ALY 6980: INDIVIDUAL PROPOSAL

Week 6:

Proposal for YOLO v9 Implementation to Track Vehicle Count and Enhance Transit Signal Priority in Intelligent Transport Systems Using Big Data Techniques

Submitted To:
Prof. Chinthaka Pathum Dinesh Herath Gedara, Faculty Lecturer

Submitted By:
Abhilash Dikshit

Academic Term: Winter 2024
Northeastern University, Vancouver, BC,Canada
Master of Professional Studies in Analytics

March 12, 2024

Proposal for YOLO v9 Implementation to Track Vehicle Count and Enhance Transit Signal Priority in Intelligent Transport Systems Using Big Data Techniques

I. Introduction:

The project aims to implement YOLO v9, an advanced AI-powered system, to track vehicle count and enhance transit signal priority (TSP) in intelligent transport systems. The rationale behind this project is to address the limitations of existing TSP systems by leveraging state-of-the-art deep learning techniques and big data analytics.

II. Background:

Current TSP systems often suffer from low accuracy and inability to adapt to changing traffic conditions. These limitations result in increased travel times, reduced productivity, and higher emissions. YOLO v9 seeks to overcome these challenges by utilizing real-time video feeds from traffic cameras and sensor data to provide accurate and timely traffic predictions.

III. Quantitative and Qualitative Data:

The project will use traffic image data from Roboflow to implement YOLOv9. The analysis will focus on measuring accuracy, precision, recall, and F1 score of the vehicle detection model. Moreover, the system will work towards improving these metrics through iterative model refinement and optimization.

IV. Plan to Use V2X Technology to Address Traffic Congestion:

The project will integrate YOLO v9 with vehicle-to-everything (V2X) technology to address traffic congestion. By leveraging real-time data from vehicles, infrastructure, and traffic management systems, the proposed solution will optimize traffic signal timings, prioritize transit vehicles, and reduce congestion at intersections.

V. Placeholder Proposal Paper Sections:

1. Abstract: A concise summary of the project objectives, methodology, and expected outcomes.

2. Literature Review: Review of existing literature on TSP systems, deep learning, and big data analytics in transportation.

3. Methodology: Detailed explanation of data collection, preprocessing, model development, and evaluation methods.

4. Results: Presentation and analysis of results obtained from implementing YOLO v9 for vehicle tracking and TSP optimization.

5. Discussion: Interpretation of findings, implications for intelligent transport systems, and potential future research directions.

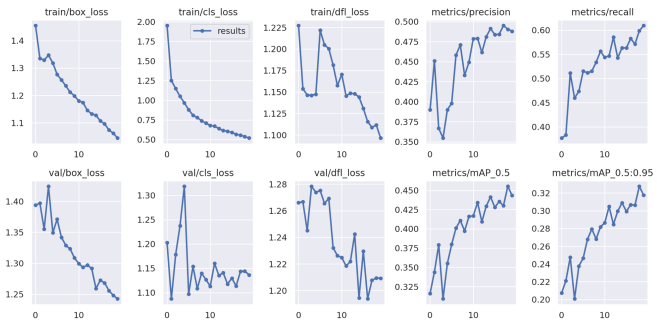
VI. Analysis Approach and Overall Goal:

The project will analyze the speed and count of vehicles to calculate distance and time, enabling predictive modeling of traffic signals at intersections. By grouping intersections into clusters and employing reinforcement learning techniques, the system will address anomalies and optimize traffic flow in real-time.

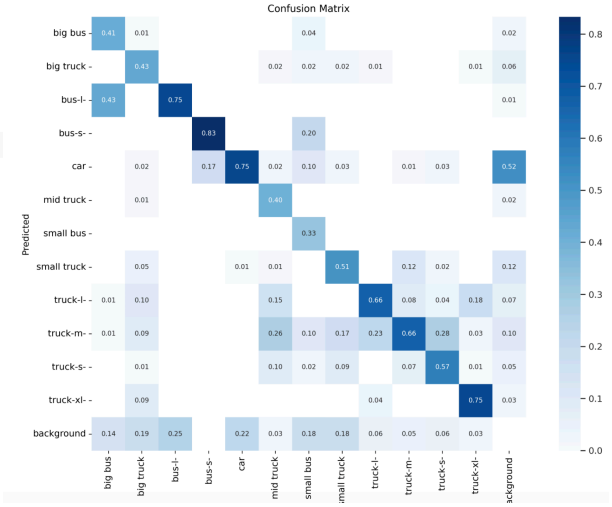
```
!python train.py \
--batch 16 --epochs 20 --img 640 --device 0 --min-items 0 --close-mosaic 15 \
--data {dataset.location}/data.yaml \
--weights weights/gelan-c.pt \
--cfg models/detect/gelan-c.yaml \
--hyp hyp.scratch-high.yaml
```

```
      15/19      14.2G      1.107     0.5894      1.131        110        640: 100% 165/165 [02:09<00:00,  1.28it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 31/31 [00:23<00:00,  1.30it/s]
                   all        966      13450      0.484      0.563      0.428      0.299

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      16/19      14.2G      1.096     0.5671      1.116         93        640: 100% 165/165 [02:08<00:00,  1.28it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 31/31 [00:23<00:00,  1.30it/s]
                   all        966      13450      0.484      0.582      0.436      0.307

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      17/19      14.2G      1.074     0.5552      1.109        112        640: 100% 165/165 [02:08<00:00,  1.28it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 31/31 [00:23<00:00,  1.30it/s]
                   all        966      13450      0.495      0.571       0.43      0.306

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      18/19      14.2G      1.062     0.5386      1.112        109        640: 100% 165/165 [02:08<00:00,  1.28it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 31/31 [00:23<00:00,  1.31it/s]
                   all        966      13450      0.491      0.598      0.455      0.328

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      19/19      14.2G      1.045     0.5189      1.096        104        640: 100% 165/165 [02:09<00:00,  1.28it/s]
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 31/31 [00:23<00:00,  1.30it/s]
                   all        966      13450      0.488      0.609      0.443      0.318

20 epochs completed in 0.878 hours.
Optimizer stripped from runs/train/exp/weights/last.pt, saved as runs/train/exp/weights/last_striped.pt, 51.5MB
Optimizer stripped from runs/train/exp/weights/best.pt, saved as runs/train/exp/weights/best_striped.pt, 51.5MB

Validating runs/train/exp/weights/best.pt...
Fusing layers...
gelan-c summary: 467 layers, 25420212 parameters, 0 gradients, 102.5 GFLOPs
                 Class     Images  Instances          P          R      mAP50   mAP50-95: 100% 31/31 [00:31<00:00,  1.00s/it]
                   all        966      13450      0.493      0.596      0.456      0.328
               big bus        966        273      0.758      0.413      0.757      0.567
             big truck        966       1162      0.829      0.438      0.637      0.427
                bus-l-        966          8      0.045       0.75      0.047      0.023
                bus-s-        966         12      0.216      0.828      0.346      0.288
                   car        966       8537      0.863      0.728      0.837      0.532
             mid truck        966        257       0.69      0.424      0.431      0.337
             small bus        966         49       0.27      0.327      0.129     0.0689
           small truck        966       1721      0.732      0.516      0.624      0.411
              truck-l-        966        433      0.456      0.677      0.477      0.372
              truck-m-        966        629      0.361      0.688      0.374       0.29
              truck-s-        966        221      0.288      0.593      0.248      0.171
             truck-xl-        966        148      0.413      0.777       0.56      0.448
Results saved to runs/train/exp
```

```
Image(filename="/content/yolov9/runs/train/exp/results.png", width=1000)
```




```
filename="/content/yolov9/runs/train/exp/confusion_matrix.png", width=1000)
```




```
Image(filename="/content/yolov9/runs/train/exp/val_batch0_pred.jpg", width=1000)
```

VII. Conclusion:

The proposed YOLO v9 implementation offers a promising solution to enhance transit signal priority and improve traffic management in intelligent transport systems. By leveraging big data techniques and V2X technology, the project aims to revolutionize urban mobility, reduce congestion, and promote sustainable transportation solutions.

This draft proposal outlines the project's objectives, methodology, data analysis approach, and expected outcomes. It provides a framework for further development and refinement in preparation for submission as a full proposal.

VIII. Code File:

Google Colab Link for code