

Documentation JK CEMENT HACK123

Overview

This project processes a video of rail wagons to:

1. Detect and count the total number of wagons using instance segmentation.
2. Classify each wagon as Loaded or Unloaded using a CNN model.
3. If a wagon is Loaded, calculate its volume using depth estimation.
4. If a wagon is Unloaded, check for damages using an instance segmentation model.
5. Capture images of damaged wagons, label them, and generate a PDF report.
6. Generate a comprehensive PDF report summarizing the results.

Workflow

1. Video Preprocessing

- The input video is loaded and frames are extracted using OpenCV.
- Instance segmentation (Detectron2) detects wagon edges (front and rear) to count wagons.

2. Wagon Classification

- Each detected wagon is classified as Loaded or Unloaded using a CNN model.
- TensorFlow/Keras-based image classification model is used for inference.

3. Volume Calculation for Loaded Wagons

- Depth estimation is applied to determine real-world dimensions.
- A reference object is used for calibration (e.g., known wagon dimensions).
- The volume of material inside the wagon is computed.
- This project utilizes DepthAnything-Large HF for depth estimation to accurately calculate the volume of materials carried in each wagon.

4. Damage Detection for Unloaded Wagons

- If a wagon is Unloaded, an instance segmentation model detects damages.
- Detected damaged areas are marked, and images are saved with labels.

5. PDF Report Generation

- The system generates a PDF summarizing the results:
- Loaded wagons with their calculated volumes.
- Unloaded wagons with detected damages and corresponding images.

Libraries Used

The project uses the following libraries:

Core Libraries

- numpy - Numerical operations
- os - File management
- collections.defaultdict - Data storage
- matplotlib.pyplot - Visualization

Computer Vision & Machine Learning

- cv2 (OpenCV) - Video and image processing
- torch - PyTorch framework for deep learning
- detectron2 - Instance segmentation (for wagon and damage detection)
- tensorflow.keras - CNN model for Loaded/Unloaded classification

Report Generation

- reportlab - Generating PDF reports with text and images

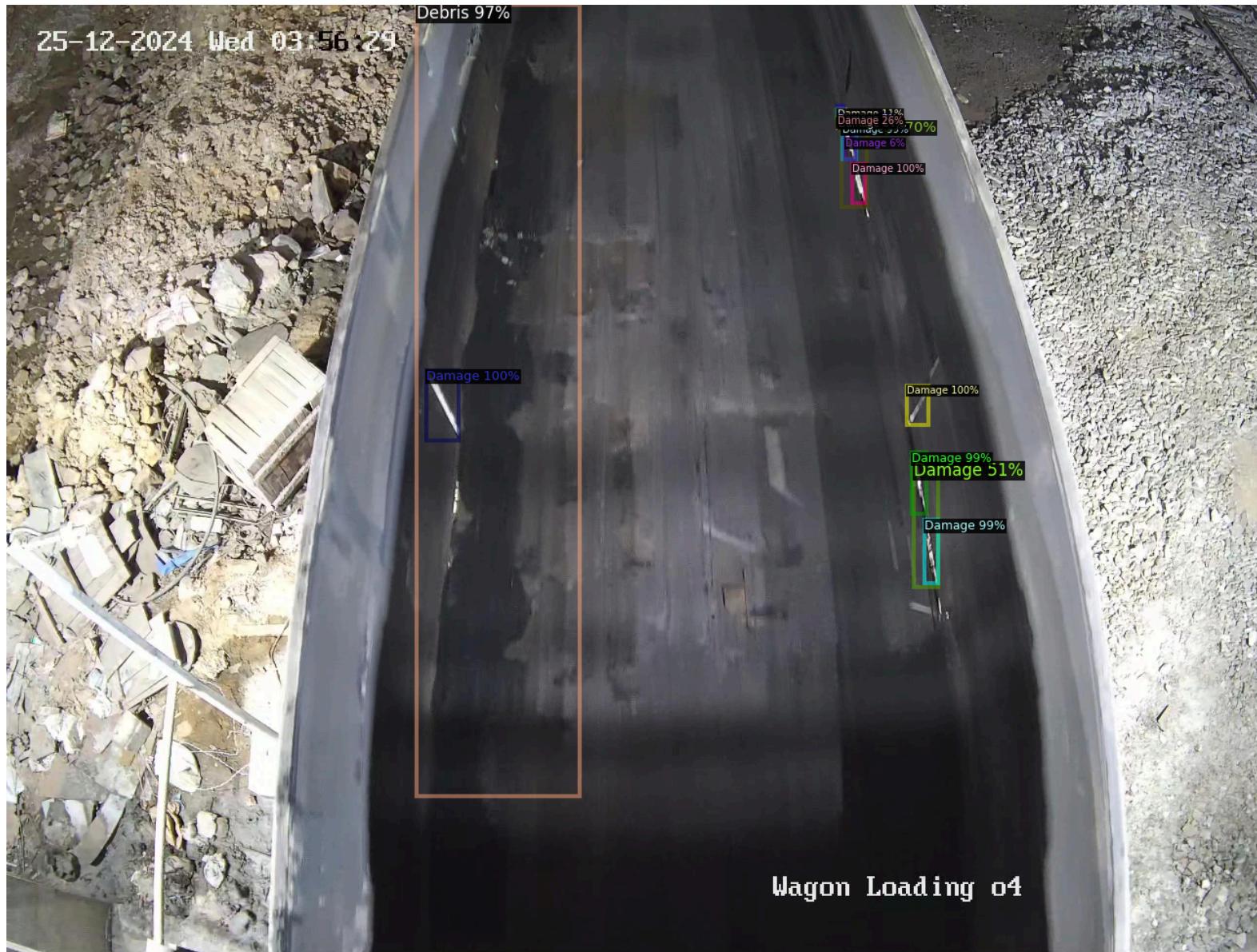
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IN Loading no 04

Model Generated Content (by Innov8tors)

Wagon No: 1

- **Date:** 25-12-2024 (WED)
- **Time:** 4:04:37
- **Load:** Empty
- **Damage:** Wagon has damages at 3 places (*please find the image for further details*)
- **Debris:** Wagon has debris (*please find the image*)



- 3 medium damage
- 8 small damages

Wagon No: 2

- **Date:** 25-12-2024 (WED)
- **Time:** 4:05:01
- **Load:** Empty
- **Damage:** Wagon has damages at 6 places (please find the image for further details)
- **Debris:** Wagon has debris (please find the image)



- 2 medium damage

- 6 small damages

Wagon No: 3

- **Date:** 25-12-2024 (WED)
- **Time:** 4:06:01
- **Load:** Empty
- **Damage:** Wagon has damages (*please find the image for further details*)
- **Debris:** Wagon has debris (*please find the image*)



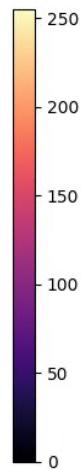
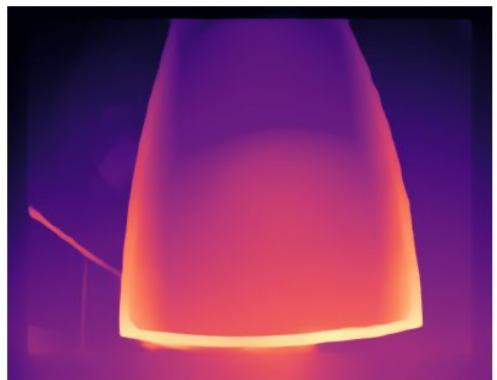
Out Loading no 04

Model Generated Content (by Innov8tors)

Wagon No: 1

- **Date:** 25-12-2024 (WED)
- **Time:** 4:04:37
- **Load:** Loaded
- **Volume:** 398 m³

- **Depth Map:** (See image below)





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