OSM Sumo RL Brief Report

git Branch: osm_maps
new files: run_multiagents_rltl_osm.py and simulator_osm.py
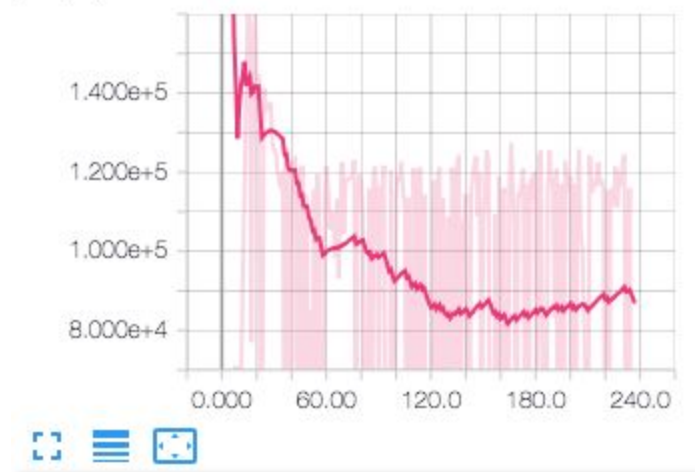
Differences with master branch:
- Common unique model between shared by all agents

- Inputs (number of inputs = max_number_of_lanes of any TL on the map * 2 + fixed_number_of_tl_states=3):
  - normalized id between 0 and 1 (if 10 TLs then {0, 0.1, 0.2, 0.3, ….})
  - green phase indicator
  - current_phase_time / max_phase_duration
  - for each lane (positive values if lane has green light else negative values if red or orange):
    - number of vehicles in lane proportional to lane's length
    - normalized distance of closest car in lane

- Reward:
  - total waiting time at all traffic lights

- Traffic and map generated with webizard

- Must do some cleaning up on imported traffic lights (from webwizard):
  - set all yellows phases to 3 seconds
  - set all green phases to 50 seconds (any number superior to max phase length)
  - sometimes merge TLs
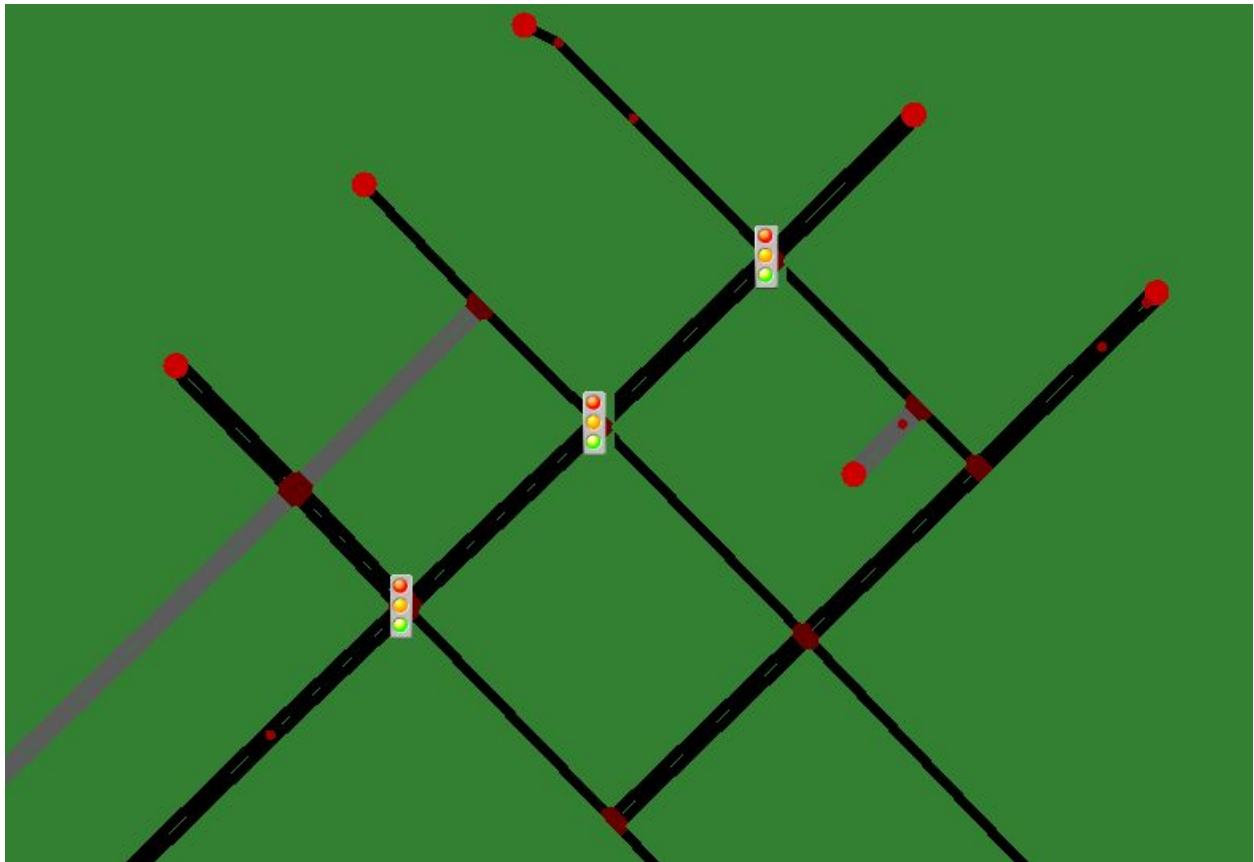 - remove some wasteful phases

Results:

Applied on a single intersection situated in Oakland, Pittsburgh on Forbes Avenue.
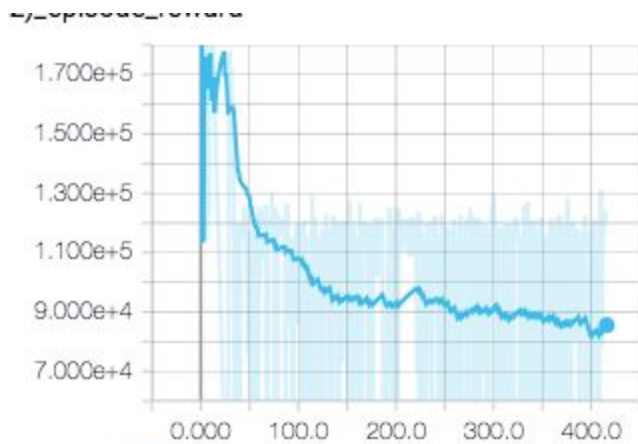We observe a 40% reduction in waiting time at the intersection.

(3,2)_episode_reward

With 3 intersections, also on Forbes Avenue:

```
dense_3 (Dense)                    (None, 2)
================================================
Total params: 270,338
Trainable params: 270,338
Non-trainable params: 0
_____
None
Could not connect to TraCI server at localhost:47985 [Err
sed
 Retrying in 1 seconds
Evaluation Result for average of 1 episodes
average total reward: 12.9397917355
overall waiting time: 8.62483994878
equipped waiting time: 8.62483994878
unequipped waiting time: 0.0
(DQN-ENV) rusheng@rusheng-portable:~/RLTL$
```
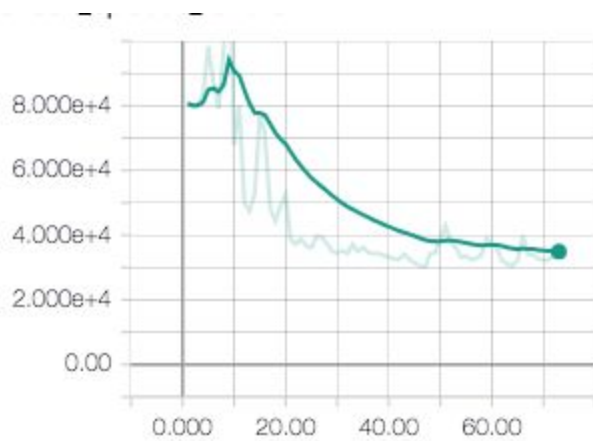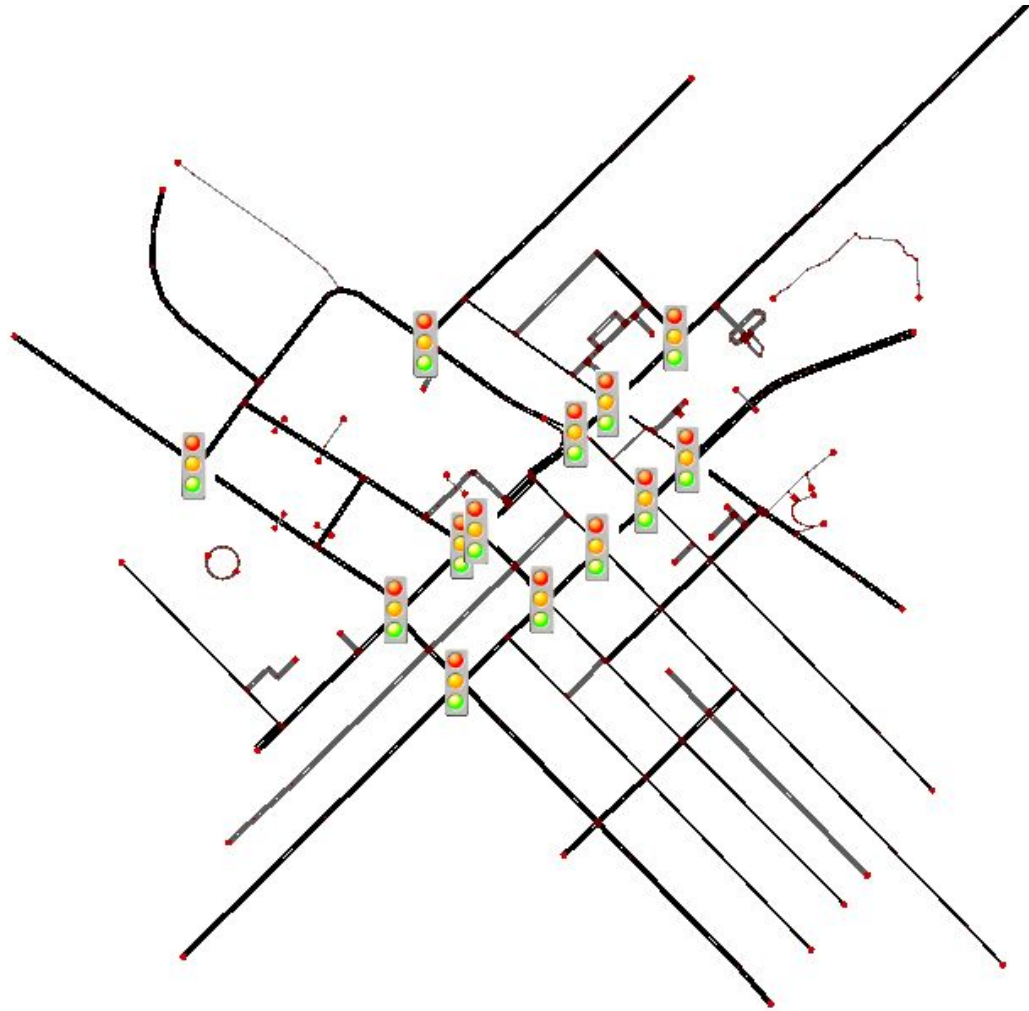
```
rusheng@rusheng-portable: ~/RLTL
_____
None
Could not connect to TraCI server at localhost:56391 [Errno 111] Con
sed
 Retrying in 1 seconds
Evaluation Result for average of 1 episodes
average total reward: 7.60427022746
overall waiting time: 2.43277848912
equipped waiting time: 2.43277848912
unequipped waiting time: 0.0
(DQN-ENV) rusheng@rusheng-portable:~/RLTL$ python run_multiagents_rlt
mode train --cpu
/home/rusheng/DQN-ENV/local/lib/python2.7/site-packages/h5py/__init__.
ureWarning: Conversion of the second argument of issubdtype from `floa
floating` is deprecated. In future, it will be treated as `np.float64
e(float).type`.
  from ._conv import register_converters as _register_converters
Using TensorFlow backend.
libsumo not installed properly, please use traci only
Could not connect to TraCI server at localhost:49373 [Errno 111] Connec
sed
 Retrying in 1 seconds
Warning: Environment variable SUMO_HOME is not set, schema resolution wi
low website lookups.
```

We observe a 30% waiting time decrease and see that traffic lights act intelligently by visual observation.

Finally with 13 Intersections Oakland, Pittsburgh:

We have a 65% decrease of total waiting time compared with random actions at the start of the training.

Beneath is waiting time of cars with the traffic lights which are automatically guessed by Sumo/webWizard when importing the map. (these include weird orange phase durations and bad left-turn phase)

Beneath is waiting time of cars with the traffic lights which result from after map cleanup with fixed phase duration (all orange phases at 3 seconds, green phases at 50 seconds)

Beneath is waiting time of cars with the traffic lights which result from our best weights after running the RL on the above traffic lights but with adjustable phase durations.

These results seem quite interesting as we have huge decreases in waiting times:

13 intersections on real osm map of Oakland