() {
      const url = new URL(youtubeLink.value);
      const videoId = url.searchParams.get('v');
    if (videoId) {
        const thumbnailUrl =
`https://img.youtube.com/vi/${videoId}/maxresdefault.jpg`;
```

```
        previewImg.src = thumbnailUrl;
        previewImg.style.display = 'block';
        analyzeBtn.disabled = false;
      } else {
        previewImg.style.display = 'none';
        analyzeBtn.disabled = true;
      }    });
    const form = document.getElementById('youtube-form');
    form.addEventListener('submit', function(event) {
      event.preventDefault();
      const videoUrl = youtubeLink.value;
      const local_server_url =
`${window.location.protocol}//${window.location.hostname}:${window.loc
ation.port}`;
      const redirectUrl =
`${local_server_url}/predict?source=${encodeURIComponent(videoUrl)}`;
      window.location.href = redirectUrl;
    });
  </script>
</body>
</html>
```

CHAPTER 6

RESULTS

The results of the YOLOv8-based image classification, object detection, and human pose estimation system are categorized into several scenarios. The system processes images and videos, identifying objects, segments, and poses based on the pre-trained YOLOv8 models.

Positive Match:

The system correctly identifies objects, segments, or poses and matches them to known categories in its model. This indicates that the YOLOv8 model has successfully recognized the elements within the input media.

Use Case:

Object Detection: Identifying vehicles, pedestrians, animals, etc., in real-time for traffic management, surveillance, and autonomous driving.

Image Classification: Classifying images into predefined categories for sorting and tagging.

Human Pose Estimation: Detecting and analyzing human poses for fitness applications, motion capture, and ergonomics.

Negative Match:

The system correctly recognizes that the presented input does not contain any recognizable objects, segments, or poses that match the known categories in its model. This scenario is crucial for identifying unknown or irrelevant inputs.

Use Case:

Unauthorized Object Detection: Recognizing and alerting about unauthorized or unexpected items in a restricted area.

Quality Control: Ensuring that defective or incorrect products are identified and flagged in manufacturing processes.

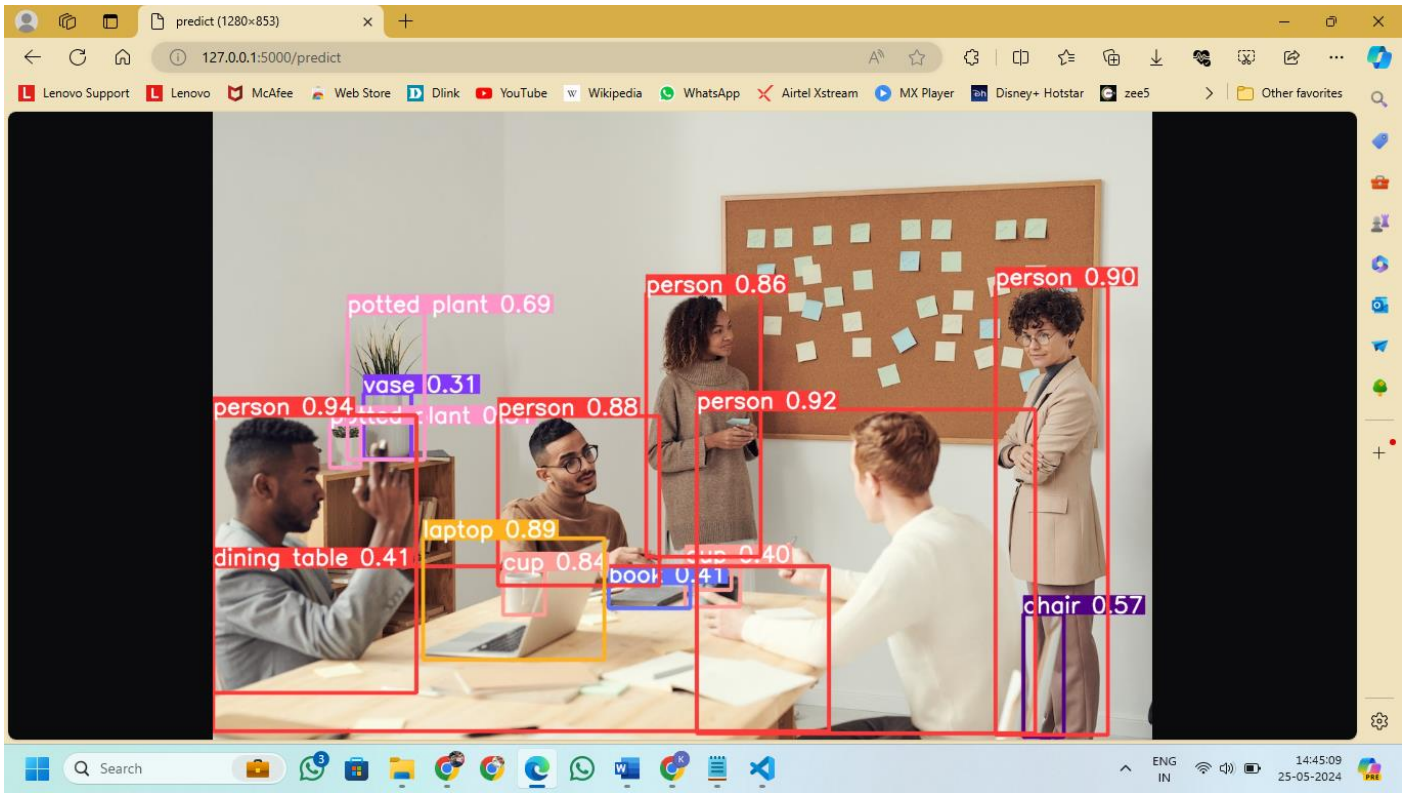
Safety and Security: Detecting the absence of required safety gear or equipment in industrial environments.

Code execution

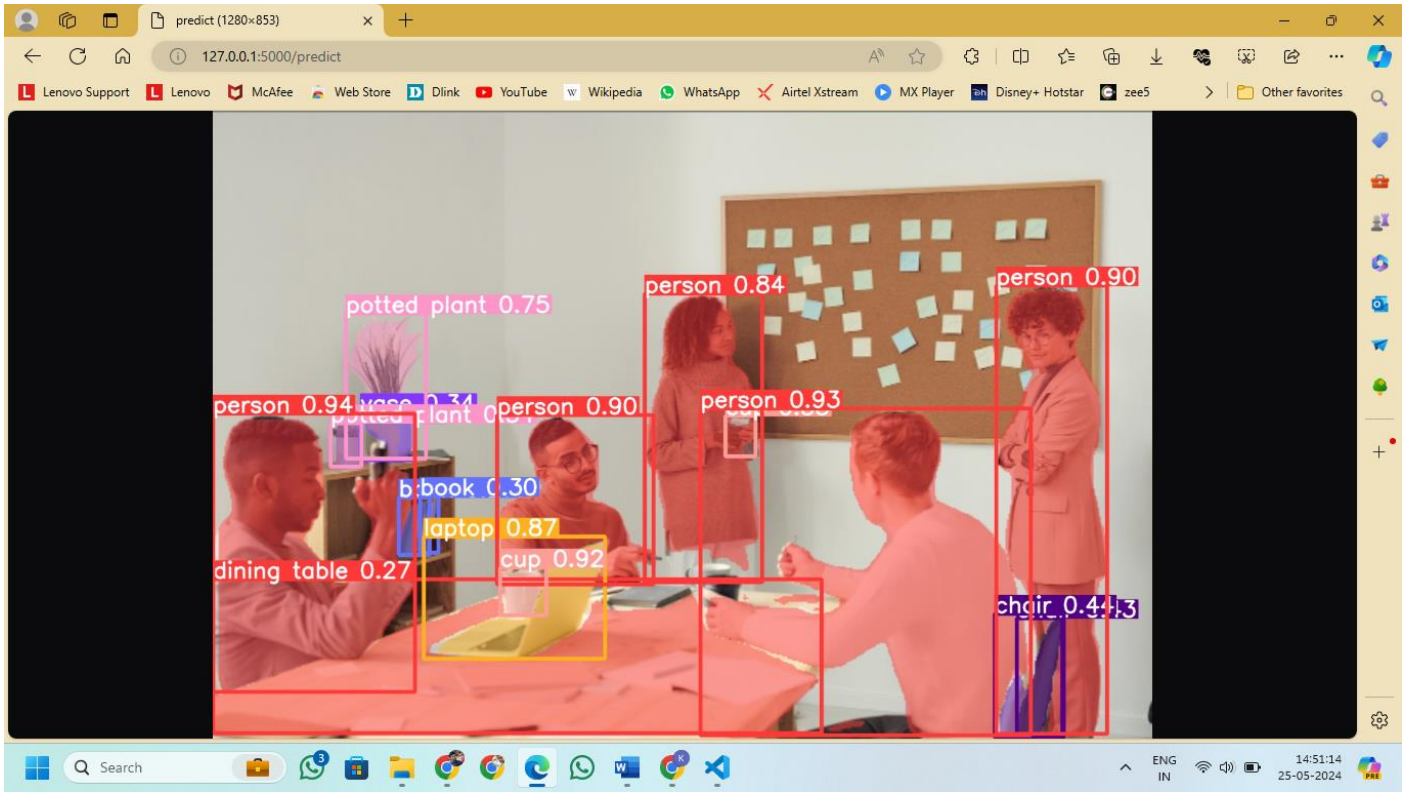
```
_boxes=True, exist_ok=False, project=runs\detect, name=exp, dnn=False, raw_data=data\raw, port=5000
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
127.0.0.1 - - [25/May/2024 14:48:40] "GET /local HTTP/1.1" 200 -

image 1/1 C:\Users\KOTA\Downloads\projects\yolov8\data\raw\office_4.jpg: 448x640 5 persons, 2 cups, 2 chairs, 2 potted plants, 1 dining table, 1 laptop, 2 books, 2 vases, 43904.3ms
127.0.0.1 - - [25/May/2024 14:50:50] "POST /predict HTTP/1.1" 200 -
Speed: 179.7ms preprocess, 43904.3ms inference, 33128.4ms postprocess per image at shape (1, 3, 448, 640)
PS C:\Users\KOTA\Downloads\projects\yolov8> python app.py --weights yolov8s-seg.pt
app: model=yolov8s-seg.pt, source=data\images, conf=0.25, iou=0.7, imgsz=[640], half=False, device=, show=False, save=False, save_txt=False, save_conf=False, save_crop=False, show_labels=True, show_conf=True, max_det=300, vid_stride=1, stream_buffer=False, line_width=None, visualize=False, augment=False, agnostic_nms=False, retina_masks=False, classes=None, show_boxes=True, exist_ok=False, project=runs\detect, name=exp, dnn=False, raw_data=data\raw, port=5000
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000

image 1/1 C:\Users\KOTA\Downloads\projects\yolov8\data\raw\office_4.jpg: 448x640 5 persons, 2 cups, 2 chairs, 2 potted plants, 1 dining table, 1 laptop, 2 books, 2 vases, 25752.3ms
127.0.0.1 - - [25/May/2024 14:56:46] "POST /predict HTTP/1.1" 200 -
Speed: 119.9ms preprocess, 25752.3ms inference, 13028.8ms postprocess per image at shape (1, 3, 448, 640)
PS C:\Users\KOTA\Downloads\projects\yolov8> python app.py --weights yolov8s-pose.pt
app: model=yolov8s-pose.pt, source=data\images, conf=0.25, iou=0.7, imgsz=[640], half=False, device=, show=False, save=False, save_txt=False, save_conf=False, save_crop=False, show_labels=True, show_conf=True, max_det=300, vid_stride=1, stream_buffer=False, line_width=None, visualize=False, augment=False, agnostic_nms=False, retina_masks=False, classes=None, show_boxes=True, exist_ok=False, project=runs\detect, name=exp, dnn=False, raw_data=data\raw, port=5000
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
127.0.0.1 - - [25/May/2024 15:03:24] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [25/May/2024 15:03:27] "GET /local HTTP/1.1" 200 -

image 1/1 C:\Users\KOTA\Downloads\projects\yolov8\data\raw\office_4.jpg: 448x640 5 persons, 22690.3ms
```

Output

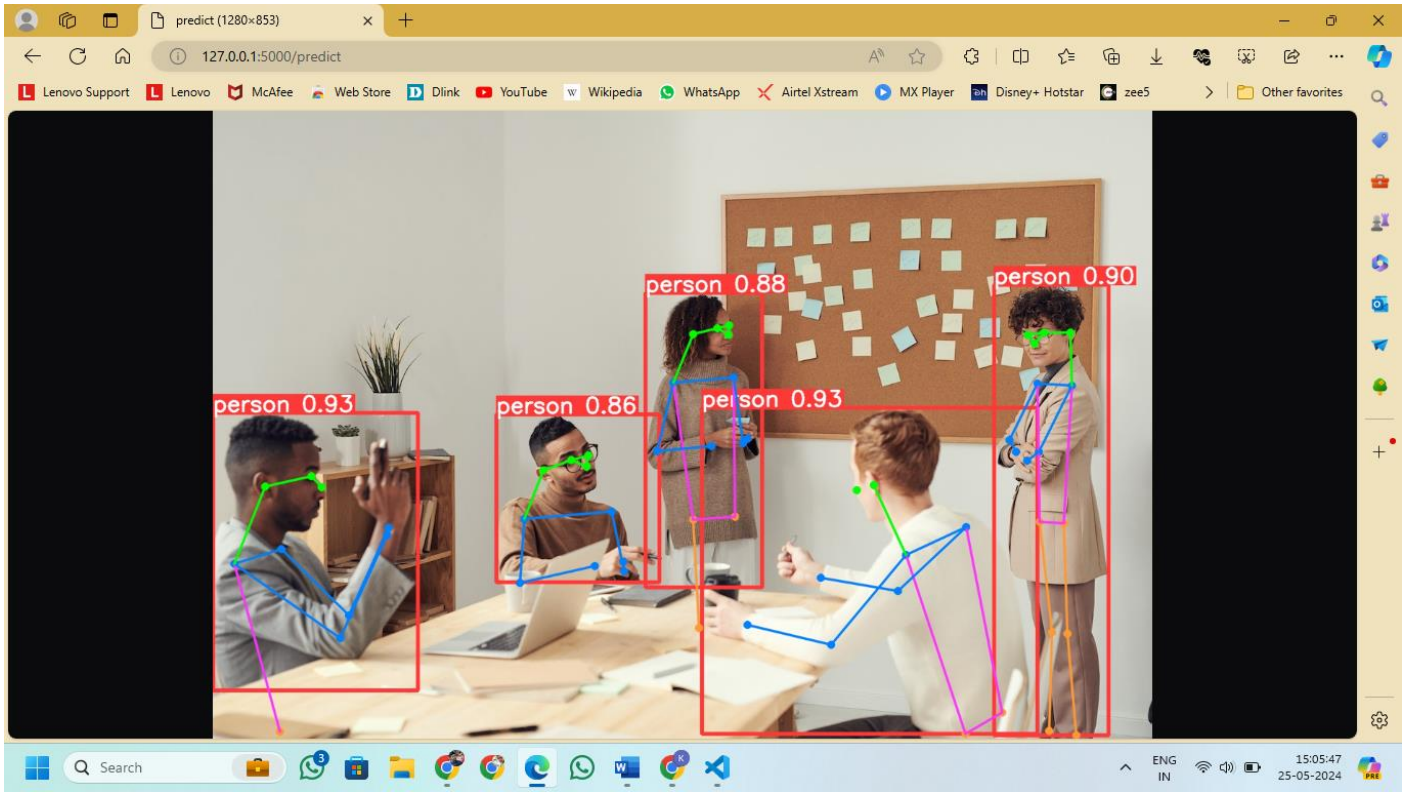
Detection



Segmentation



Pose



CHAPTER 7

CONCLUSION

Project Conclusion

This project successfully demonstrates the capabilities of the YOLOv8 model for image classification, object detection, and human pose estimation. By leveraging advanced deep learning techniques, the system can accurately identify and classify objects, detect various segments, and estimate human poses in both images and videos. The results highlight the model's robustness and efficiency in handling diverse and complex visual data, making it suitable for a wide range of applications such as security surveillance, autonomous driving, and human-computer interaction. Overall, the integration of YOLOv8 into our project showcases the potential of state-of-the-art neural networks in solving real-world problems with high precision and reliability.

Future Enhancement

While the current implementation of the YOLOv8-based system demonstrates excellent performance, there are several avenues for future enhancement. One potential improvement is the incorporation of real-time processing capabilities to further optimize the system's responsiveness and applicability in dynamic environments. Additionally, expanding the model's training dataset with more diverse and comprehensive samples can enhance its accuracy and generalization to new scenarios. Another promising direction is the integration of additional features such as multi-camera support, advanced tracking algorithms, and the ability to recognize and interpret complex interactions between detected objects. These enhancements will broaden the system's functionality and effectiveness, paving the way for even more sophisticated and versatile applications.

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- **Roboflow:** https://roboflow.com/ (For annotating and preparing datasets)
- **PyTorch Documentation:** https://pytorch.org/docs/stable/index.html
- **Flask Documentation:** https://flask.palletsprojects.com/en/2.2.x/
- **OpenCV Documentation:** https://docs.opencv.org/
- **MDN Web Docs:** https://developer.mozilla.org/en-US/ (Web development resources)
- **YOLOv8 Documentation:** https://docs.ultralytics.com/
- **Flask-SocketIO Documentation:** https://flask-socketio.readthedocs.io/en/latest/
- **WebRTC Documentation:** https://webrtc.org/
- **FFMPEG Documentation:** https://ffmpeg.org/documentation.html
- **RTSP Resources:** https://www.rtsp.me/