Real-Time Object Detection and Multi-Object Tracking for Autonomous Vehicle

Final Dissertation System Audit

Date: 2025-12-27

Hardware: Tesla T4

1. MODEL & TRAINING CONFIGURATION

Architecture	: YOLOv8n (Nano)
Total Parameters	: 3,012,408
Training Epochs	: 50
Batch Size	: 16
Optimizer	: auto
Initial Learning Rate	: 0.01
Input Resolution	: 640x640 px

2. DATASET INFORMATION

Dataset Name	: KITTI Vision Benchmark Suite
Source URL	: https://github.com/ultralytics/assets/releases/download/v0.0.0/kitti.zip
More details about KITTI	: http://www.cvlibs.net/datasets/kitti/
Training Samples	: 5985
Validation Samples	: 1496

3. LEARNING DYNAMICS (Validation)

mAP @ 50% IoU	: 0.8394
mAP @ 50-95% IoU	: 0.5935
Precision	: 0.8407
Recall	: 0.7829

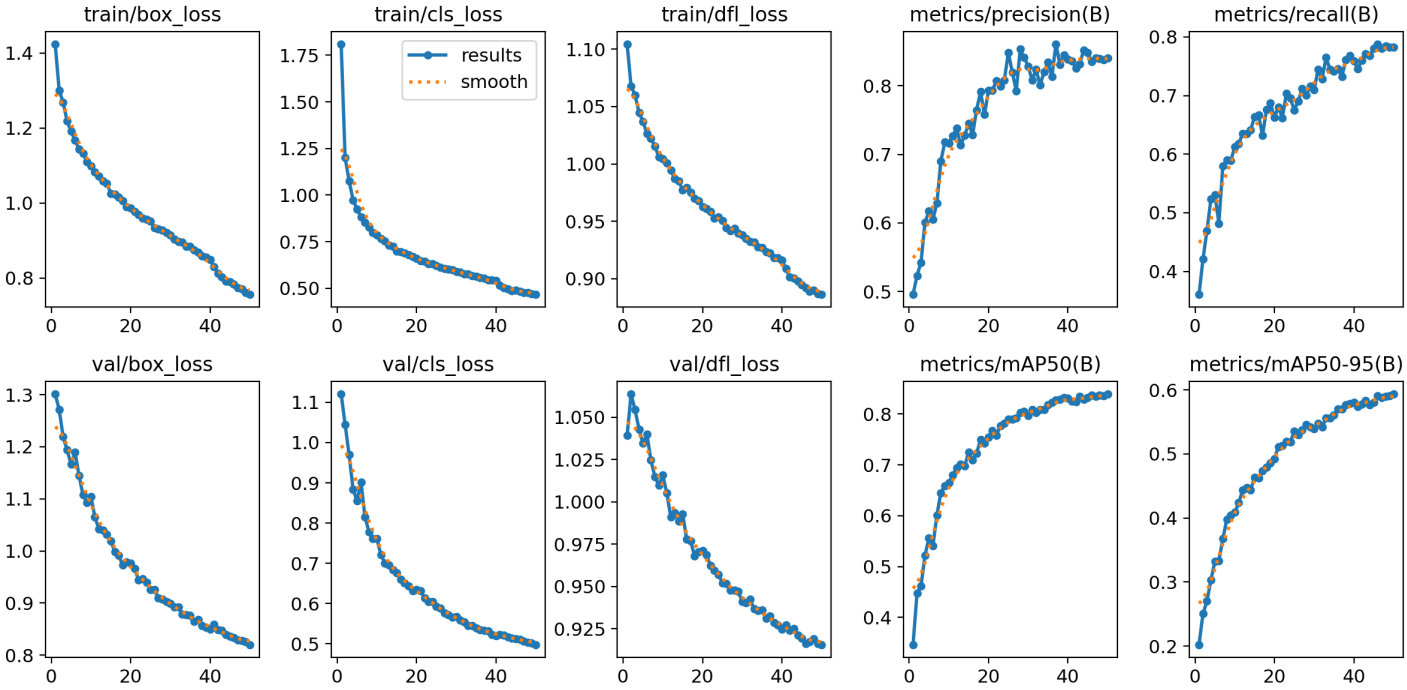
4. OPERATIONAL LATENCY

Average FPS	: 62.41 Hz
Mean Latency	: 16.02 ms
P95 Latency (Jitter)	: 37.92 ms

5. DEPLOYMENT ARTIFACTS

PyTorch (.pt)	: 5.93 MB
ONNX (Universal)	: 11.79 MB
TFLite (Edge)	: 11.72 MB
Interface	: Flask Web App + Ngrok Tunnel

6. Training Convergence Graphs

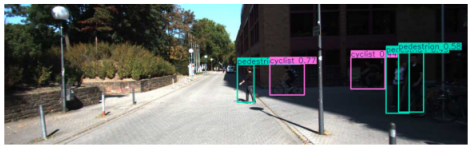


7. Qualitative Analysis

Qualitative Analysis: YOLOv8n on KITTI

Sample: 004312.png

Sample: 004389.png



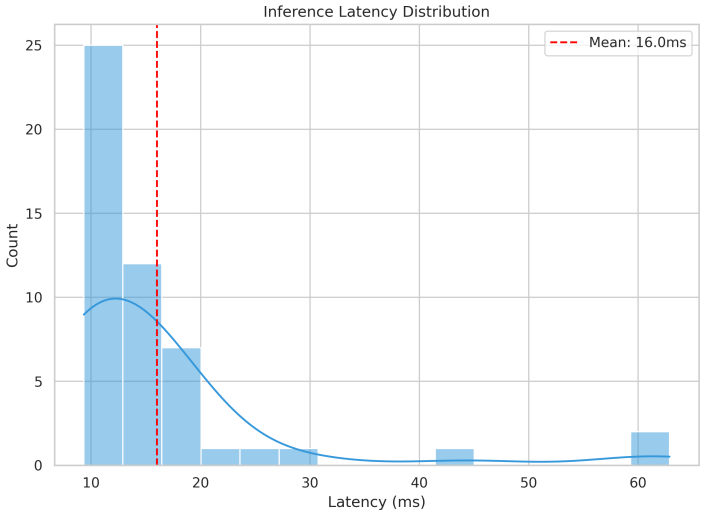
Sample: 000440.png

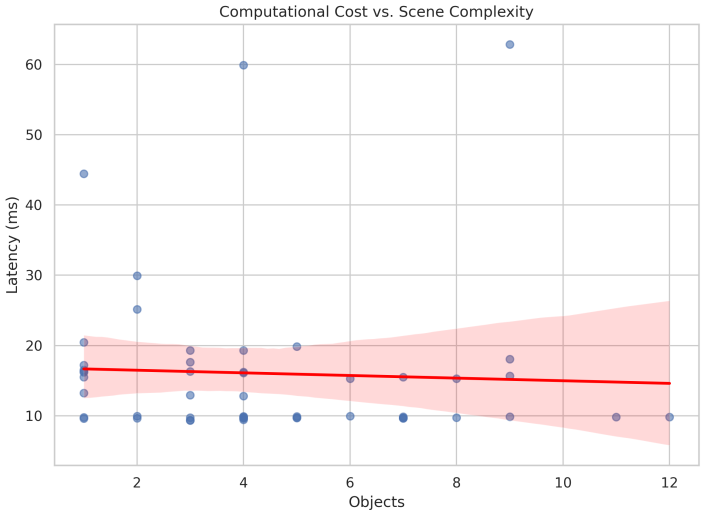
Sample: 006628.png

Sample: 000967.png

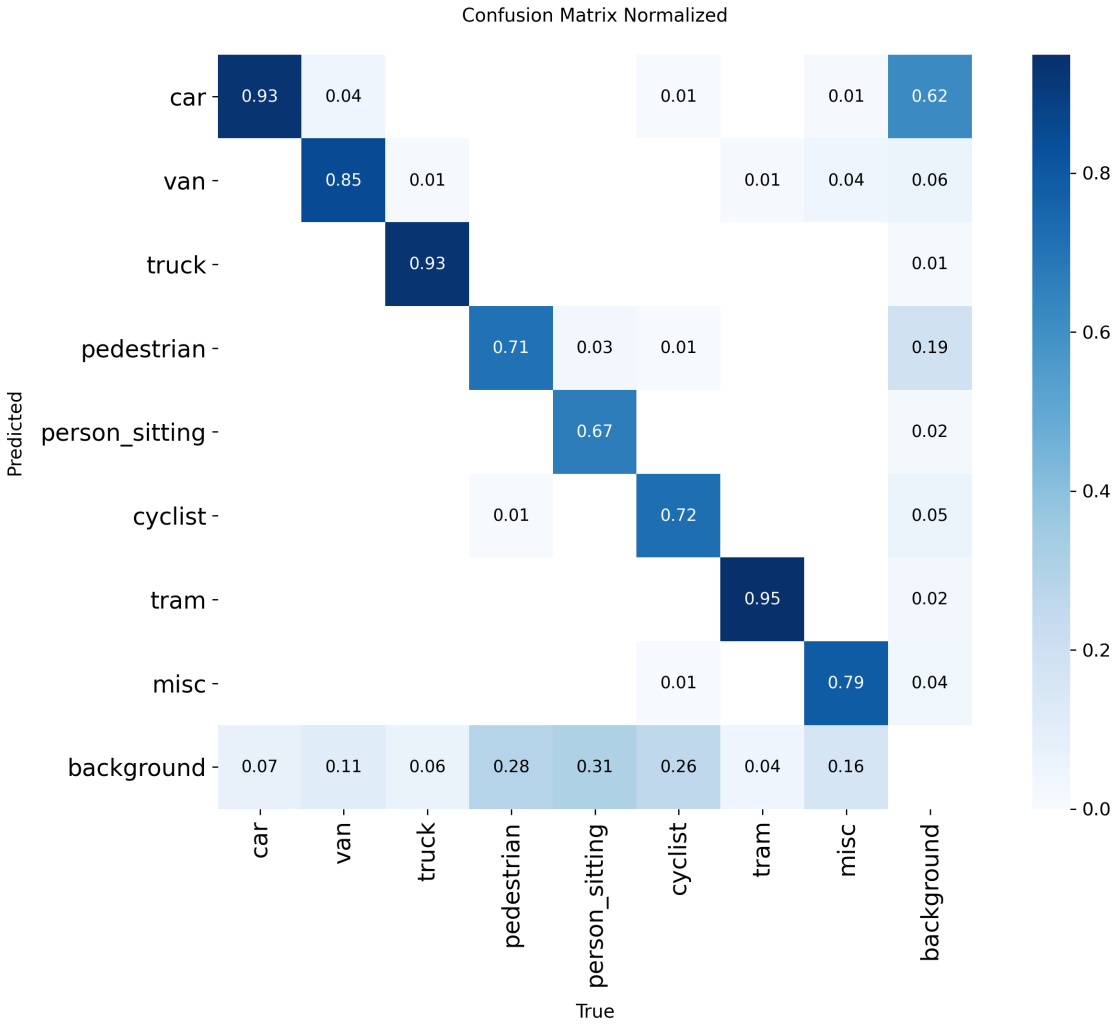
Sample: 004514.png

8. Latency Distribution Profile





9. Confusion Matrix



10. Artifact Size Comparison