Intellisys - Project Report

12th July 2021

Progresses

1. Improved pipelines for data extraction and parsing:
    - updated function to calculate edges weights. Now the weights are given by a combination of the distance from the centre of the crossing and the mutual distance between the two vehicles, see Figure 1.

Figure 1: New edges

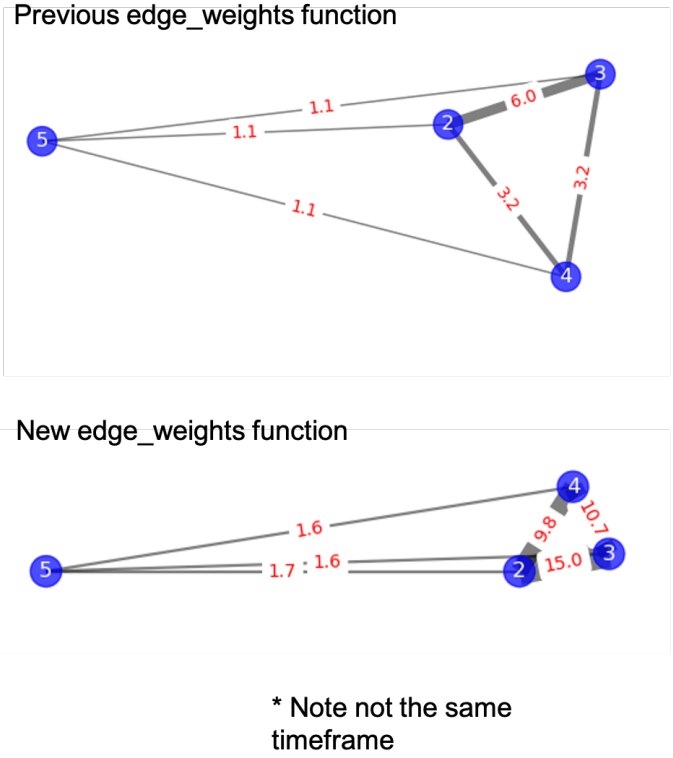
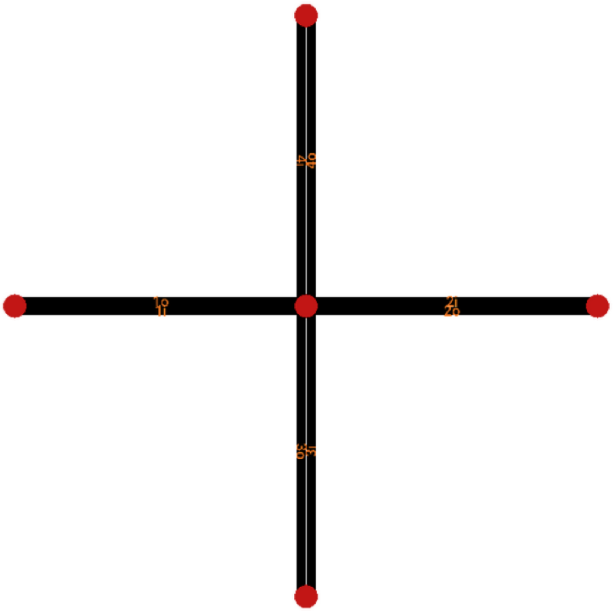


Figure 2: Simpler crossing



- Simplified the crossing see Fig 2.
- Fetched data from the new crossing, running simulations for 15000 time steps and 30000 time steps

2. Progress with the Pipeline for Training
    - Created register of collected data and training parameters, see Fig 8
    - Completed the Training pipeline: Data loading, Training, Validation and Plotting
    - Implemented combination of parameters as input to training (for more extensive exploring of parameters space).
    - Trained several models with different architectures and parameters combination.

First outputs

Training stagnates after 30-40 epochs. Predictions (light blue dots) are not satisfying, and they present precise patterns: at times the predictions are all over one line, see Fig 5 and they move towards the centre of the crossing, see Fig 6 and Fig 7.

Figure 3: Initial training with lr =0.01

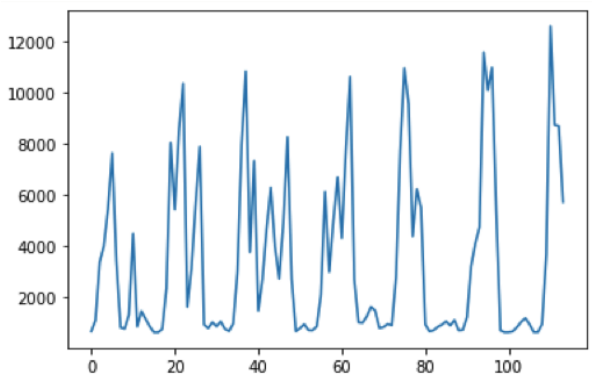


Figure 4: Improved training

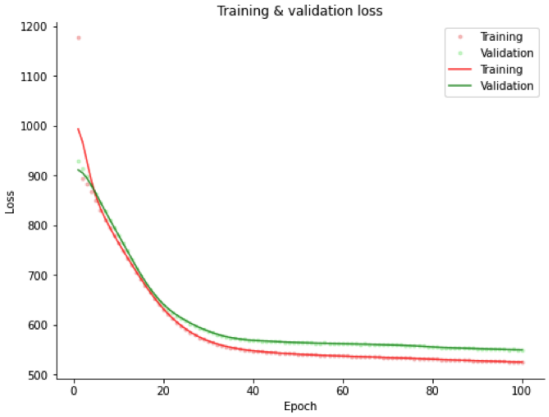


Figure 5

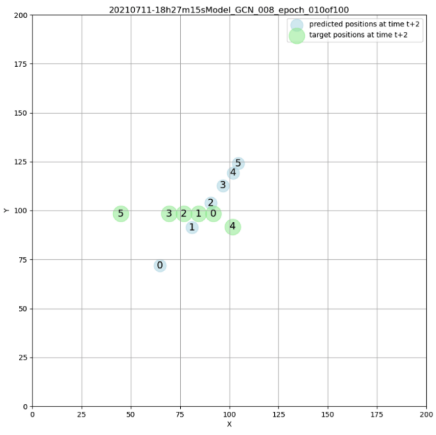


Figure 6

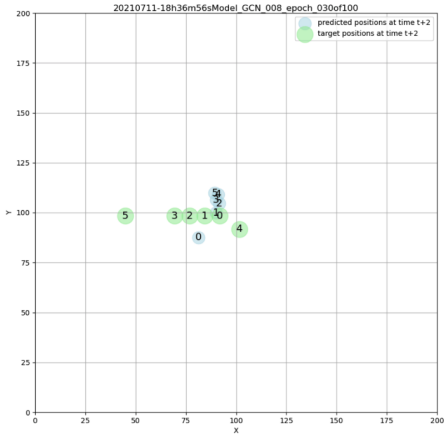
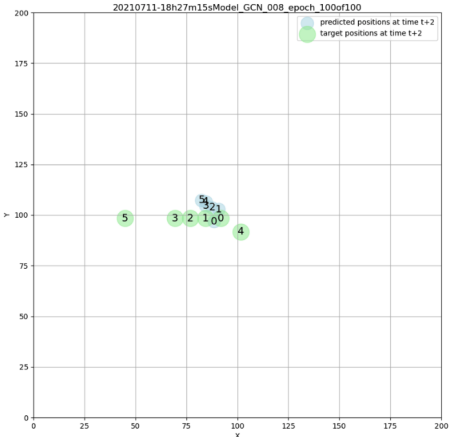


Figure 7



Next Steps

- Make the training work
  - Review input
  - Review architecture
  - More data?

Questions

- As we have been interpreting until now, the intention gives an idea on what is the final destination of the car, and currently it is one of four options (straight, left, right and U-turn) with respect to the initial position. An example in Fig **??**. Now can it be that the network is confused by this encoding?
  - Use identifiers of the road lanes for the intention instead of relative motion.
  - Shall we use the intention as from the last position in which the vehicle is seen in the sim or the intention in respect to the Δ t, in our case fixed to 2 seconds?
- Any other insight on why the models seem to be failing?
- GPU doesn't seem to be available, training on CPU is feasible, but of course it would be very nice to speed it up. Any idea how to check /fix?

Other images

Figure 8: Trainings register

	run_time	model	train_size	batch_size	Nepochs	exclude_yaw	size_input	size_output	model_architecture	criterion	optimizer	fin
0	17h55m10s	GCN_004	0.9	100	100	True	[(100, 5)]	[(100, 2)]	GCN(\n (conv1): GCNConv(5, 16)\n (conv2): GC...	NaN	NaN	
1	18h23m49s	GCN_004	0.9	100	100	True	[(100, 5)]	[(100, 2)]	GCN(\n (conv1): GCNConv(5, 16)\n (conv2): GC...	NaN	NaN	
2	19h08m29s	GCN_004	0.9	100	100	True	[(100, 4)]	[(100, 2)]	GCN(\n (conv1): GCNConv(4, 16)\n (conv2): GC...	NaN	NaN	
3	19h42m38s	GCN_005	0.9	100	100	True	[(100, 4)]	[(100, 2)]	GCN(\n (conv1): GCNConv(4, 16)\n (conv2): GC...	MSELoss()	Adam (\nParameter Group 0\n amsgrad: False\...	
4	20h00m36s	GCN_005	0.9	32	100	True	[(32, 4)]	[(32, 2)]	GCN(\n (conv1): GCNConv(4, 16)\n (conv2): GC...	MSELoss()	Adam (\nParameter Group 0\n amsgrad: False\...	
5	20h14m31s	GCN_005	0.9	32	100	True	[(32, 4)]	[(32, 2)]	GCN(\n (conv1): GCNConv(4, 16)\n (conv2): GC...	MSELoss()	SGD (\nParameter Group 0\n dampening: 0\n ...	
6	20h32m49s	GCN_005	0.9	64	1000	True	[(64, 4)]	[(64, 2)]	GCN(\n (conv1): GCNConv(4, 16)\n (conv2): GC...	MSELoss()	Adam (\nParameter Group 0\n amsgrad: False\...	
7	10h48m33s	/storage/remote /atcremers50 /ss21_multiagentcon...	0.9	256	10	True	[(256, 4)]	[(256, 2)]	GCN(\n (conv1): GCNConv(4, 16)\n (conv2): GC...	MSELoss()	Adam (\nParameter Group 0\n amsgrad: False\...	
8	11h26m51s	GCN_006	0.9	256	10	True	5	2	GCN(\n (conv1): GCNConv(5, 16)\n (conv2): GC...	MSELoss()	Adam (\nParameter Group 0\n amsgrad: False\...	
9	12h22m43s	GCN_006	0.9	128	100	True	5	2	GCN(\n (conv1): GCNConv(5, 16)\n (conv2): GC...	MSELoss()	Adam (\nParameter Group 0\n amsgrad: False\...	
10	12h37m50s	GCN_006	0.9	16	100	True	5	2	GCN(\n (conv1): GCNConv(5, 16)\n (conv2): GC...	MSELoss()	Adam (\nParameter Group 0\n amsgrad: False\...	

Figure 9: Intention, in red