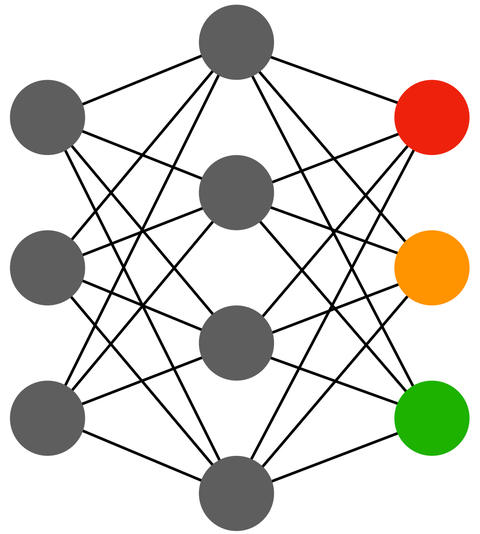
AI-TMS

Artificially-Intelligent Traffic Management System



Samuel Arbibe

Introduction

This system is based on performing simulations that represents real-time activity in a realistic manner on a particular segment, running different computational algorithms, generating data and finding an optimal operation policy for each node or system as complex as it may be.

In order to do the above, A Genetic-algorithm is applied on Neural networks that each control a simulation of a particular traffic system.

The Objective

The transportation systems used by transportation agencies around the world are not adapted to modern transport.

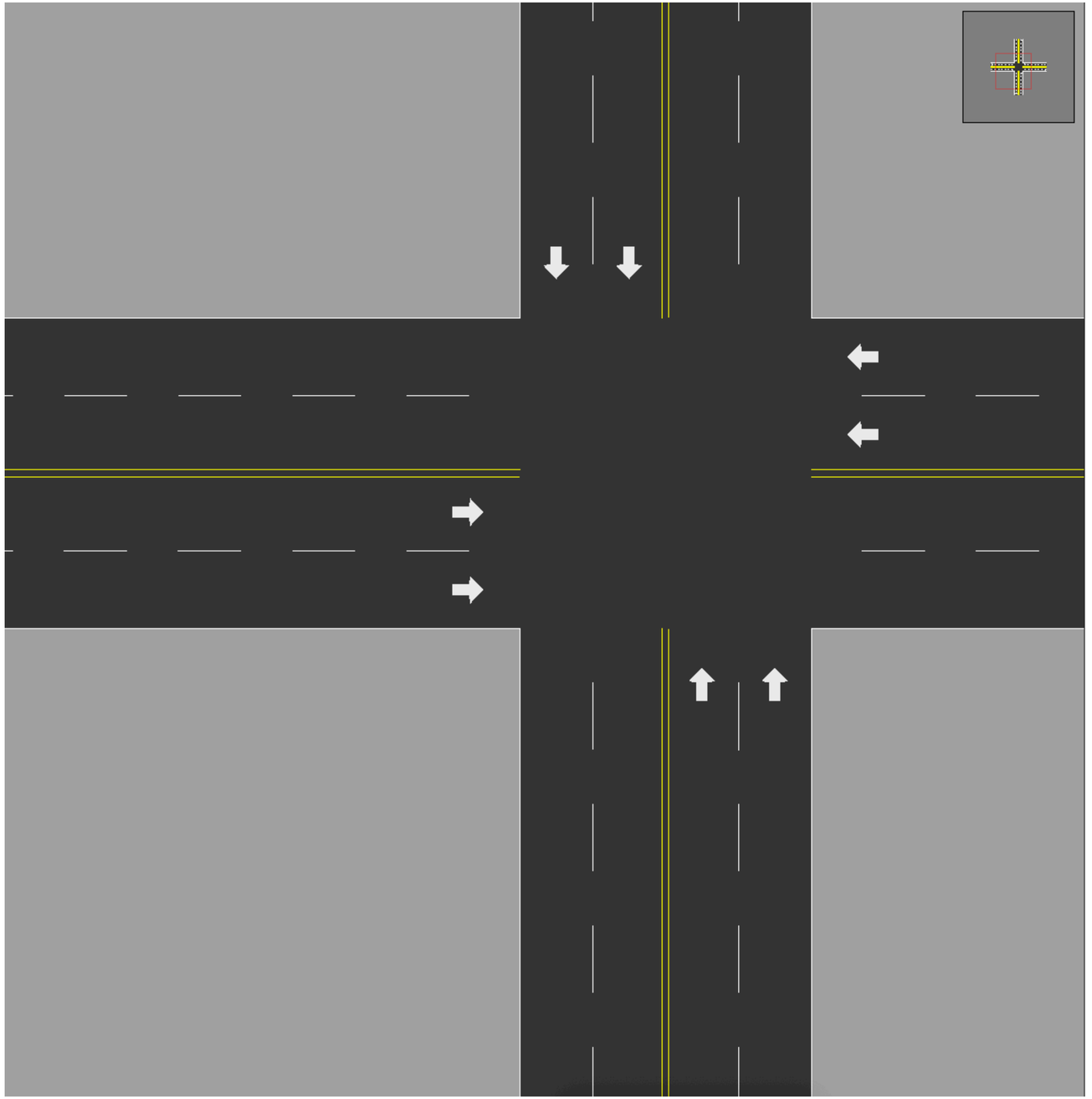
Today, innovative transportation management technologies are being used in some countries, but most of these rely on expensive infrastructures.

The objective of this system is to manage traffic systems in an efficient and adaptive manner, while staying modern and intuitive.

Functionality Summary

- Create, save and load advanced traffic systems in an intuitive manner.
- Customise vehicle configurations (variable speeds for each vehicle type).
- Configure complex traffic systems (multiple phase-cycles, traffic paths).
- View live simulation of the traffic in real time or accelerated (up to x256).
- Preconfigure and Train the Genetic-Algorithm, visualise results using a graph.
- View changes to the neural network in real time.
- Save / Load a trained Neural-Network.

Create, save and load advanced traffic systems in an intuitive manner.



MainWindow

Setup

Map | Phases | Traffic

X Position: [ ] Y Position: [ ] Add Intersection

From Intersection: 1 To Intersection: 1 Add Connecting Road

Intersection: 1 Connection Side: Up Add Road

To Road: 1 ☐ Is In road Direction Add Lane

From Lane: 1 To Lane: 1 Add Route

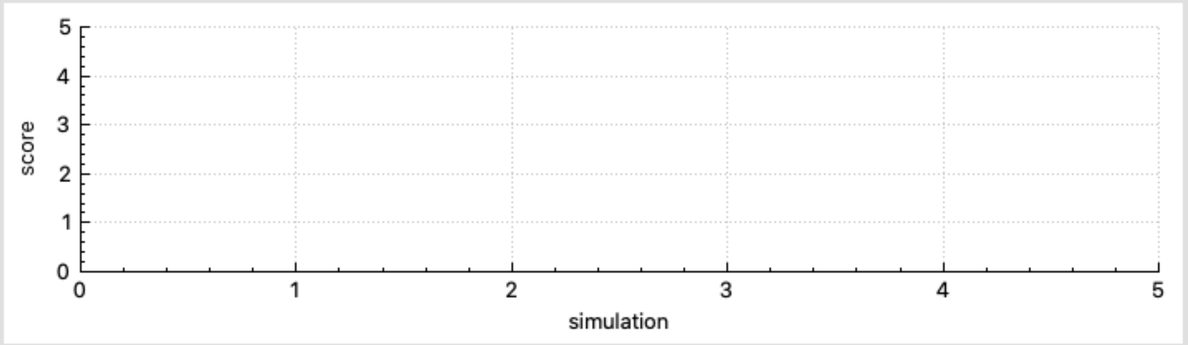
Lane Width: 3.45 m ☑ Snap To Grid ☐ Show Grid

Zoom: ☐ Show Neural Net ☐ Show Minimap ☐ Show Data Boxes

Load Map | Save Map | Reload | Delete | Reset

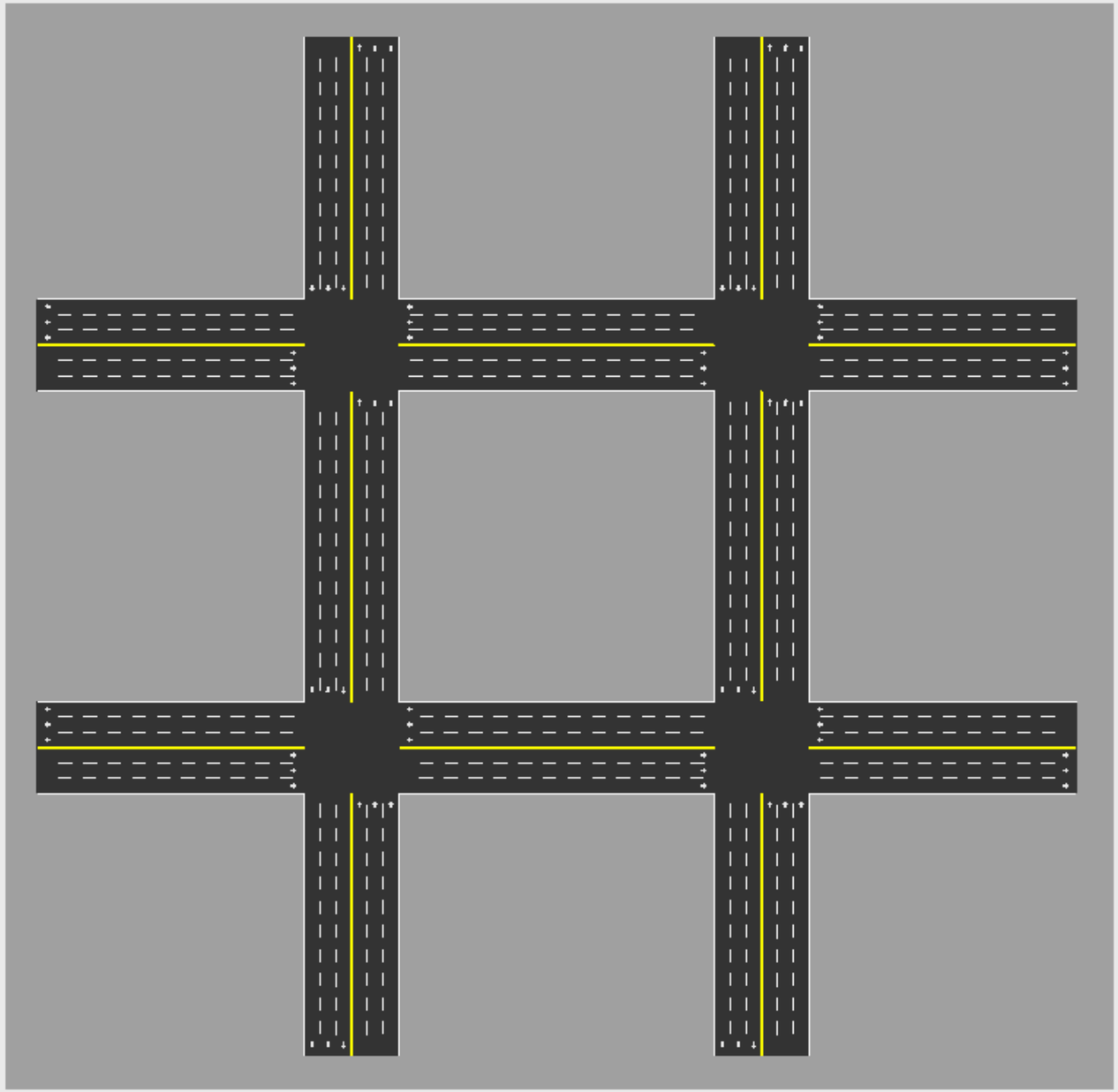
Data

Table | Graph



Run

Run Training Set | Run 50 Vehicles | For 3 Simulations ☐ Run Best Neural Net | Abort



Running speed: x1

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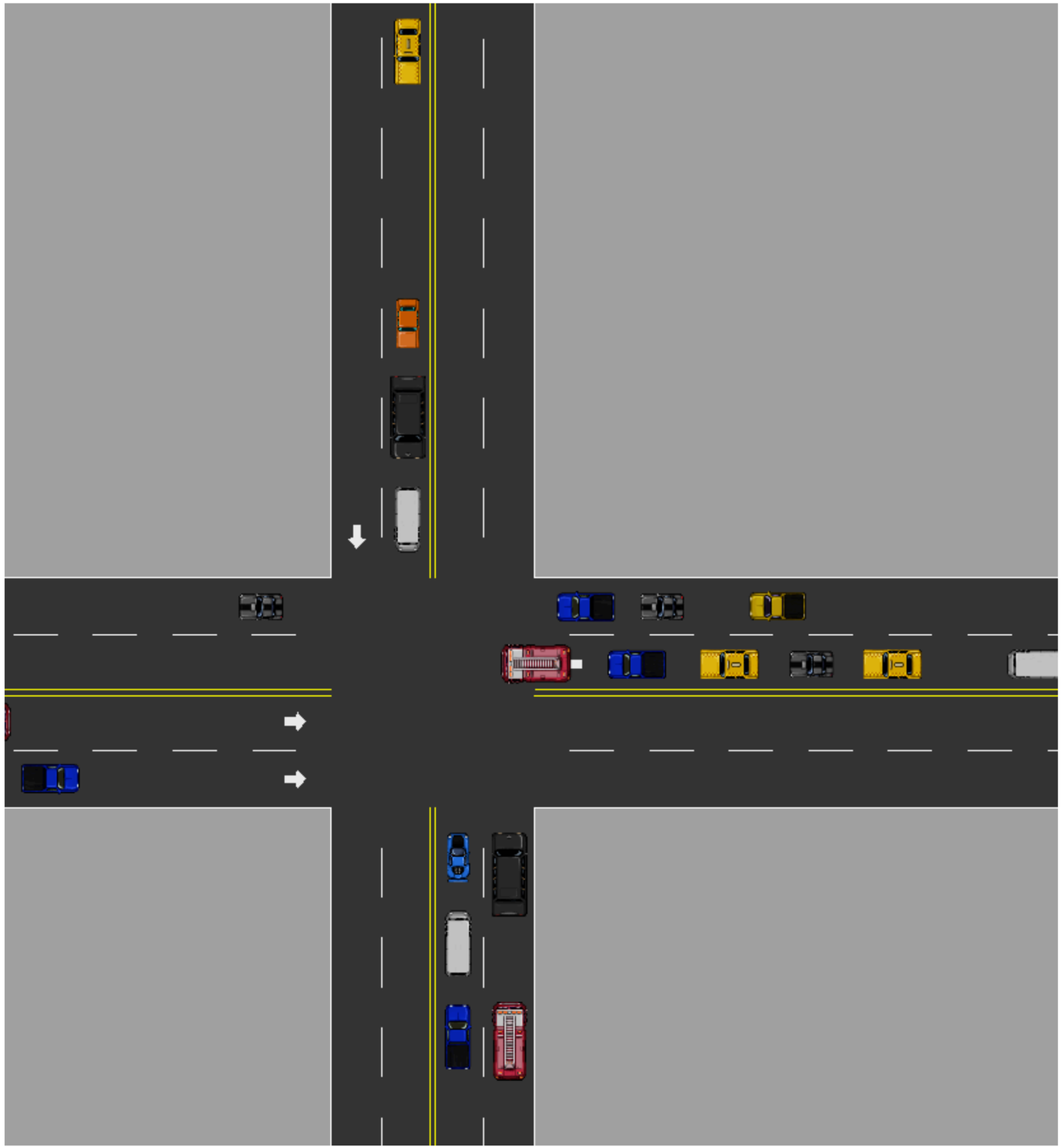
Customise vehicle configurations:

Variate max speeds for each vehicle type,
And configure vehicle spawn rate.



MainWindow

Setup

Map | Phases | Traffic

km/h

Small Car Max Speed	100
Medium Car Max Speed	125
Long Car Max Speed	140
Truck Max Speed	90

Vehicle Spawn Rate: 900 ms

☑ Draw Textures ☑ Multi Color ☑ Follow Selected Car

☐ Show Routes ☐ Show Lane Blocks ☐ Density Color

Data

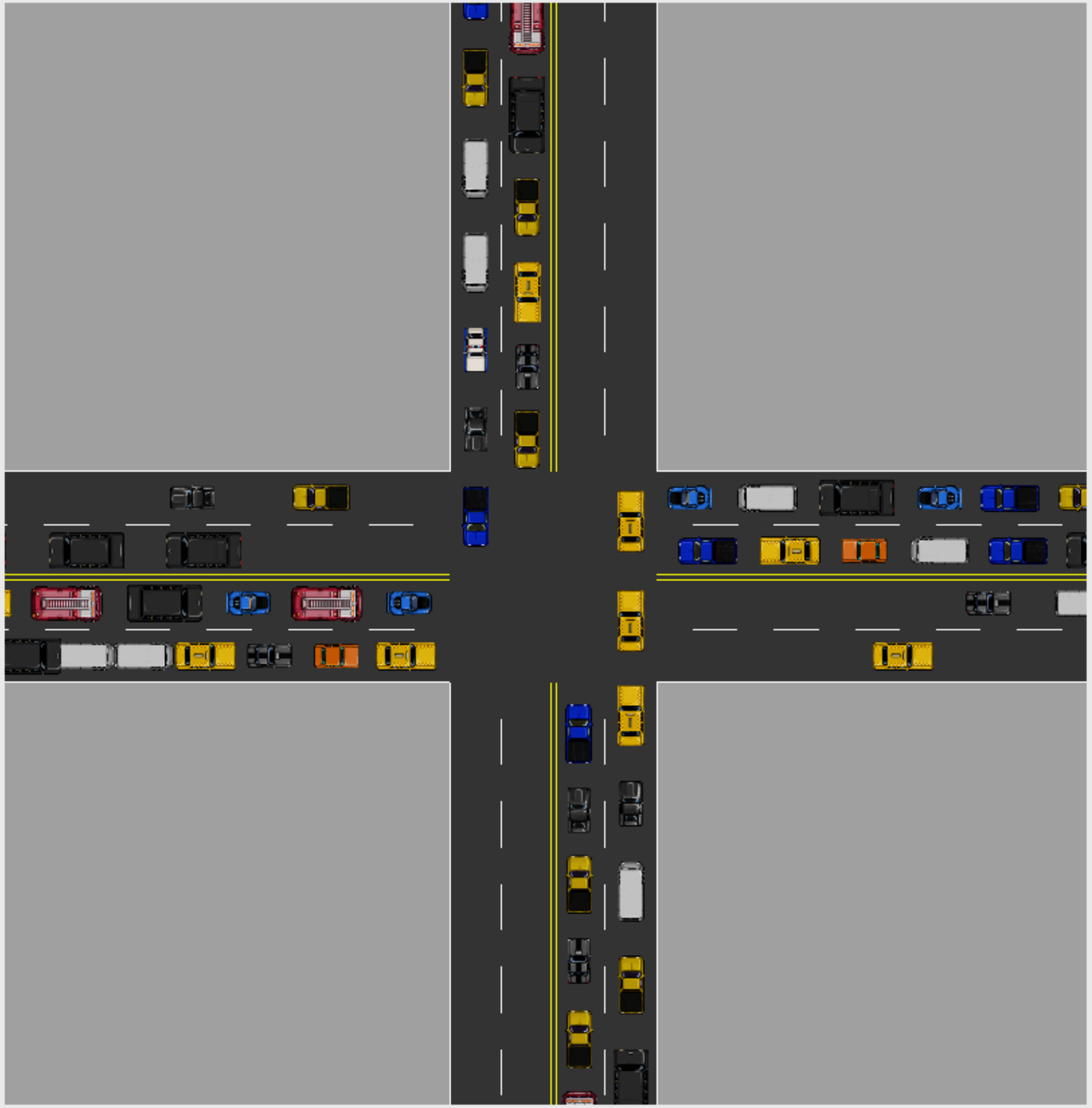
Table | Graph

Set	ID	Start Time	End Time	Simulated Time	Vehicle Count	Score
1	1	Mon May 18 ...	Mon May 18 ...	169.116	50	0.295654
1	2	Mon May 18 ...	Mon May 18 ...	176.601	50	0.283124
1	3	Mon May 18 ...	Mon May 18 ...	172.665	50	0.289578
2	4	Mon May 18 ...	Mon May 18 ...	1104.71	1000	0.905217
2	5	Mon May 18 ...	Mon May 18 ...	1051.11	1000	0.951376
2	6	Mon May 18 ...	Mon May 18 ...	1086.43	1000	0.920444

Load Set | Save Set | Save NN | Load NN ☐ Show Current Set Only | Demo | Delete

Run

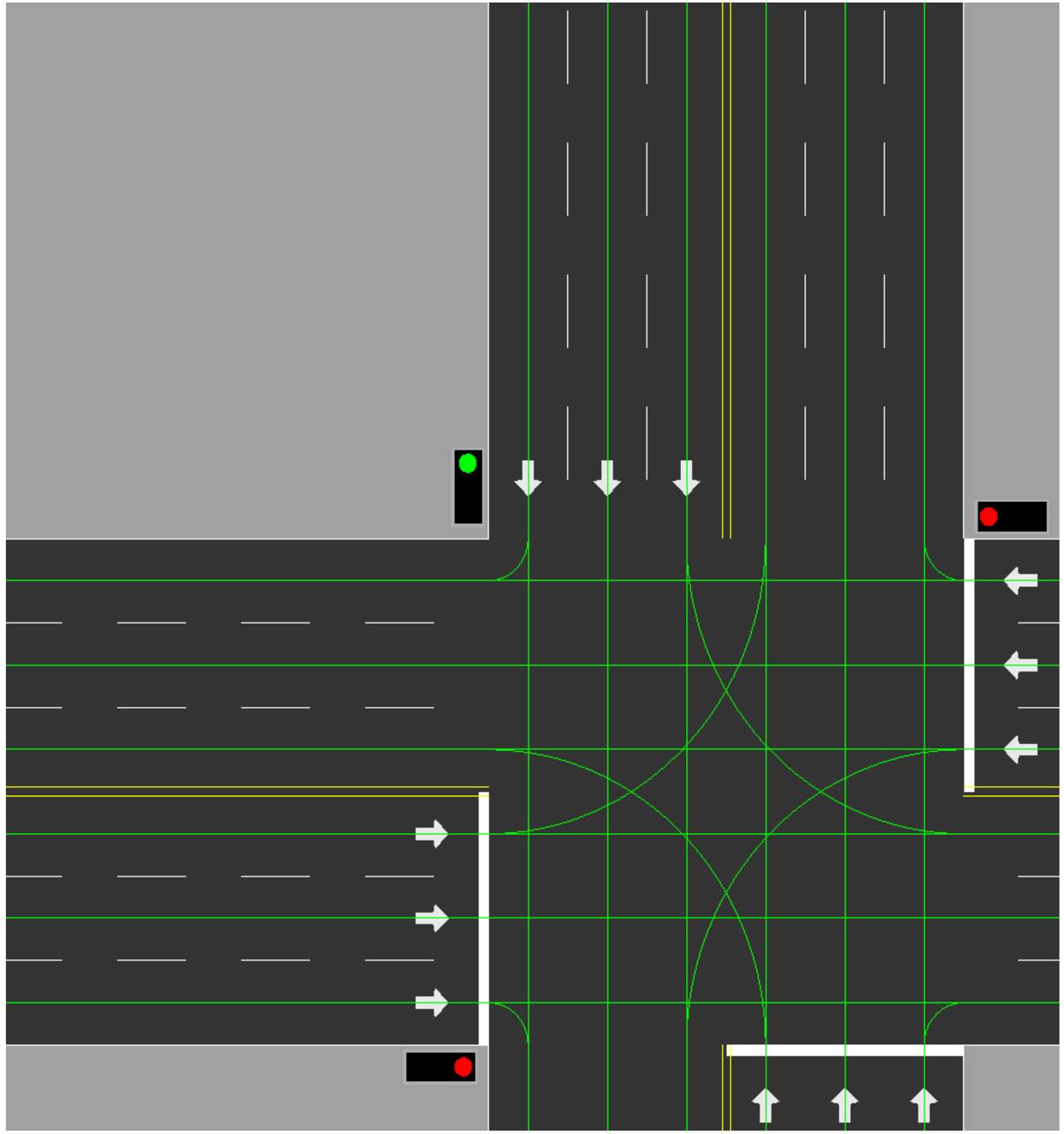
Run Training Set | Run 1000 Vehicles | For 3 Simulations ☐ Run Best Neural Net | Abort



Paused. << > >>

Configure complex traffic systems:

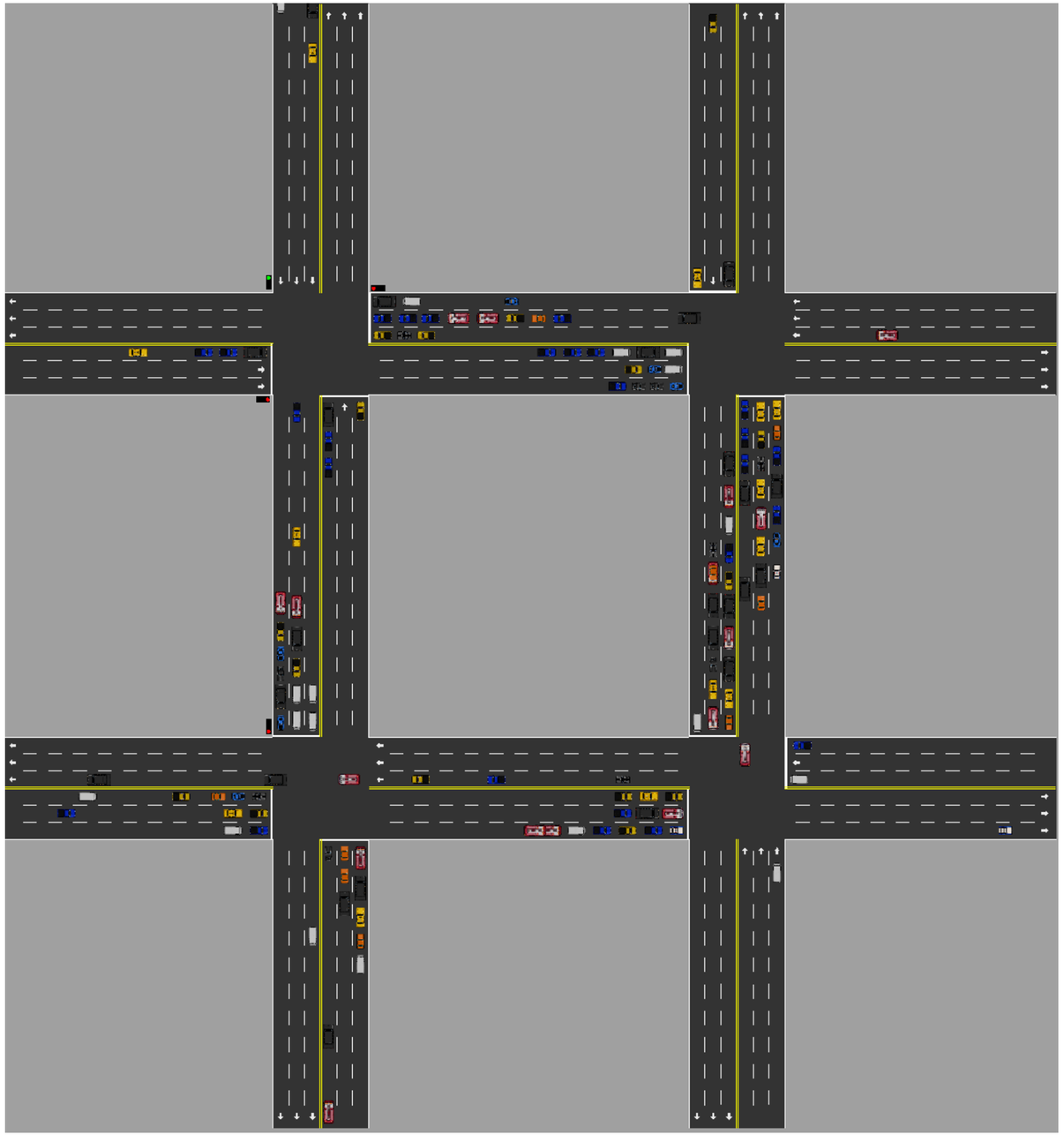
Multiple phase-cycles
And custom traffic paths.

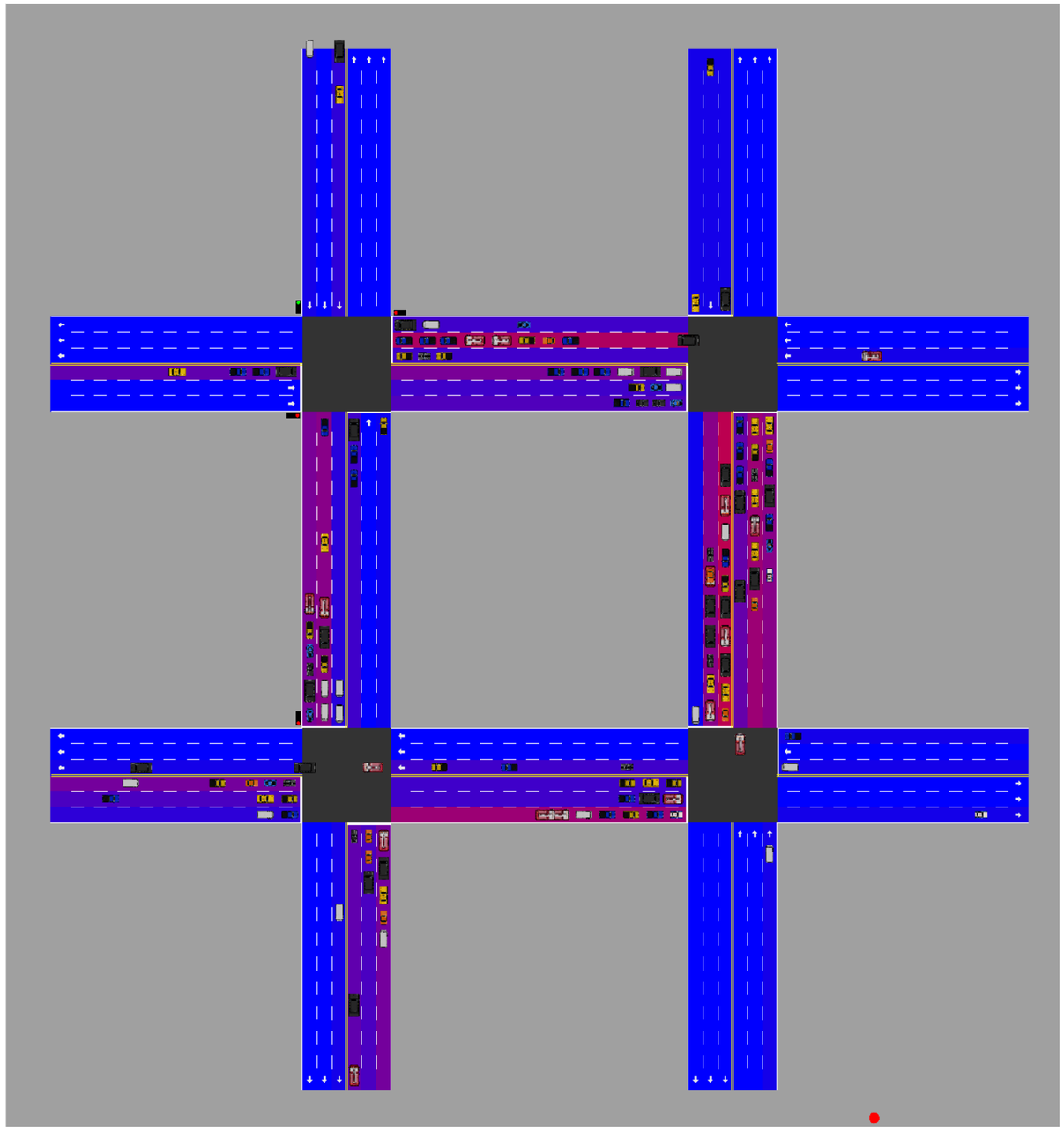


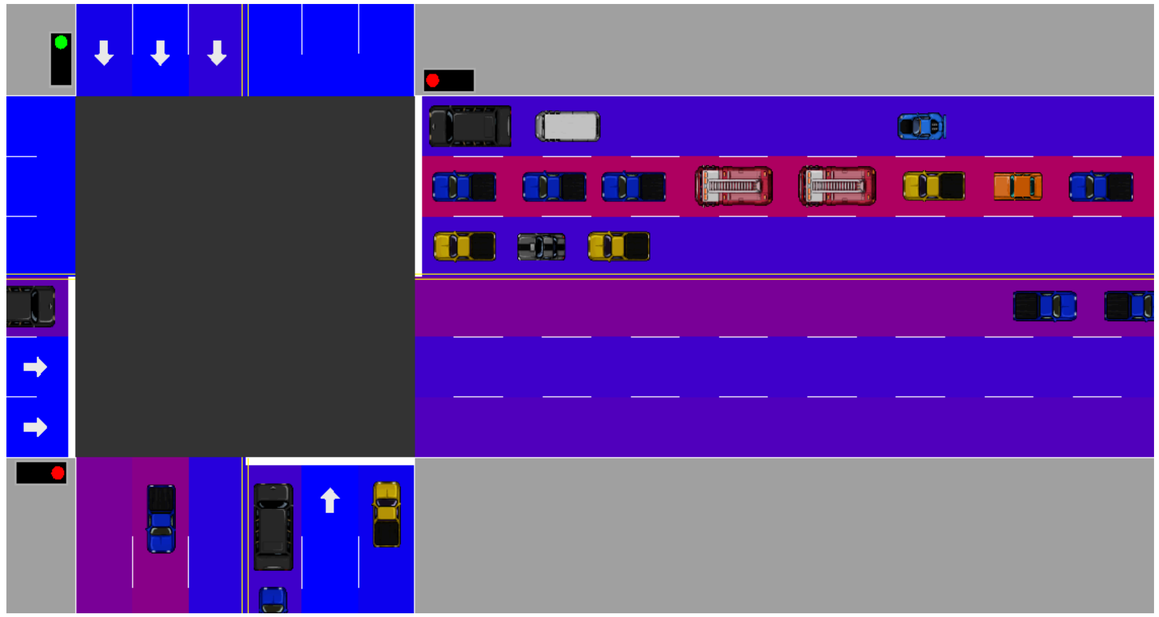
View live simulation of the traffic in real time or accelerated (up to x256).

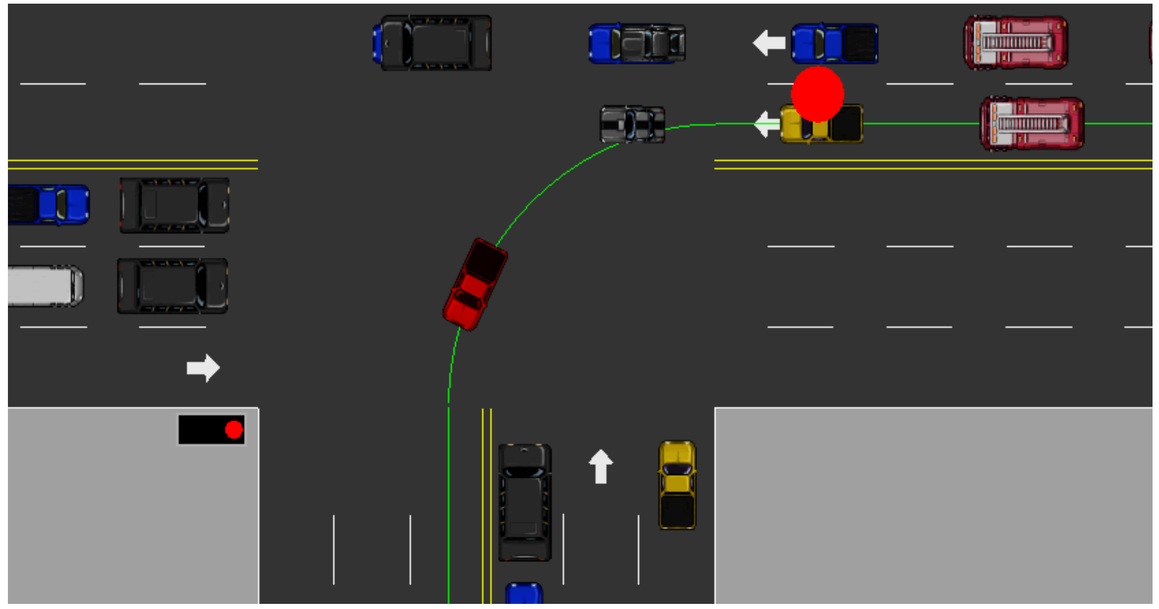
Apply different visualisations:

- **Lane density**
- **Road blocks**
- **Traffic lights**
- **Camera Follow**



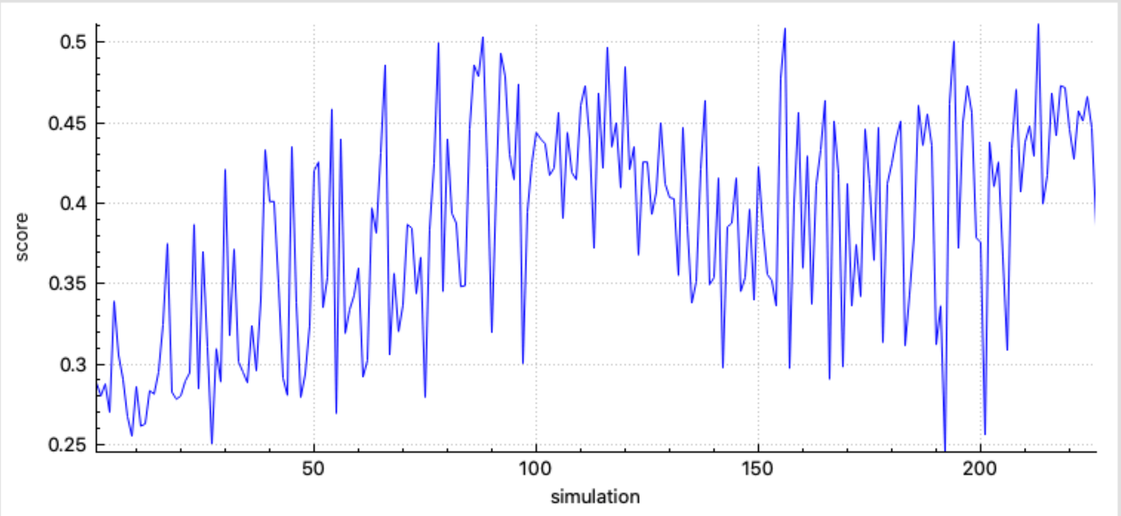






Preconfigure and Train the Genetic-Algorithm.

Visualise results using a Graph or a Data table.



Run

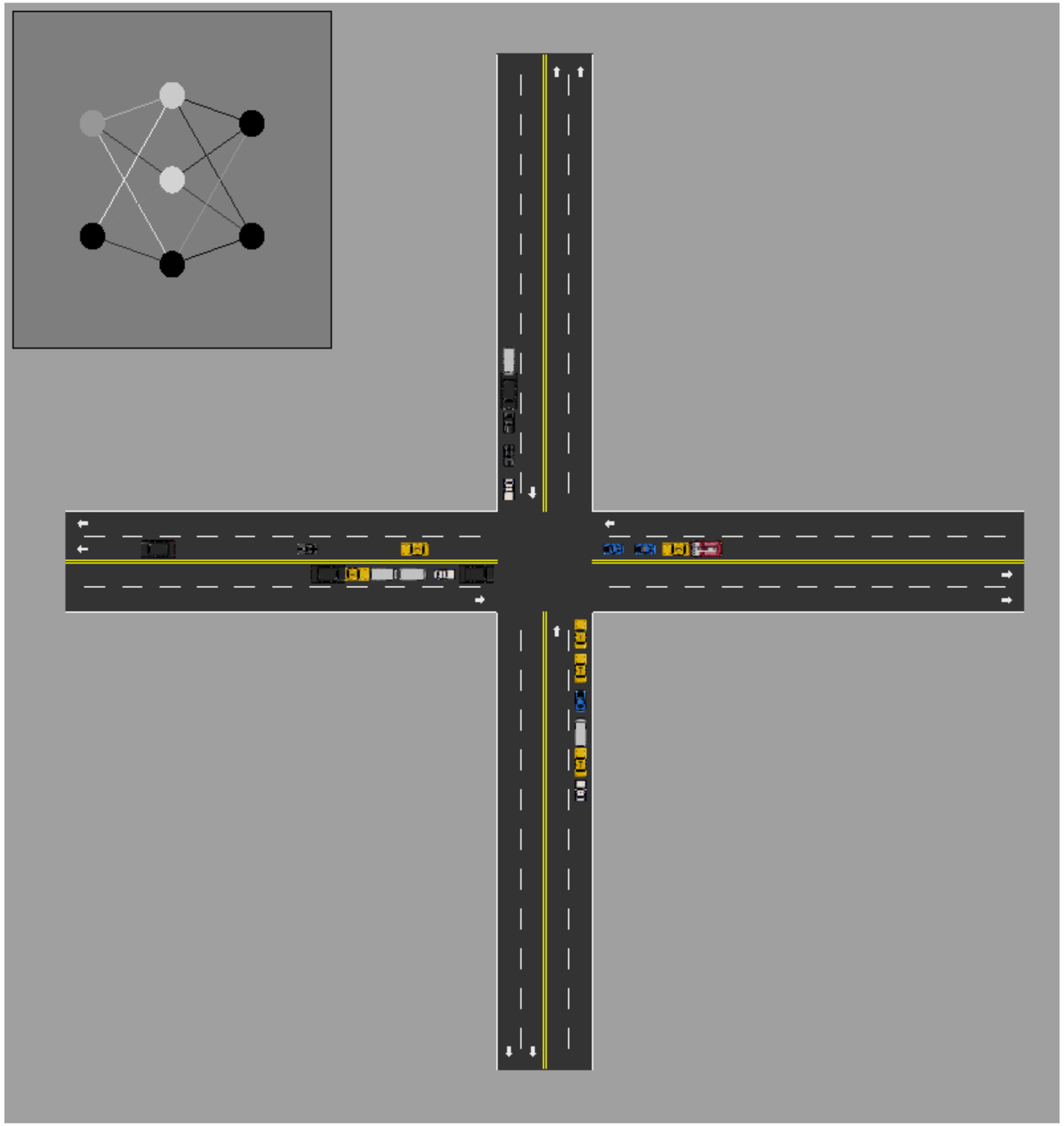
Run Training Set | Run 50 | Vehicles | For 1000 | Simulations | Run Best Neural Net | Abort

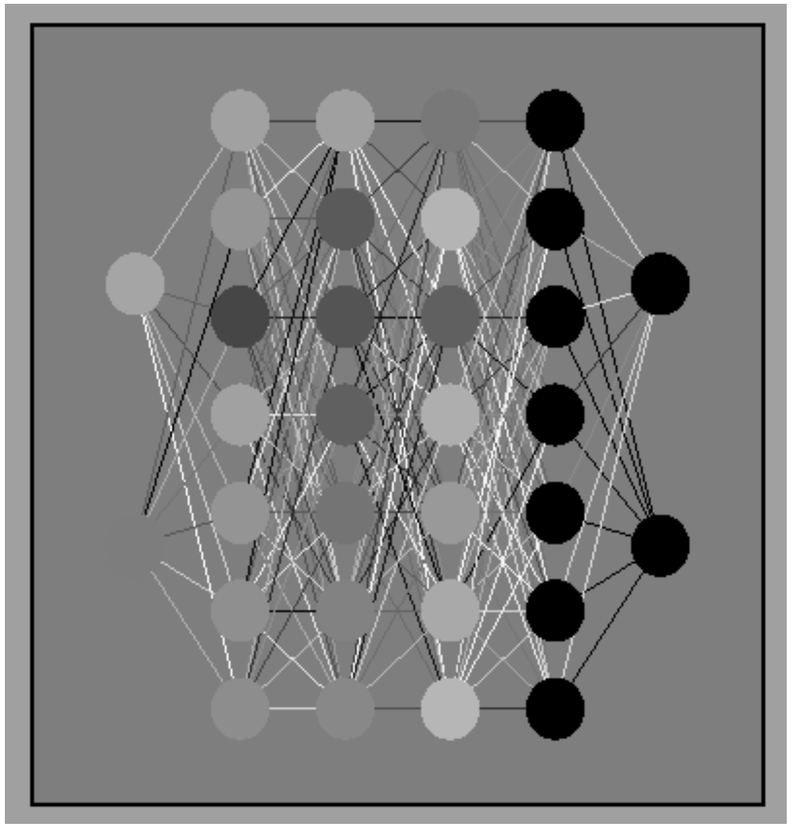
Set	ID	Start Time	End Time	Simulated Time	Vehicle Count	Score
1	218	Mon May 18 ...	Mon May 18 ...	105.728	50	0.472914
1	219	Mon May 18 ...	Mon May 18 ...	105.984	50	0.471771
1	220	Mon May 18 ...	Mon May 18 ...	112.127	50	0.445921
1	221	Mon May 18 ...	Mon May 18 ...	116.991	50	0.427382
1	222	Mon May 18 ...	Mon May 18 ...	109.312	50	0.457408
1	223	Mon May 18 ...	Mon May 18 ...	110.847	50	0.45107
1	224	Mon May 18 ...	Mon May 18 ...	107.264	50	0.466142
1	225	Mon May 18 ...	Mon May 18 ...	111.871	50	0.446941
1	226	Mon May 18 ...	Mon May 18 ...	129.535	50	0.385995

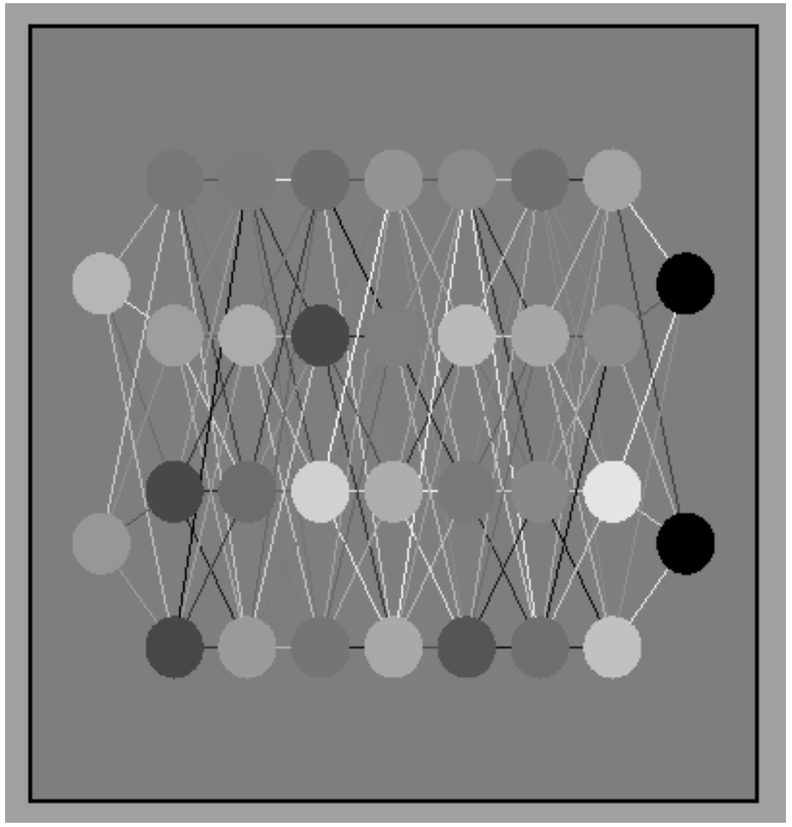
Load Set | Save Set | Save NN | Load NN | Show Current Set Only | Demo | Delete

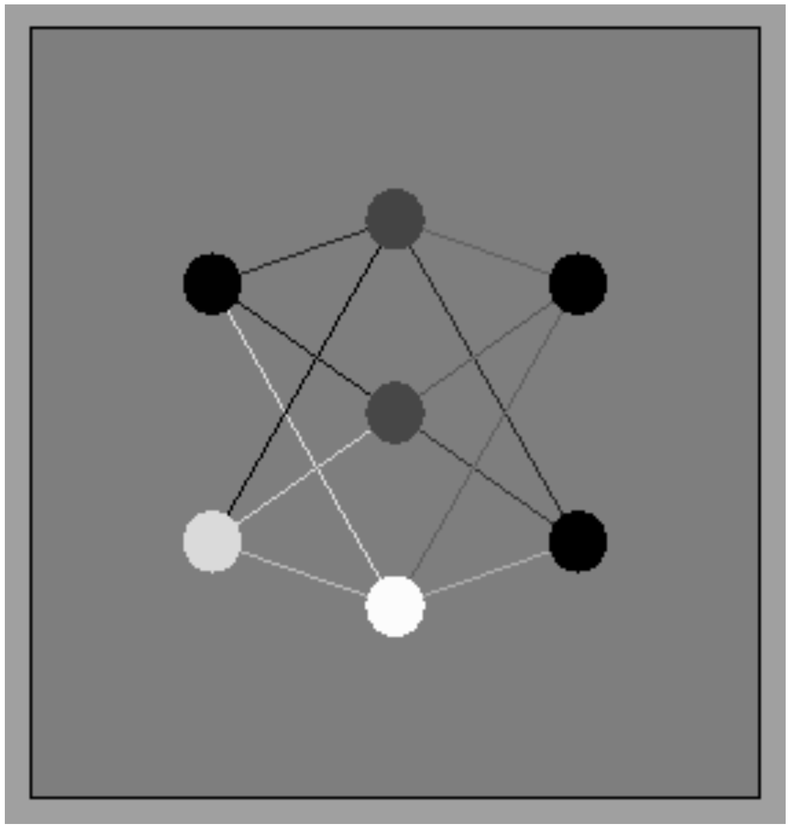
View changes to the Neural-Network in real time.

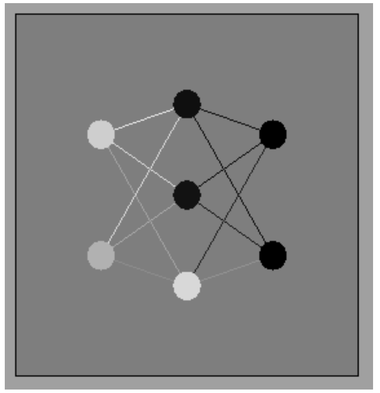
Save / Load a Trained Neural-Network.

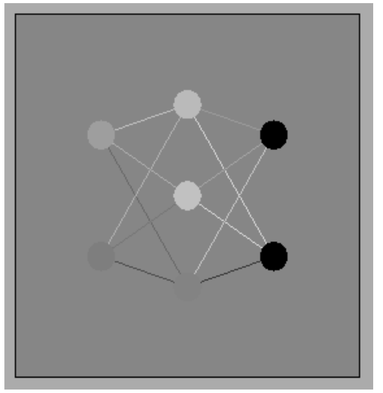












Up to **50%**

Increase in Traffic Flow using the AI-TMS system, compared to a conventional traffic management method.

Source Code - https://github.com/samuelarbibe/AI_TMS

Video Demonstration - https://www.youtube.com/watch?v=BLz_PdU2oyo

Video Explanation - https://github.com/samuelarbibe/AI_TMS

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