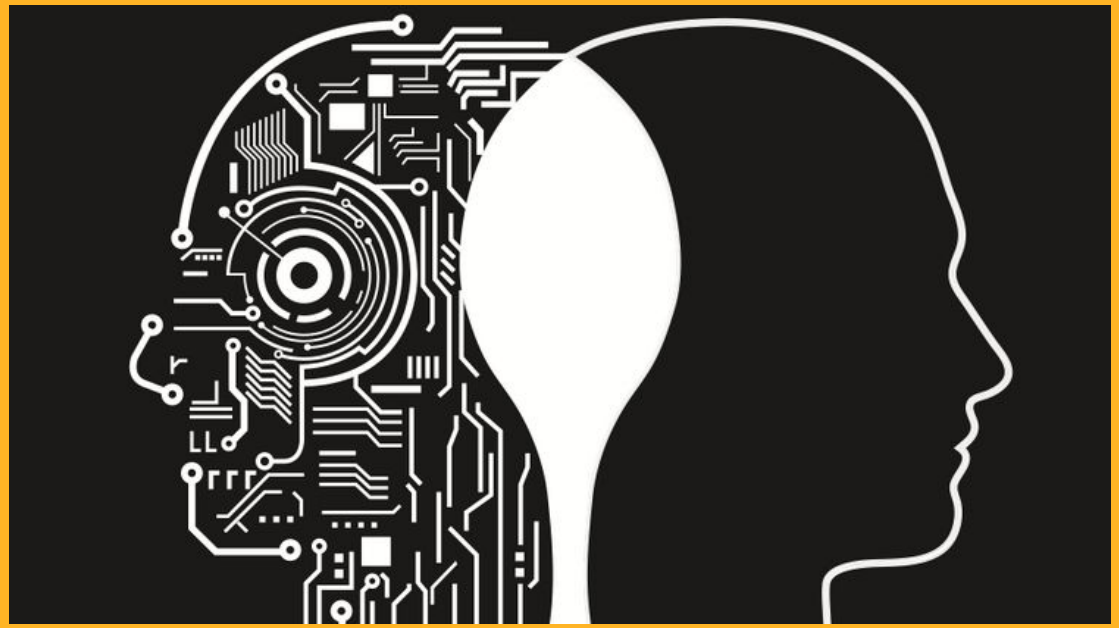


By Transparentor

Thailand

Deep Reinforcement Learning for traffic lights timing to minimize Commuting Time

Transparency is an act of government sharing the nation their data. So, their citizens and different sectors of those governments can create solutions ,or business from that data which it would be hard/impossible before.

Study the international research to solve this problem

Reference: http://news.mit.edu/2014/traffic-lights-theres-a-better-way-0707

If you ever come to Bangkok.
You may have seen these things

Reference: http://inrix.com/resources/inrix-2016-global-traffic-scorecard

Wasted time average	61 hours/year/person
Fuel lost/year	1810 million Baht
Total time value loss/year (Only people locate in Bangkok)	8,154 million Baht
Total value loss for traffic jam	9,964 million Baht

By person

Assume working 8 hr/day	300 Bath
Lost value	61×300／8 * 3,564,635 Baht

By the whole city

Fuel lost	0.025 litre/minute
Latest fuel cost	28 Baht/litre
Population in city	1782371.5

Reference:

http://inrix.com/resources/inrix-2016-global-traffic-scorecard
https://www.quora.com/How-much-gas-does-a-car-burn-per-hour-while-idling
https://www.edf.org/climate/reports/idling

Solutions

DQN + Simulation

Why deep reinforcement learning?

- Can learns transition probability by trial-error
- Can handle unexpected situation

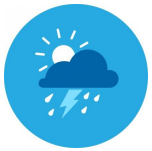
AlphaGo

TensorFlow

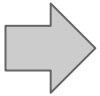
Datasets

Dataset	Source (Government Organization)
Traffic status	กรมการขนส่งทางบก (Department of Land Transportation)
	จส.100 (JS100)
	กระทรวงคมนาคม (Ministry of Transport)
Weather data	กรมอุตุนิยมวิทยา (The Meteorological Department)
Event data	Social Network
Date/Time	Local date/time

Use deep reinforcement learning to control lights timing

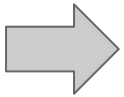


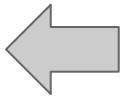
Input



Simulation

Sensor/Data stream

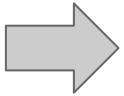


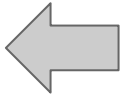


Decisión

Reinforcement learning model

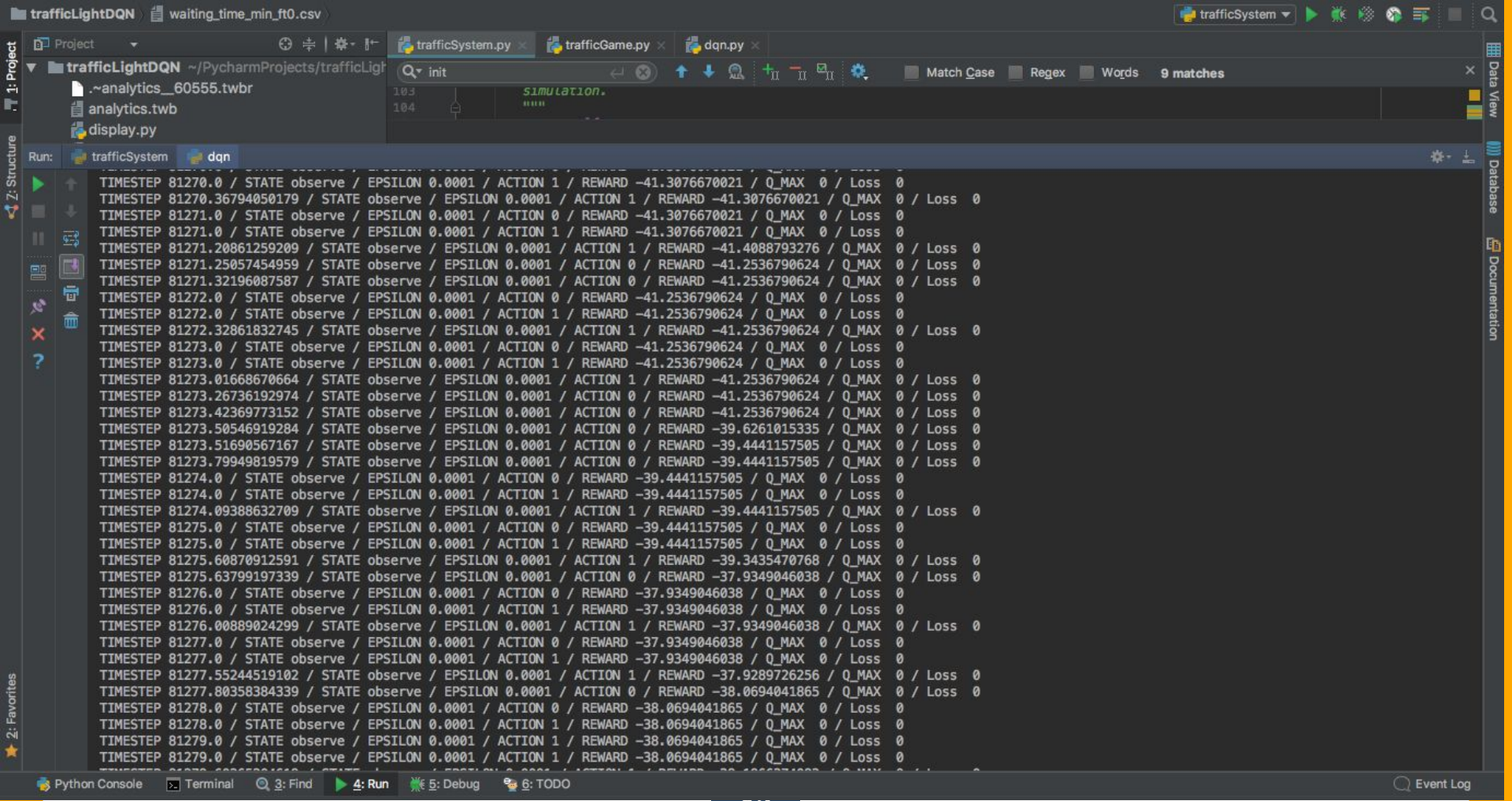
Decisión





Sensor/Data stream

Real traffic light


trafficLightDQN
waiting_time_min_ft0.csv
trafficSystem
Project
trafficLightDQN ~/PycharmProjects/trafficLigh
.~analytics__60555.twbr
analytics.twb
display.py
trafficSystem.py
trafficGame.py
dqn.py
init
Match Case
Regex
Words
9 matches
simulation.
Run:
trafficSystem
dqn
TIMESTEP 81270.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
TIMESTEP 81270.36794050179 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
TIMESTEP 81271.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
TIMESTEP 81271.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
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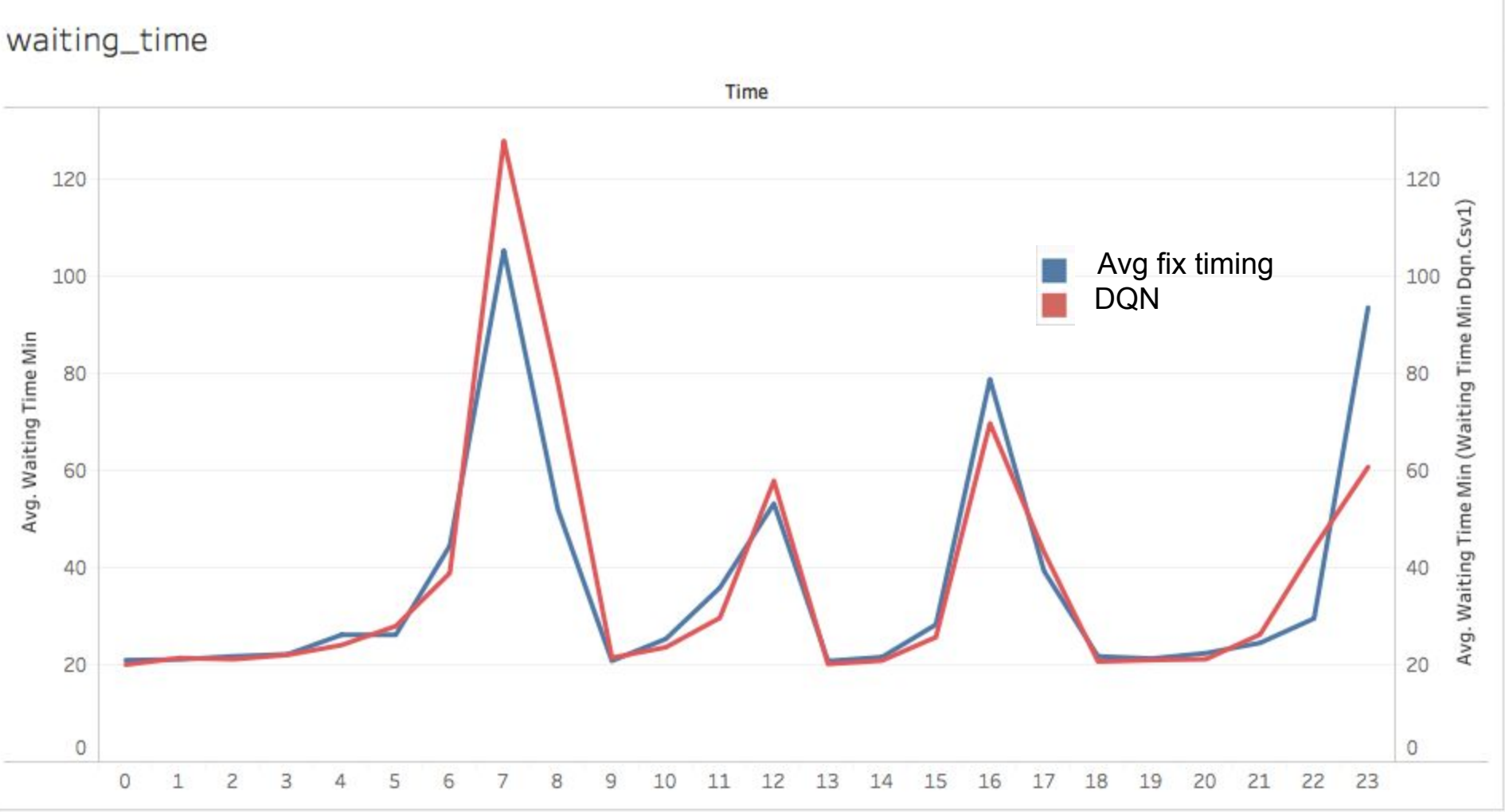
TIMESTEP 81279.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -38.0694041865 / Q_MAX 0 / Loss 0
TIMESTEP 81279.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -38.0694041865 / Q_MAX 0 / Loss 0
Python Console
Terminal
3: Find
4: Run
5: Debug
6: TODO
Event Log
Data View
Database
Documentation
1: Project
2: Favorites
Z: Structure


waiting_time
Time
Avg. Waiting Time Min
Avg. Waiting Time Min (Waiting Time Min Dqn.Csv1)
Avg fix timing
DQN
0
20
40
60
80
100
120
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

20 min

trained

Our DQN model just had been trained(simulation elapsed time)

8% improved

in average waiting time compare to the fix time approach

The individual result may vary on many factors such as train time, random seed, distribution, fidelity of simulation, etc.

Conclusion

Looking at whole system

Fast execution

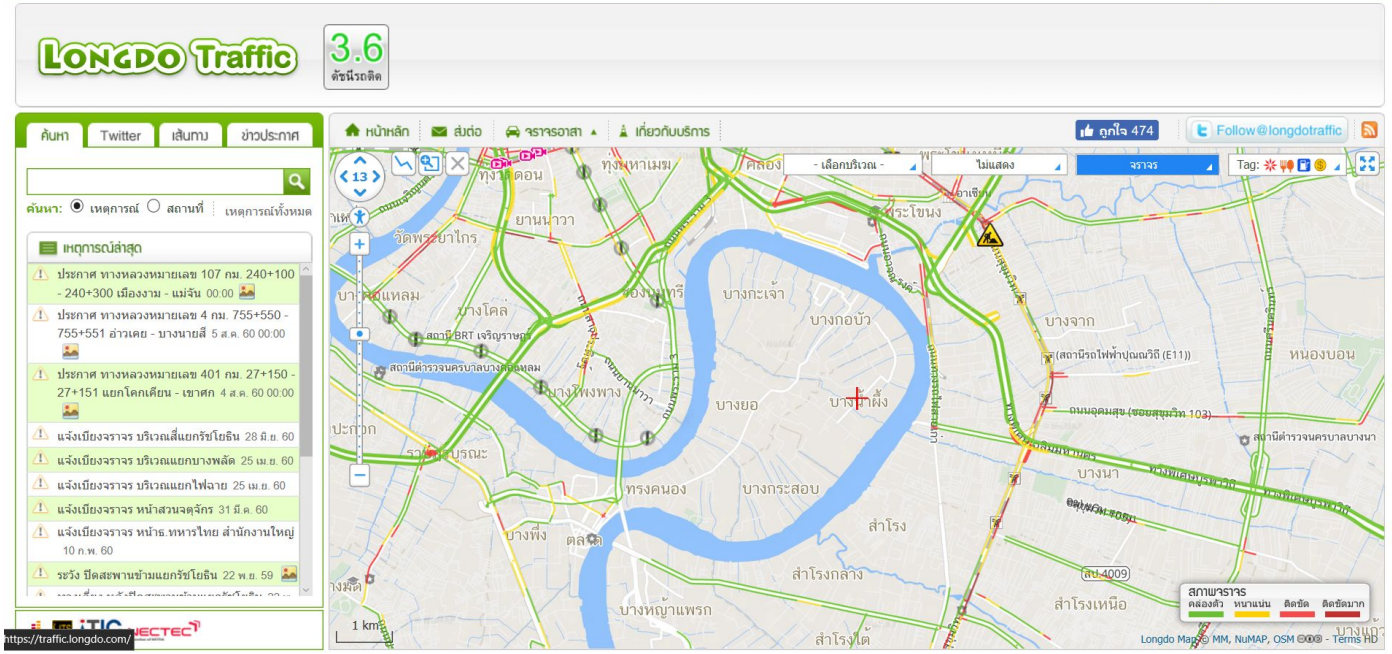
Minimize commuting time

Impacted field	Result
Logistic	Shipping faster
Individual	More free time to family
Environment	Less pollution
Emotional	People happier
Transportation	Ordering of traffic

github.com/wasdee
/trafficLightDQN

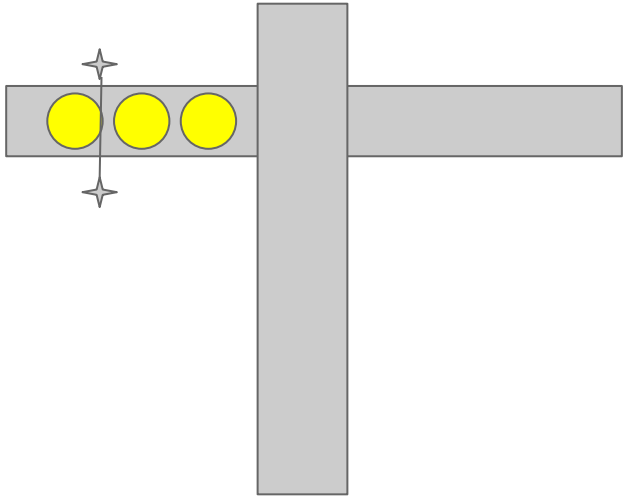
Code - Result - Slides

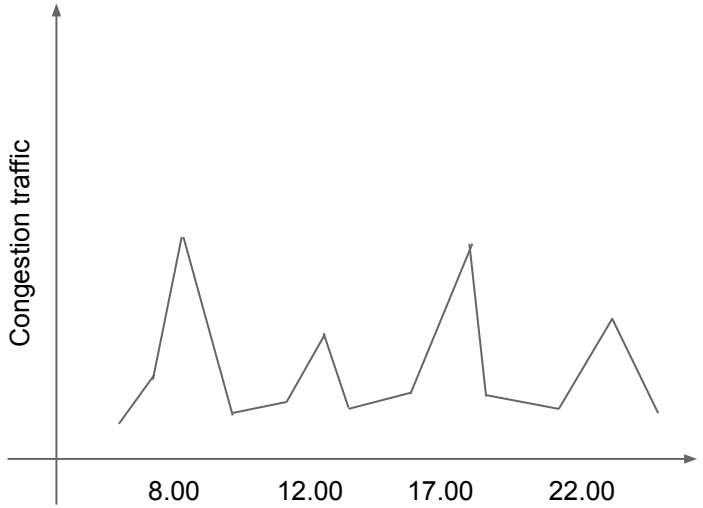
Study about **index** that measure the congestion of traffic



Provided by iTIC and T-Square

Simple Simulation Design



Vehicle

Sensor