3D Perception, Learning-Based Data Fusion

FACE DETECTION, DISTANCE MEASUREMENT AND GLOBAL POSITION USING KINECT, YOLO AND KALMAN

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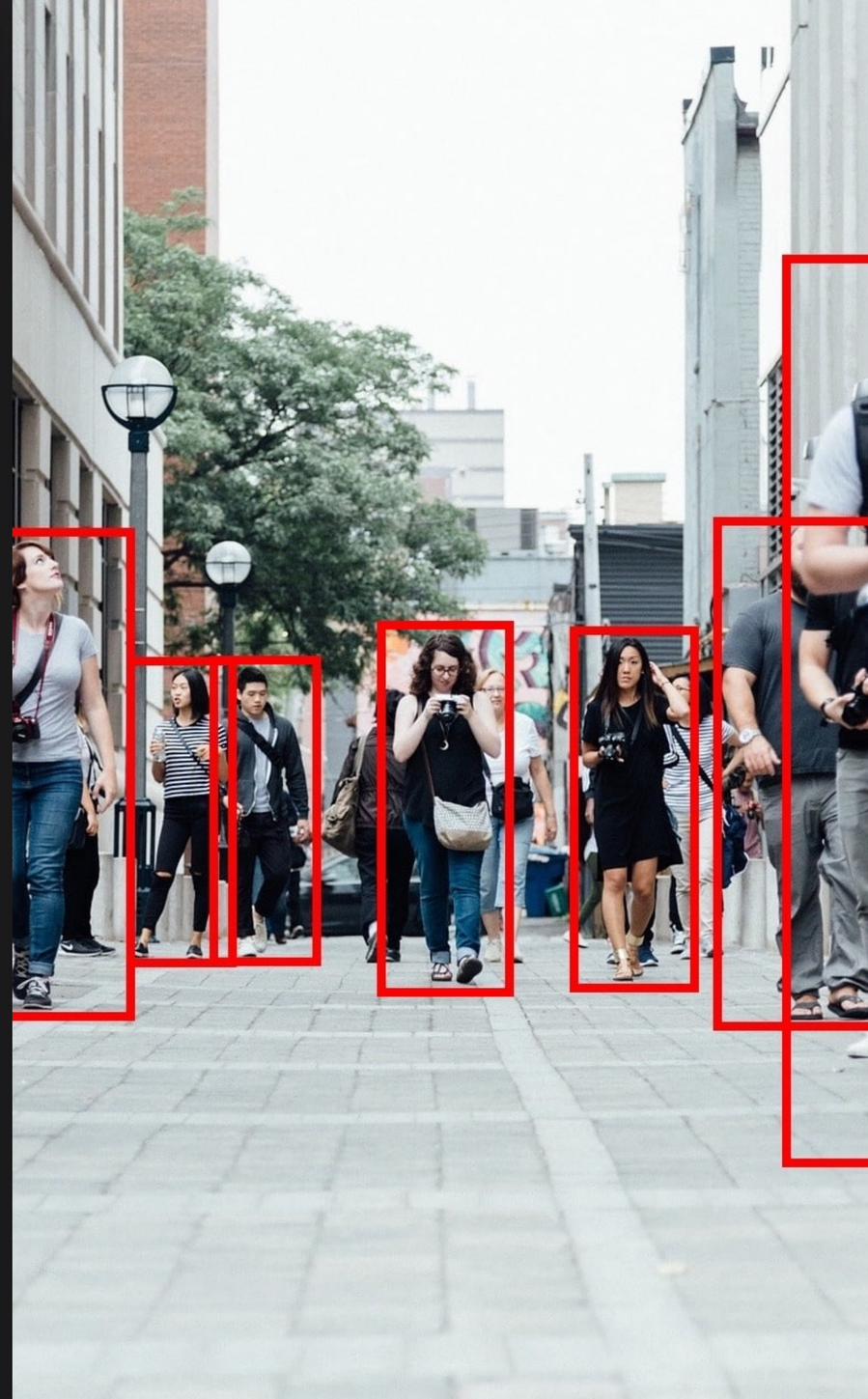
PROJECT OVERVIEW

Main Objectives

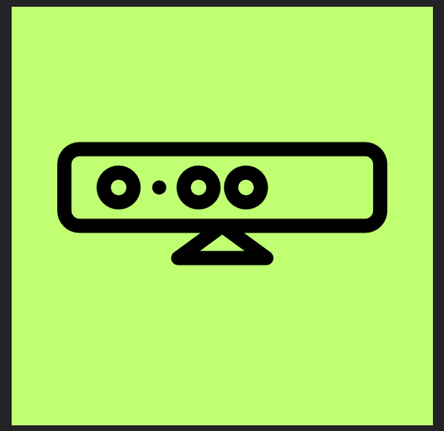
Integrate the previous project with GPS and data fusion using Kalman Filter

Add, in addition to real-time processing, the capability for post-processing



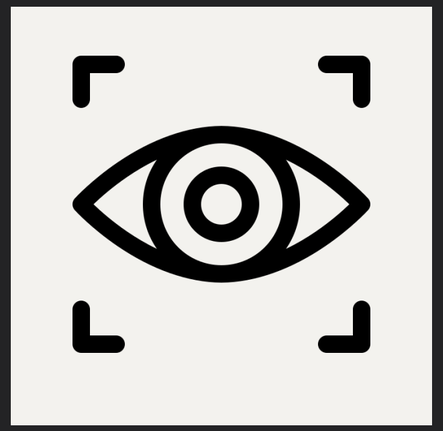
KEY TOOLS

Freenect



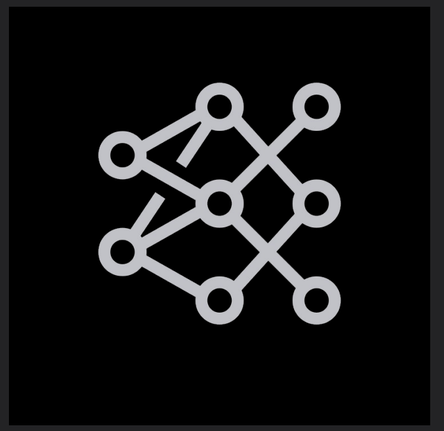
Open source drivers and libraries for the Kinect sensor.

OpenCV



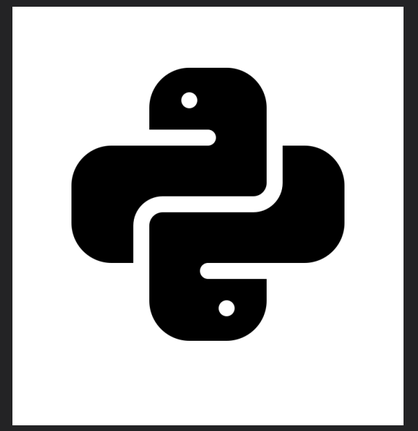
Library for computer vision and machine learning.

YOLOv11



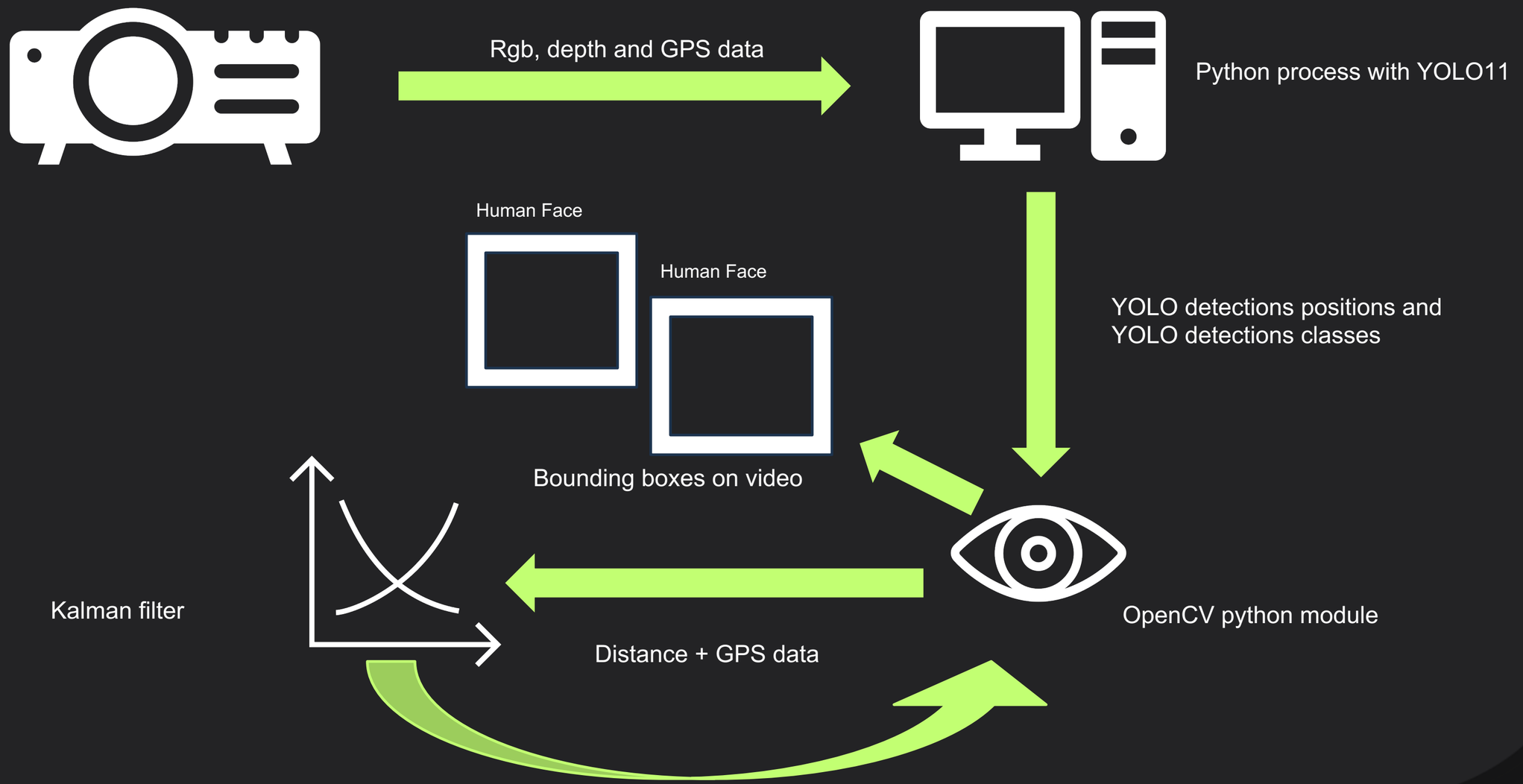
Latest deep learning model for fast object detection.

PyTorch



Framework for training YOLO.

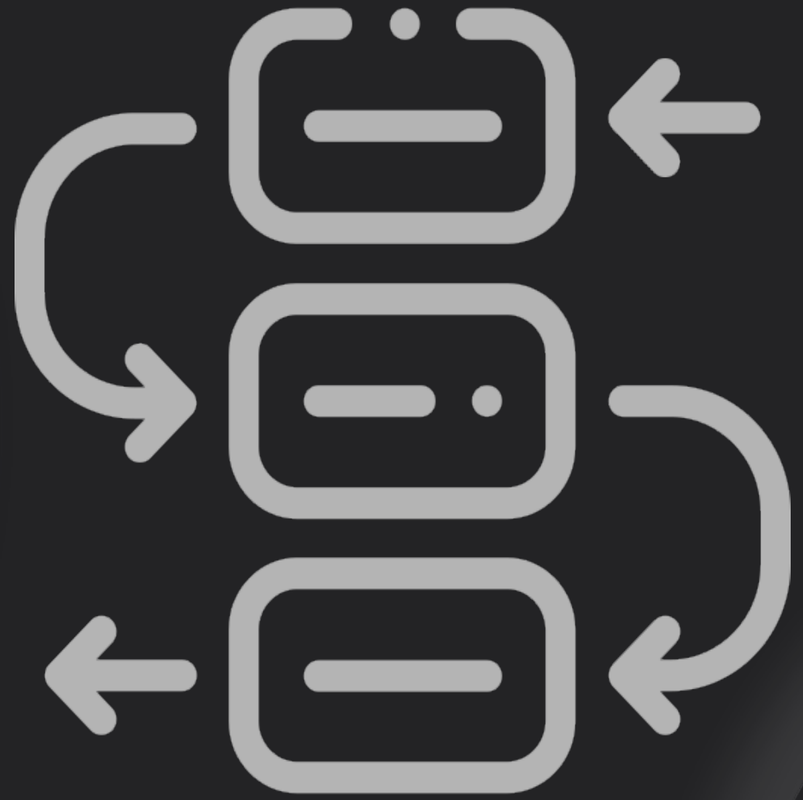
HOW IT WORKS


Rgb, depth and GPS data
Python process with YOLO11
Human Face
Human Face
YOLO detections positions and
YOLO detections classes
Bounding boxes on video
Kalman filter
OpenCV python module
Distance + GPS data

Why post-processing?

REAL-TIME IS HEAVY

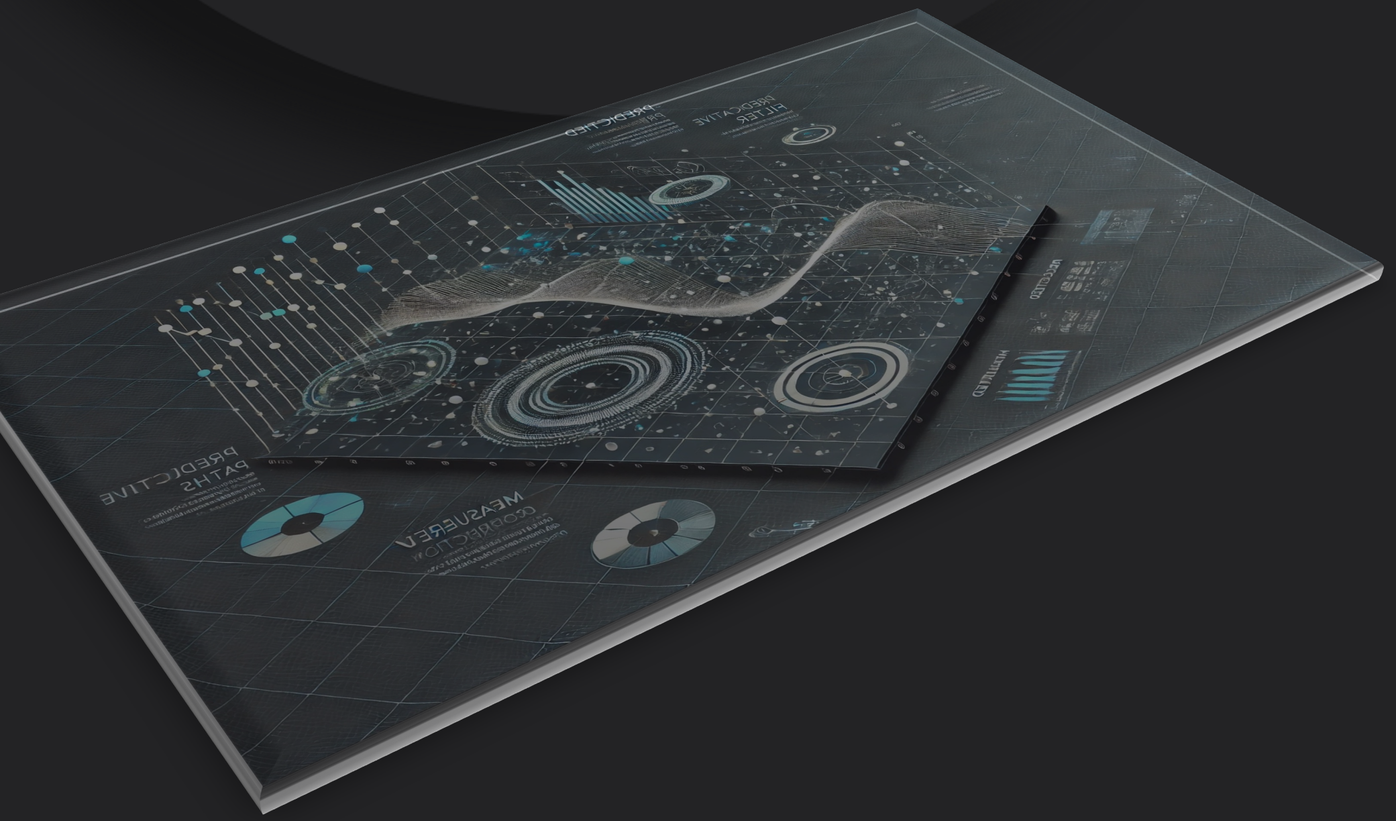
Even using a new version of YOLO model, real-time is still heavily resource dependent.



EVALUATION DATASET

With an evaluation dataset, post-processing allows us to control the accuracy of the results of our project.

KALMAN FILTER



x0 Latitude, longitude, x_center_bb, y_center_bb, distance.

F State trantition matrix.

H Observation matrix.

Q Process noise covariance.

R Measurement noise covariance.

P0 Initial error covariance.

B Control vector.

KALMAN FILTER

01 Predicts the depth of existing objects.

02 Associate with detected objects.

03 Update the Kalman filter.

OUTPUT RESULTS

FUTURE IMPROVEMENTS FOR OUR PROJECT

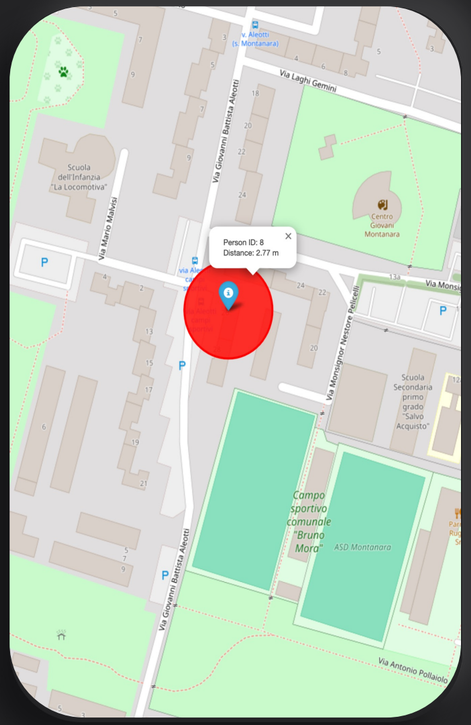
INTEGRATION WITH COMPASS

HIGH-PERFORMANCE COMPUTING SYSTEMS

SMALLER MAPS

OUR CHALLENGES

Challenge 1

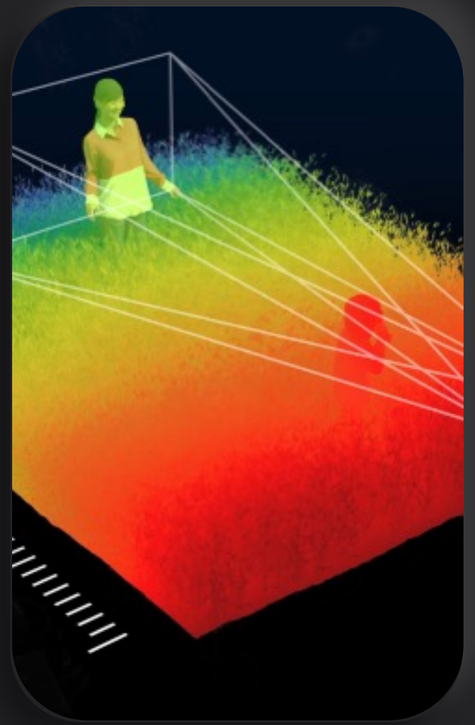


Difficulty in representing nearby objects on a large-scale map.

Challenge 2

Operating on inefficient machines leads to substantial overheating.

Challenge 3



Adjust depth based on each data input.

Thank you for your attention

CREDITS

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and

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