# Smart Digital Junction

*Benchmarking the Raspberry Pi 5,
Hailo8, and x86/Nvidia CPU-GPU*

Overview

- To determine the feasibility of using the Hailo8 module for real-time traffic monitoring and analysis

- Benchmarking Platforms
  - Raspberry Pi 5
  - Raspberry Pi 5 + Hailo8 Accelerator
  - Desktop PC with Nvidia A600, AMD Ryzen ThreadRipper Pro 5995WX

- Evaluation & Standardization
  - Execute a basic object detection script in Python
  - Yolov6n model on all platforms
  - 90.28 second mp4 video file of moderate traffic flow --- 480p @ 25 fps (2257 frames total)

- Comparison Metrics:
  - Visual comparison and Execution time comparison/speed

Desktop PC with Nvidia A600 + ThreadRipper
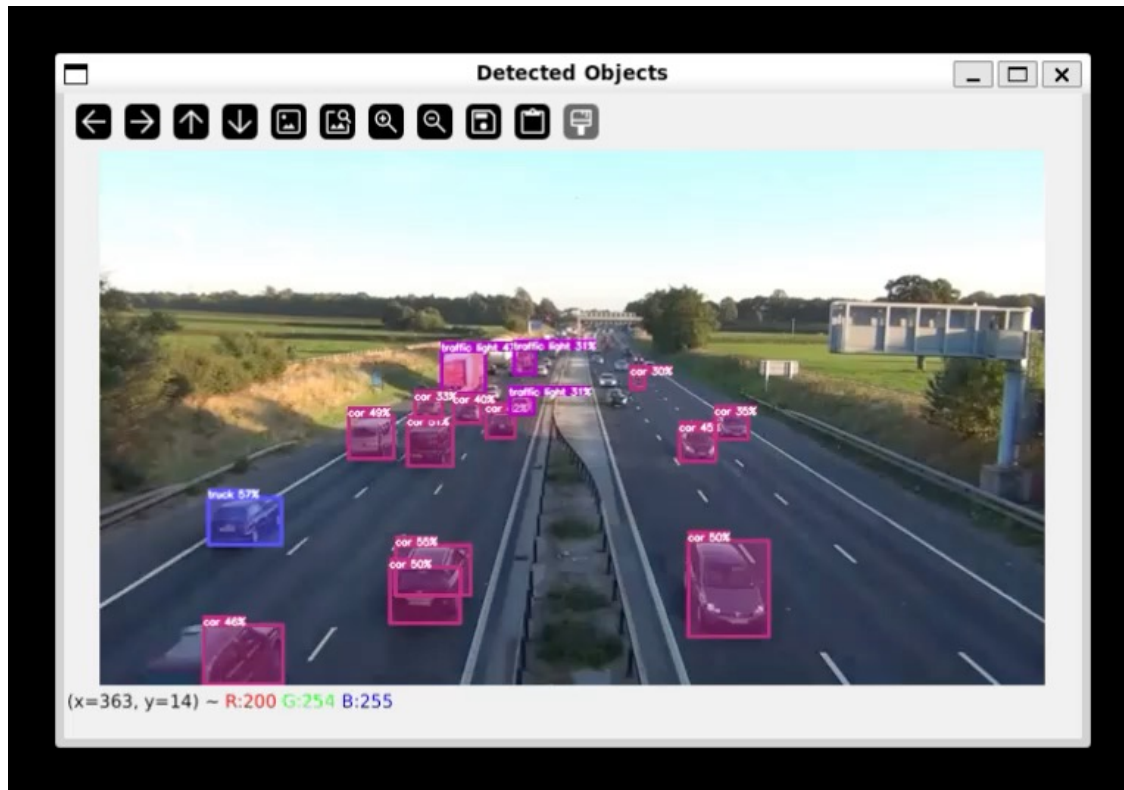
Time taken:
66.27518916130066
(subsystem) (base) WO

- Time taken: 66.3 seconds
- 1.34x faster than real-time
- 74.6% of total duration

Raspberry Pi 5

- Time taken: 548.4 seconds
- 0.16x slower than real-time
- Takes 609% of total duration of video (i.e. 6x longer to process)
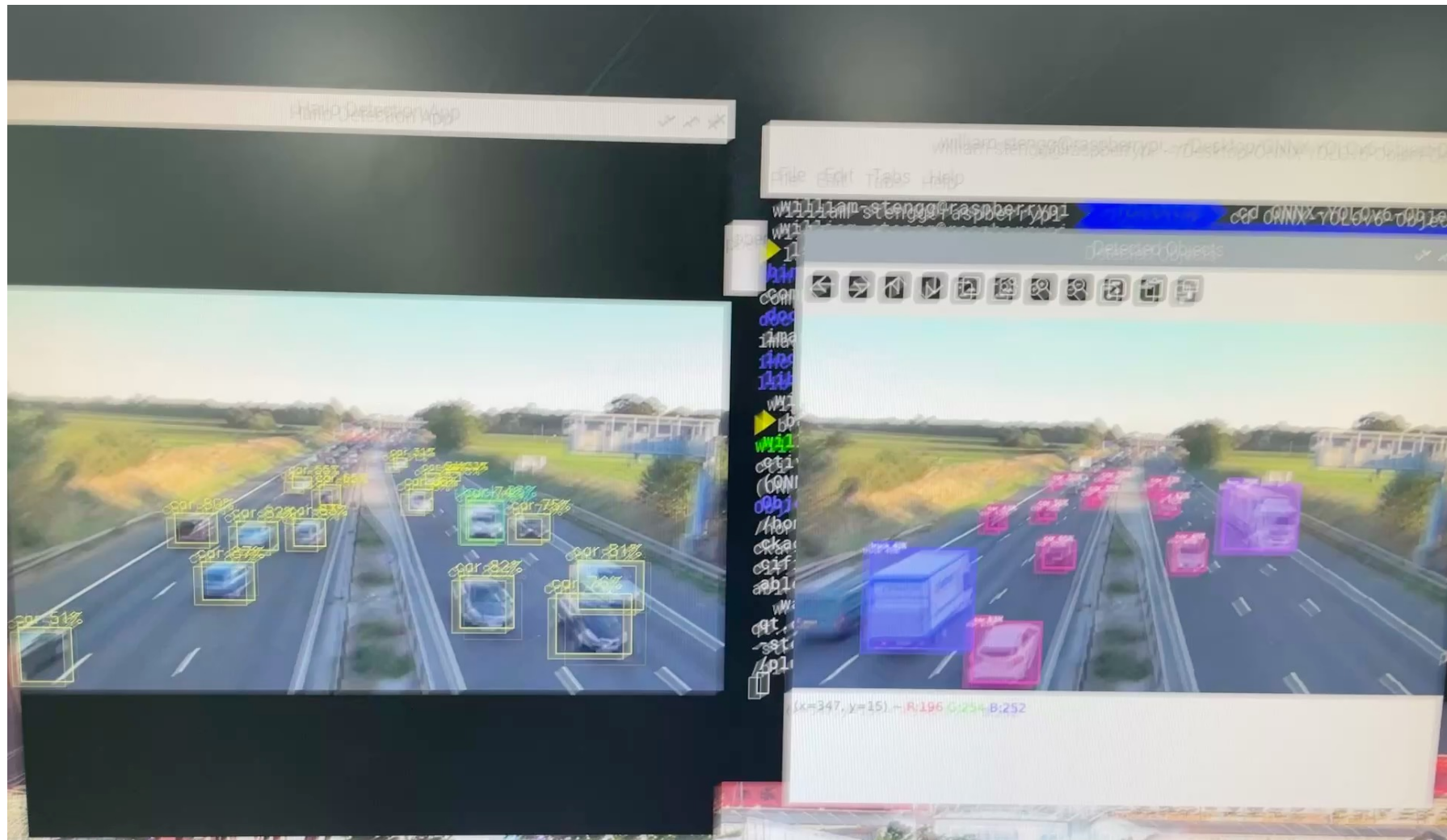

TIME TAKEN (SECONDS)
548.3938457965851

Raspberry Pi 5 + Hailo8

- Time taken: 90.55 seconds
- On-par with real-time

End-of-stream
TOTAL TIME TAKEN (SECONDS
90.55046367645264

RPi + Hailo8

RPi Only

Conclusion

- Hailo8 module performs sufficiently well for real-time traffic monitoring
- Much faster processing speed (on-par with video framerate of 25fps)
- Much lower cost and energy consumption compared to Desktop PC
- Performance is much closer to PC than regular RPi
- Some concerns
  - Measuring Accuracy
  - Measuring Latency
  - Most suitable/specific model to use other than basic object detection
  - How to derive useful data from this (for e.g. speed estimation, counting, etc.)
  - Limit testing the Hailo8