



Data Science and AI - T5 Bootcamp

POLLUVISION

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Outline

-  **Problem Statement**
-  **Saudi 2030 Vision**
-  **Dataset & Challenges**
-  **AI-based Solution**
-  **Transfer Learning**
-  **Application in Real Life**
-  **Future Work**
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Problem Statement

- **Problem**
 - Visual Pollution
 - Lack Of Pollution Reduction Effective Strategies
- **AI-based Solutions**
 - Detect and Classify Visual Pollution
 - Provide Coordinates of the Location
 - Less Human Interaction

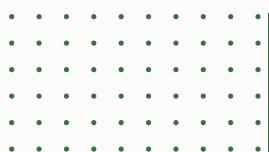




Saudi 2030 Vision



- Enhance the global status of Saudi cities and their Urban Environment
- Ambition to reach the top 5 countries in the field of Artificial Intelligence (AI)
- Contributes to Saudi Arabia's Vision 2030, by utilizing artificial intelligence
- Promotes the evolution of cities into smart urban centers



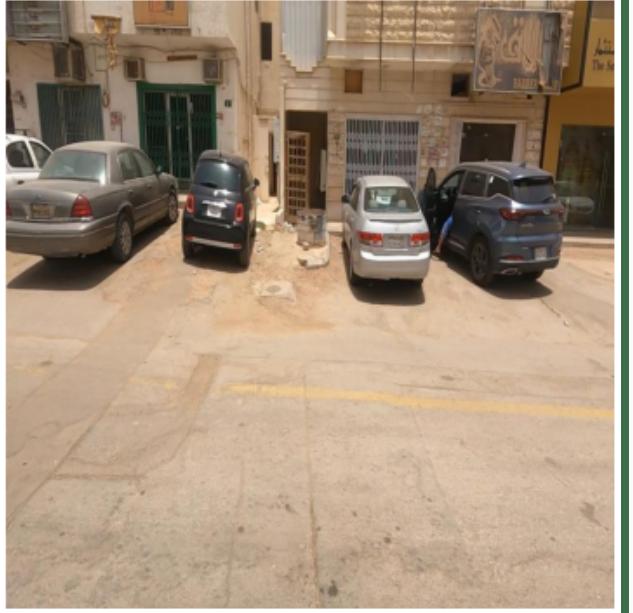
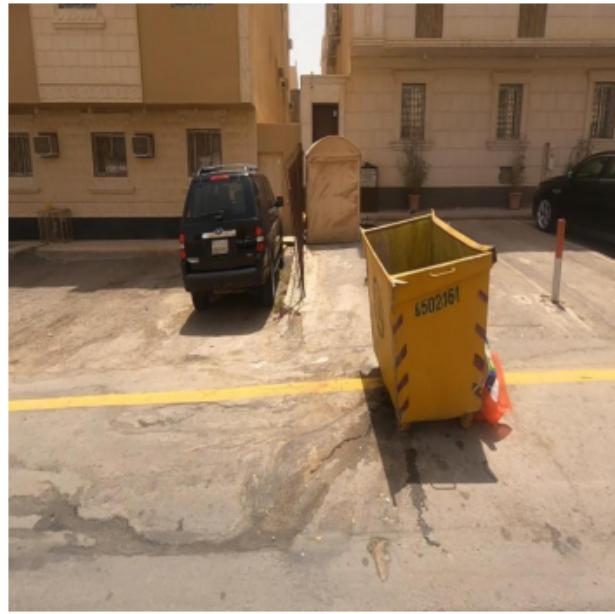


”
بُسْرِنِي أَنْ أَقْدِمْ لِكُمْ رُؤْيَا الْحَاضِر
لِلْمَسْقَبِ، الَّتِي نَرِدْ أَنْ نَبْدُ أَلْعَمْلُ بِهَا
الْيَوْمِ لِلْفَدِ، بِخَيْرٍ نَصِيرٍ عَنْ طَمَوْحَائِنَا
جَمِيعاً وَنَكِسْنِ قَدْرَاتِ بَلَادِنَا.
”

صاحب السمو الملكي الأمير محمد بن سلمان بن عبدالعزيز

Dataset

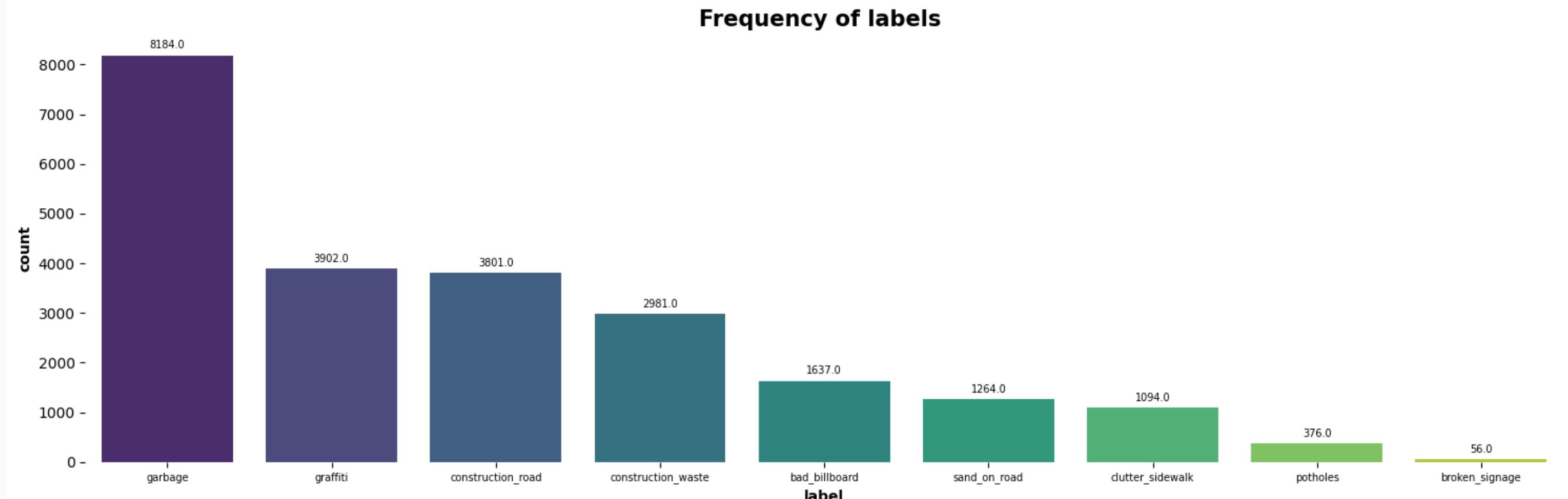
- **Urban Visual Pollution Dataset**
- Source: [kaggle](#)
- Visual Pollution data were specifically obtained from the Kingdom of Saudi Arabia roads.
 - Train: 10,872
 - Validation: 1,048
 - Test: 524



Dataset Challenges

Imbalanced Classes

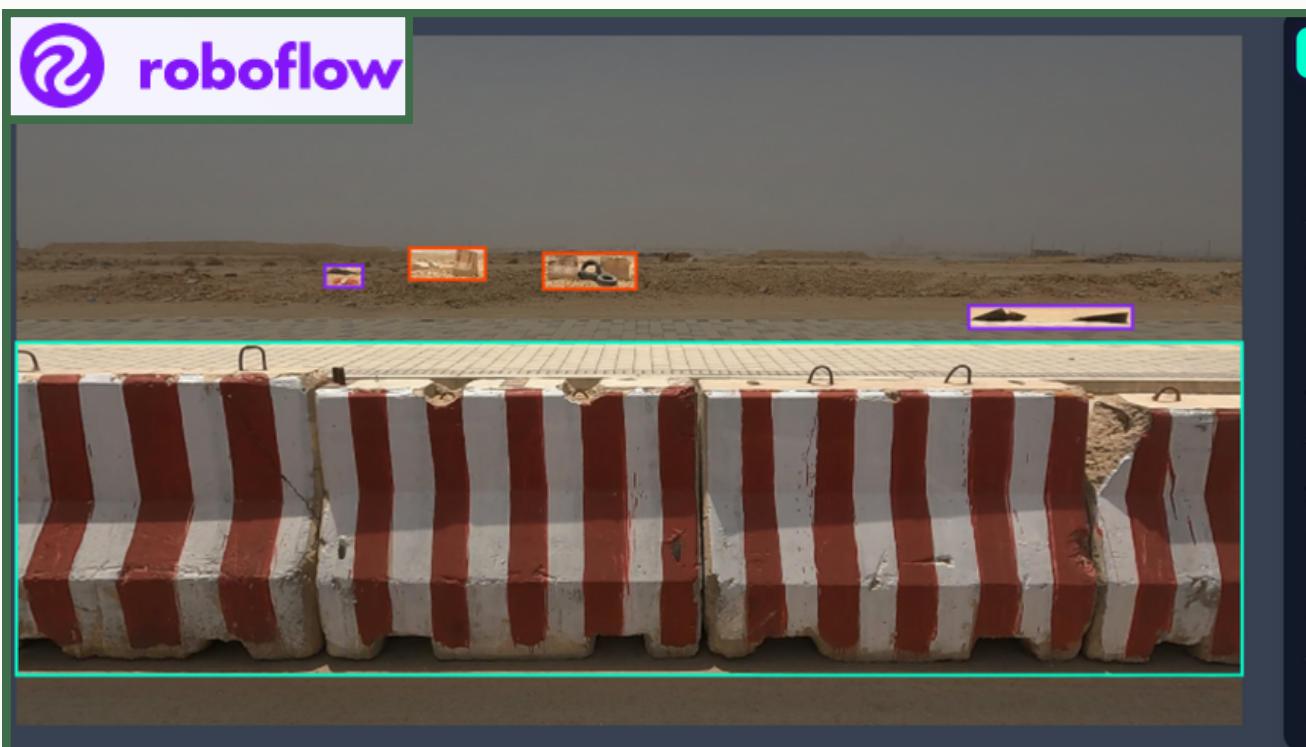
- The original dataset was 5196 images which has imbalance data
- We Apply data augmentation techniques which is Rotation: Between -25° and +25° and Saturation: -40% and +40%
- Then the dataset become 12K images



Dataset Challenges

Annotation and Labeling

- Incorrect Bounding Boxes
- Manual Annotation and Labeling Using Roboflow (Time-consuming)
- Includes multiple labels
- Images hold multiple annotations



CLASSES	LAYERS
● construction_road	1
● construction_waste	2
● garbage	2



Dataset Challenges

Dataset Size

- Large image datasets
- Computationally expensive, requiring specialized hardware
- Used Colab cloud with power GPU and RAM and more compute unit

The Colab Pro logo, featuring two overlapping circles in yellow and orange.

Colab Pro



AI-based Solution

CNN

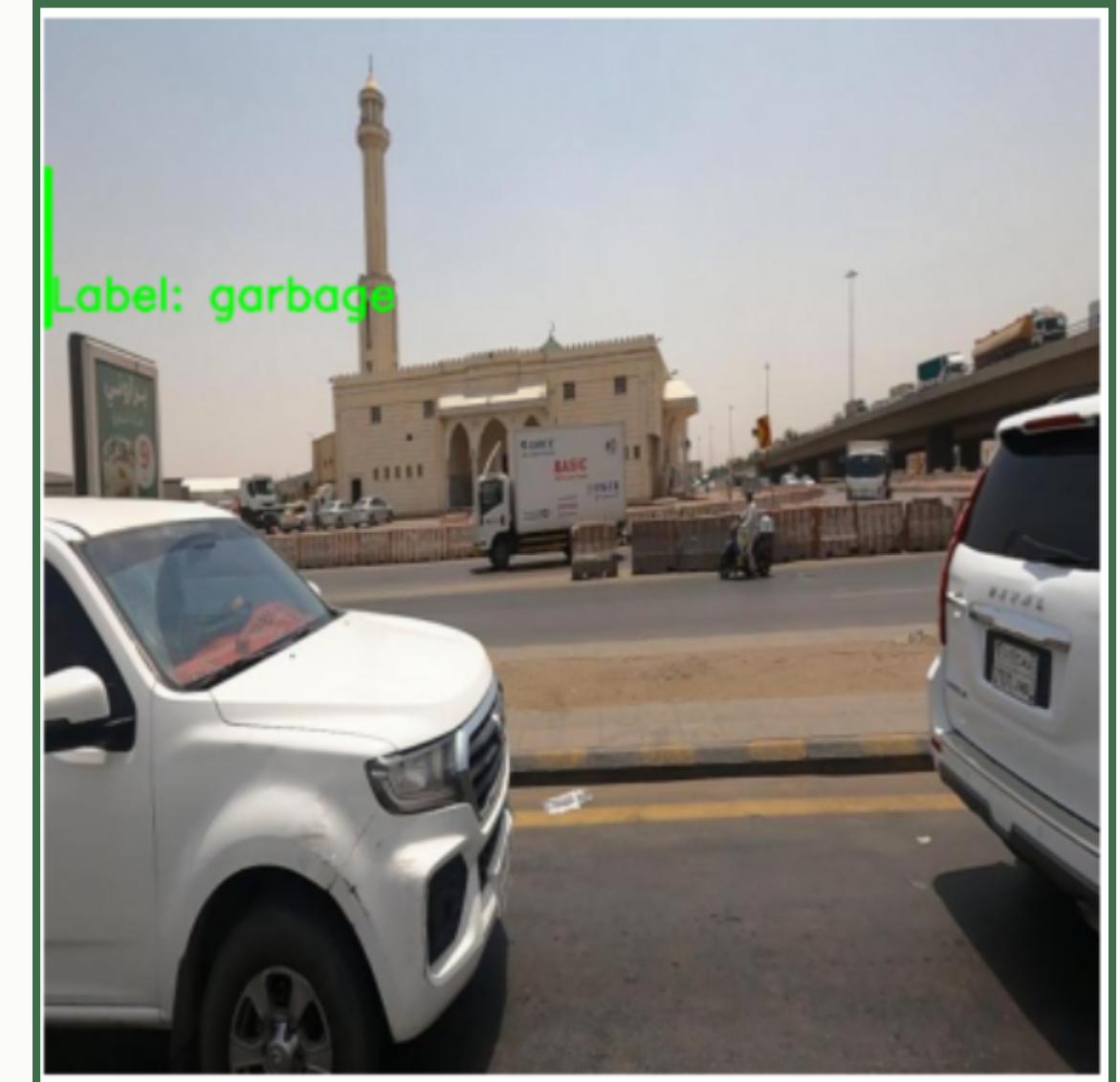
- 15 layers (6 convolutional layers and 2 fully connected layers)
- Total params: 799371
- Failed to classify the label
- Bounding box in an incorrect area.



Transfer Learning

VGG 16

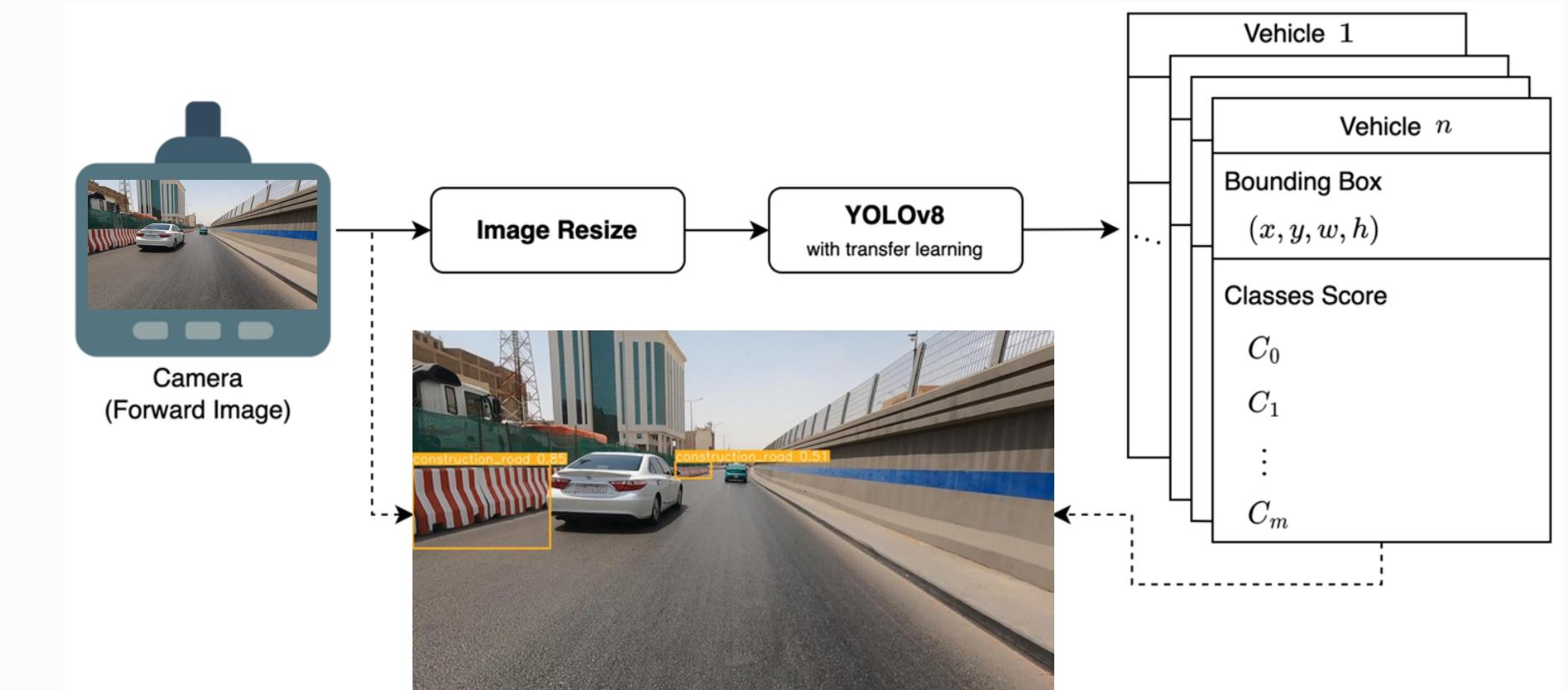
- 16 layers, (14 convolutional layers and 2 fully connected layers)
- Modifying the last layers of VGG16.
- Successfully classified the label
- Placed the bounding box in an incorrect area.



Transfer Learning

YOLO V8

- Using YOLOv5, and YOLOv7 versions of yolo the best result came from YOLOv8m
- Training YOLOv8m on our dataset with
 - Epochs = 100
 - Image Size = 640
 - Confidence Threshold = 0.45
 - Intersection Over Union = 0.4

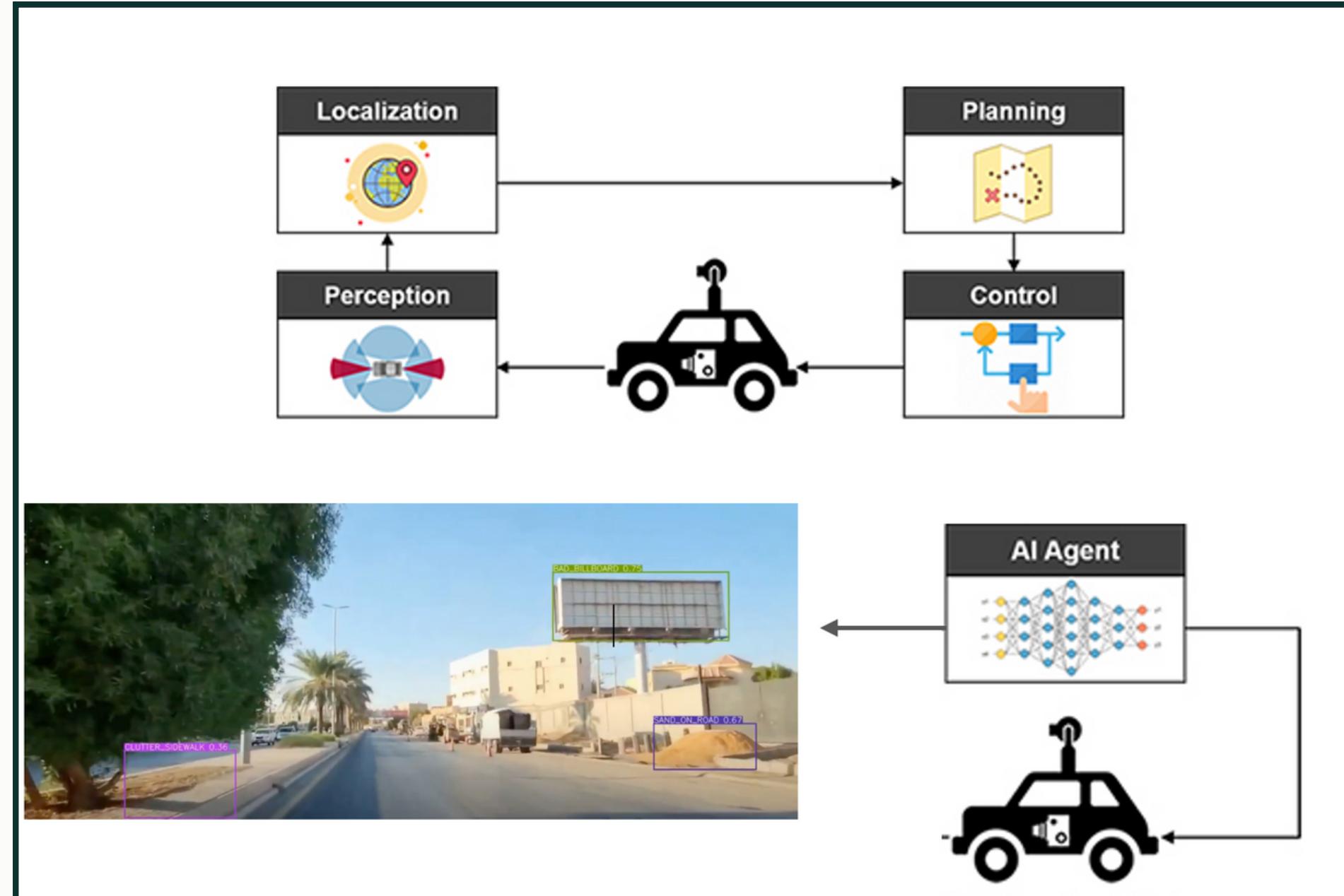


Application in Real Life

- The usual process to maintain the pollution in the roads were
 - Time-consuming
 - Manually from the municipal employees
- Navigating visual pollution in modern cities is complex, and PolluVision simplifies this process.



Application in Real Life



Future Work

- Autonomous cars use exteroceptive sensors like cameras, inertial sensors, and GPS to gather environmental information.
- Enhance the model to work in real-time
- Expand the identification of visual pollution
- Image Captioning



Tools

Pre-processing and Visualization	 pandas	 NumPy	  roboflow	 seaborn	 Python
Build Model	 Keras	 PyTorch	 TensorFlow	 OpenCV	 ultralytics
Website	 PC	 Streamlit	 dbip		





LINKEDIN & GITHUB



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Project Repository





DEMO





THANK YOU
FOR YOUR ATTENTION

