Video Frame Extraction and Segmentation for Real-Time Object Analysis

Adil Dafedar
Department of Information Technology, PCCOE, Pune, India
adil.dafedar23@pccoepune.org
🔗 *GitHub Repository*

I. AIM

To create an automated system that processes video frames, detects objects accurately, and helps users find related products online quickly.

II. MOTIVATION

Videos are everywhere—from social media to surveillance—and contain valuable objects and products.
Manual object tagging is slow and not practical.

Enabling users to interact with and purchase products detected in video content (e.g., clothes, electronics) can
revolutionize e-commerce by linking visual media directly to product discovery.

Linking objects in videos to shopping platforms enhances user experience and creates new e-commerce opportunities.

III. LITERATURE REVIEW

Concepts	Reference
Object detection builds on image segmentation and feature extraction from images.	*Object detection in real-time video surveillance using attention mechanism and Transformer-based detection head,* 2025.
YOLOv8n is chosen because it is lightweight, fast (can handle real-time), and accurate enough for many practical uses.	1.Sung, T.-W. et al., *Improvement of YOLOv8 Object Detection Based on Lightweight Neck Model for Complex Images,* 2025. *The evolution of object detection methods: Performance improvements with YOLOv8,* 2025.
Deep learning models learn features automatically, unlike traditional manual filters, making them powerful for complex video scenes.	*1.SO-YOLOv8: A novel deep learning-based approach for small object detection,* 2025. 2.H. Jain et al., *YOLOv8 and its Advancements,* IJRP Reviews, 2025.

YOLO Version	Speed	Accuracy	Use Case
YOLOv3	Fast	Moderate	Real-time detection with decent accuracy. Good for general use on limited hardware.
YOLOv4	Medium	High	Balanced speed & accuracy. Works well for small objects.
YOLOv5	Fast	High	Flexible model sizes (Nano to XLarge). Good for deployment & custom training.
YOLOv7	Fast	Moderately High	Best real-time accuracy. Great on COCO dataset. Efficient architecture.
YOLOv8	Fast	Very High	Latest features, strong on custom datasets. Modern design with highest accuracy.

Existing Systems	This Project (Unique Features)
Works on single images or snapshots	Processes entire videos automatically by extracting frames
Requires manual user input to upload or capture image	Fully automated frame extraction and object detection

Detects one main object per image	Detects multiple objects across multiple frames
Focused mostly on image-based product search	Combines video processing with e-commerce product link generation

IV. METHODOLOGY

1.Frame Extraction

Input: Pre-recorded video (input_video.mp4).

Frames are extracted at 2 FPS using OpenCV.

Each frame is saved sequentially as an image file for further processing.

2.Object Detection

Model: YOLOv8n.pt from the Ultralytics YOLO library

Each saved frame is passed to the YOLO model for detection.

Objects detected are collected across frames and filtered for uniqueness

Detections are logged and stored in detected_objects.txt.

3.Product Link Generation

Each unique object is mapped to a product search query

Example:

🔎 Bottle

- Amazon: https://www.amazon.com/s?k=bottle

- Flipkart: https://www.flipkart.com/search?q=bottle

- eBay: https://www.ebay.com/sch/i.html?_nkw=bottle

- Walmart: https://www.walmart.com/search?q=bottle

V. Results

🎯 Unique objects detected in video:

- airplane
- baseball bat
- bottle
- cell phone
- dining table
- donut
- fork
- person
- refrigerator
- remote
- scissors
- toothbrush

✅ Saved detected objects to detected_objects.txt

🛒 Suggested Buy Links:

🔎 Airplane

- Amazon: https://www.amazon.com/s?k=airplane

- Flipkart: https://www.flipkart.com/search?q=airplane

- eBay: https://www.ebay.com/sch/i.html?_nkw=airplane

- Walmart: https://www.walmart.com/search?q=airplane

🔎 Baseball Bat

- Amazon: https://www.amazon.com/s?k=baseball+bat

- Flipkart: https://www.flipkart.com/search?q=baseball+bat

- eBay: https://www.ebay.com/sch/i.html?_nkw=baseball+bat

- Walmart: https://www.walmart.com/search?q=baseball+bat

🔎 Bottle

- Amazon: https://www.amazon.com/s?k=bottle
- Flipkart: https://www.flipkart.com/search?q=bottle
- eBay: https://www.ebay.com/sch/i.html?_nkw=bottle
- Walmart: https://www.walmart.com/search?q=bottle

🔎 Cell Phone
- Amazon: https://www.amazon.com/s?k=cell+phone
- Flipkart: https://www.flipkart.com/search?q=cell+phone
- eBay: https://www.ebay.com/sch/i.html?_nkw=cell+phone
- Walmart: https://www.walmart.com/search?q=cell+phone

🔎 Dining Table
- Amazon: https://www.amazon.com/s?k=dining+table
- Flipkart: https://www.flipkart.com/search?q=dining+table
- eBay: https://www.ebay.com/sch/i.html?_nkw=dining+table
- Walmart: https://www.walmart.com/search?q=dining+table

🔎 Donut
- Amazon: https://www.amazon.com/s?k=donut
- Flipkart: https://www.flipkart.com/search?q=donut
- eBay: https://www.ebay.com/sch/i.html?_nkw=donut
- Walmart: https://www.walmart.com/search?q=donut

🔎 Fork
- Amazon: https://www.amazon.com/s?k=fork
- Flipkart: https://www.flipkart.com/search?q=fork
- eBay: https://www.ebay.com/sch/i.html?_nkw=fork
- Walmart: https://www.walmart.com/search?q=fork

🔎 Refrigerator

- Amazon: https://www.amazon.com/s?k=refrigerator
- Flipkart: https://www.flipkart.com/search?q=refrigerator
- eBay: https://www.ebay.com/sch/i.html?_nkw=refrigerator
- Walmart: https://www.walmart.com/search?q=refrigerator

🔎 Remote

- Amazon: https://www.amazon.com/s?k=remote
- Flipkart: https://www.flipkart.com/search?q=remote
- eBay: https://www.ebay.com/sch/i.html?_nkw=remote
- Walmart: https://www.walmart.com/search?q=remote

🔎 Scissors

- Amazon: https://www.amazon.com/s?k=scissors
- Flipkart: https://www.flipkart.com/search?q=scissors
- eBay: https://www.ebay.com/sch/i.html?_nkw=scissors
- Walmart: https://www.walmart.com/search?q=scissors

🔎 Toothbrush

- Amazon: https://www.amazon.com/s?k=toothbrush
- Flipkart: https://www.flipkart.com/search?q=toothbrush
- eBay: https://www.ebay.com/sch/i.html?_nkw=toothbrush
- Walmart: https://www.walmart.com/search?q=toothbrush

VI. CONCLUSIONS

This project successfully demonstrates an end-to-end pipeline for extracting video frames, detecting and analyzing objects using deep learning, and integrating the results with e-commerce functionality.
The approach is scalable and can be enhanced with more advanced models, real-time tracking, and API integration for live product search.
This system has potential applications in smart surveillance, interactive advertising, and automated content tagging for e-commerce platforms.

VII. REFERENCES

[1] ***Sung, T.-W., Li, J., Lee, C.-Y., & Fang, Q. (2025). "Improvement of Yolov8 Object Detection Based on Lightweight Neck Model for Complex Images."***
[2] ***SO-YOLOv8: A novel deep learning-based approach for small object detection," 2025.***
[3] ***H. Jain, J. Jain, V. Shrivastava, A. Pandey, and S. Sharma, "YOLOv8 and its Advancements," International Journal of Research Publication and Reviews***
[4] ***Object detection in real-time video surveillance using attention mechanism and Transformer-based detection head," 2025. [5] The evolution of object detection methods: Performance improvements with YOLOv8.***
[5] ***The evolution of object detection methods: Performance improvements with YOLOv8.***