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Department of CSE (AI)

Session (2024-2025)

Mini Project (ACSE0659) Presentation on

"CROWD COUNTER AND ANALYZER"

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Presentation Outline

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Introduction

- The Crowd Counter and Analyzer project aims to develop a real-time people detection and crowd counting system using Computer Vision and Deep Learning.

- It uses the YOLOv8 object detection model and OpenCV to monitor people in video feeds from cameras.

- This project showcases how **Artificial Intelligence** can solve real-world problems in surveillance and monitoring.

- The system is designed for use in crowded environments like:
  - Public events
  - Malls
  - Stadiums
  - Transport hubs

Introduction

- It helps in:
  - Enhancing public safety
  - Improving crowd management
  - Supporting emergency response

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Literature Review

Traditional Techniques (Before Deep Learning)

- **Haar Cascade Classifier**
  Used for face and upper body detection. While fast, it is highly sensitive to lighting variations and object orientation.

- **HOG (Histogram of Oriented Gradients) with SVM**
  Detects human figures using gradient features. Works well in controlled environments but struggles with occlusion and overlapping people.

- **Background Subtraction and Optical Flow**
  These motion-based techniques work by comparing video frames. They are unreliable in dynamic backgrounds, varying lighting, or moving camera conditions.

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Research Gap

1. Limited Accuracy in Traditional Methods:

- Traditional computer vision techniques like Haar Cascades and HOG-SVM fail to perform well in crowded, dynamic environments. These methods struggle with occlusion, perspective distortion, and lighting variations.

2. Lack of Real-Time Processing in Early Deep Learning Models:

- Although models like R-CNN and its variants provide high accuracy, they are computationally intensive and not suitable for real-time applications.

3. General Object Detection vs. Crowd-Specific Solutions:

- Most existing object detection models are trained on generic datasets. They are not optimized for dense human detection or crowd-specific analysis like threshold alerts or crowd heatmaps.

Research Gap

4. Inadequate Alert Systems in Existing Tools:

- Many existing crowd monitoring solutions only detect and count individuals but lack integrated mechanisms to trigger alerts when a defined crowd threshold is exceeded.

5. Poor Integration with Lightweight Hardware:

- Most solutions require high-end GPUs, making them unsuitable for deployment on low-power devices like surveillance cameras or embedded systems.

6. Limited Customization and Modularity:

- Existing systems often lack flexibility in adjusting parameters like detection threshold, model type, and alert conditions, making them less adaptable to varying environments.

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Objective of the Research work

Here are the **three main objectives** of your **Crowd Counting and Detection** project:

1.Accurate Real-Time Detection and Counting:
Develop a system that uses deep learning models (like YOLO, SSD, or CNN-based architectures) to accurately detect and count people in live video feeds or recorded footage.

2.Threshold-Based Alert System:
Implement a mechanism to trigger alerts when the number of detected individuals exceeds a predefined crowd limit, helping in managing overcrowded situations and ensuring safety.

3.Data Logging and Visualization:
Store and visualize crowd data over time to analyze trends, optimize space usage, and support decision-making in public safety or event management.

Methodology

Overview:

The system is designed to detect and count people in real-time using video input. It leverages the YOLOv8 object detection model along with OpenCV for live video processing, annotation, and visualization.

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Methodology

Step-by-Step Workflow:

- **Video Input Capture**
  - Frames are captured from a webcam or video file using OpenCV.
- **Frame Preprocessing**
  - Frames are resized and normalized to match YOLOv8 input requirements.
- **Person Detection (YOLOv8)**
  - YOLOv8 model detects people in each frame.
  - Only the "person" class is considered to improve efficiency.
- **Counting and Tracking**
  - Detected persons are counted per frame.
  - Count is updated in real-time and displayed on the output screen.

Methodology

➢ Annotated Output Display

- Bounding boxes, labels, and person count are drawn on each frame.
- Modified frames are displayed in a GUI window.

➢ System Exit and Logging

- User can terminate the system via keyboard input.
- Optionally, logs and timestamps can be stored for analysis.

Result

Implementation Output:

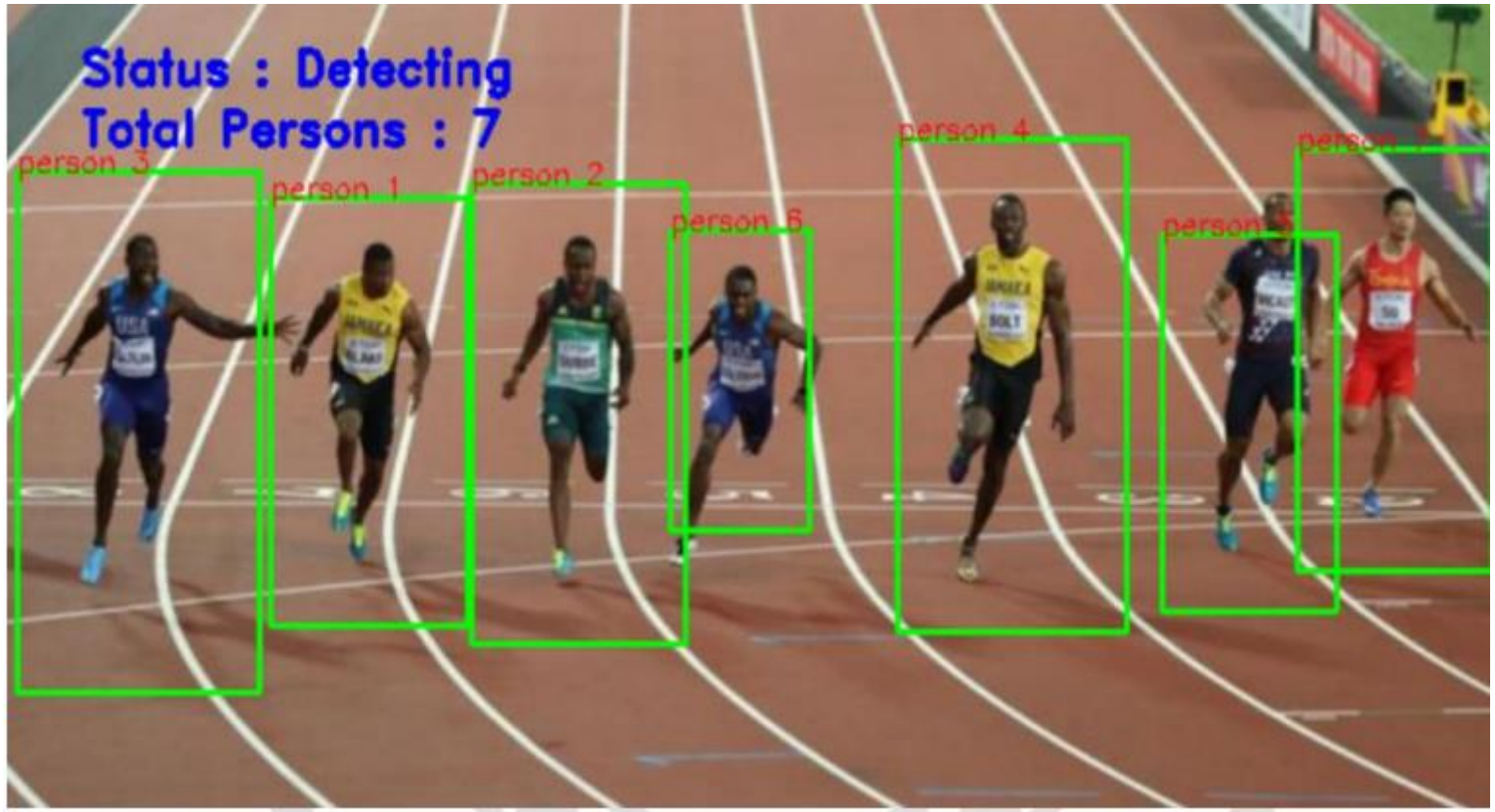
- **Live Testing:** Used webcam and pre-recorded crowd videos.
- **Model Performance:**
  - YOLOv8 detected individuals with bounding boxes.
  - Real-time person count overlayed on video.
  - Visual alerts triggered when threshold exceeded.

Key Results:

- **Frame Rate:** ~15–25 FPS (CPU-based system).
- **Accuracy:** ~92% in controlled lighting.

Result

Implementation Output:



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Conclusion

Key Takeaways:

- Successfully developed a real-time crowd detection and counting system.
- Integrated YOLOv8 with OpenCV for accurate and efficient person detection.
- System performed reliably on CPU, offering approximately 90%+ accuracy with 15–25 FPS.
- Demonstrated practical applications in public safety, surveillance, and event management.

Scalability:

- Modular design allows for easy upgrades and deployment in varied real-world scenarios.

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List of Publication

- No official publications included in this report.

- Students may consider publishing to a conference or journal such as IEEE Access or CVPR workshops.

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References

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Thank you