Reinforcement Learning-Based Optimal Public Transportation Route Search Considering Time and Cost

Team Members: Kim SeoYeong

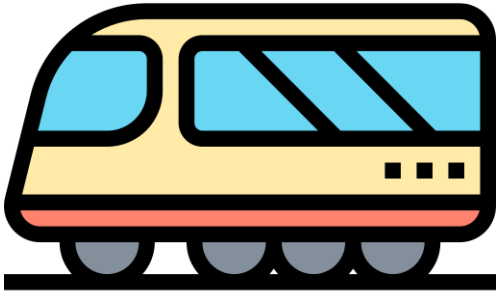
Email: carsk0607@g.skku.edu

Applied Artificial Intelligence

Sungkyunkwan University, Korea

Introduction

BUS



METRO

WALK

Problem

Problem


23기-3
경진여객11/14 첫차부터
타결시까지 파업
3000 7770 7780 7800
8471 8472 9802 M5443
경인일보

Problem

Problem

We need a optimal public transportation route search system that can dynamically adapt real-time road conditions!

Existing Solutions

A* algorithm, Dijkstra algorithm

- **cannot consider non-linear road conditions**

  ex. traffic jam, weather, traffic control

- **cannot apply to other episode**
- **cannot reflect dynamic environment which changes by time step**

Existing Solutions

A* algorithm, Dijkstra algorithm

- **cannot consider non-linear road conditions**

  ex. traffic jam, weather, protest

- **cannot apply to other episode**
- **cannot reflect dynamic environment which changes by time step**

=> use Reinforcement Learning methods!

Your Approach - state

Start
Seoul Station

Destination
Sungkyunkwan Univ

Obstacles
Traffic jam, protests

Implement map as 16*16 grid world

Your Approach - action

BUS

103, 104, 151, 173, 201, 301, 704, 1102, 7022

METRO

line 1, line 2, line 3, line 4, line 5

WALK

up, down, left, right

Your Approach - reward

- **Separate reward into 2 components**
  : time reward, cost reward
- **Total reward consider both 2 components**

$$totalreward = \frac{timereward}{2} + \frac{costreward}{30}$$

Your Approach - reward

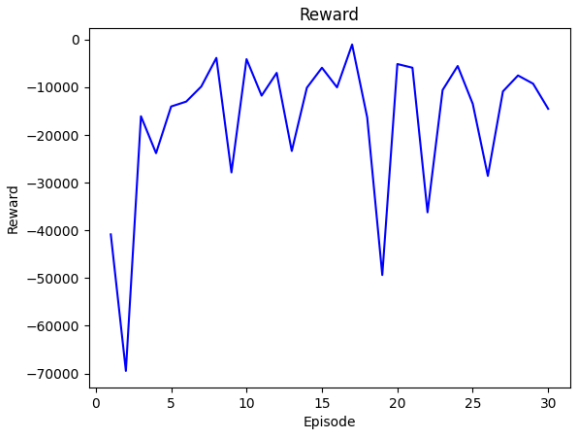
	Time Reward			Cost Reward
State	Destination	Obstacle	Normal	All
Bus	-10	-150	-10	-1500
Metro	-15	-150	-15	-1400
Walk	-150	-150	-150	0

Your Approach - method

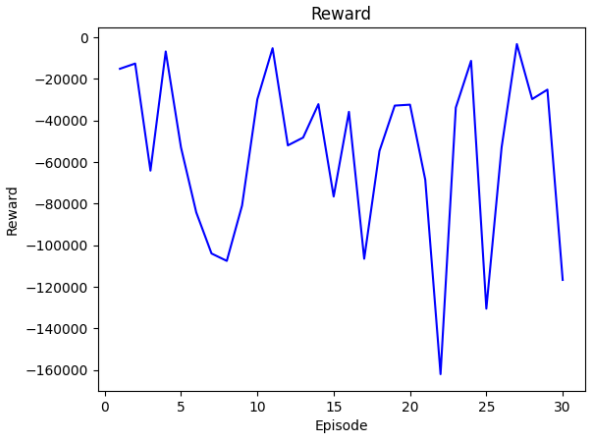
- **Can represent the value function with a table**
- **Learn on each timestep**
- **Control problem**

=> Q-learning, SARSA, Expected SARSA!

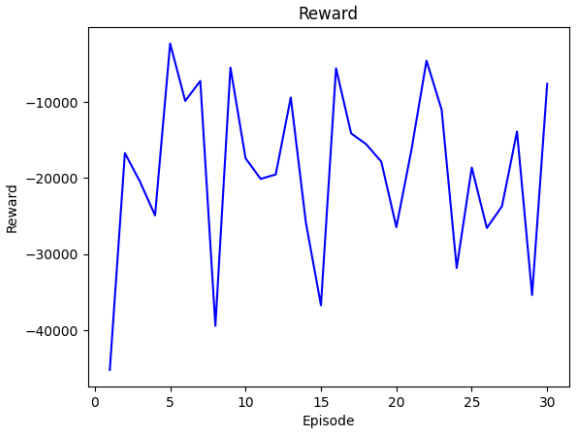
Results – Total Reward



Q-learning



SARSA

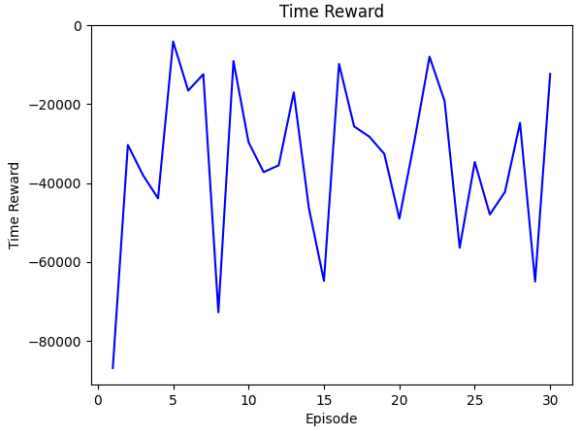


Expected SARSA

Results – Time Reward

Q-learning

SARSA



Expected SARSA

Results – Cost Reward

Q-learning

SARSA

Expected SARSA

Conclusions

- **Overall, Expected SARSA performs best**
- **In terms of time, Expected SARSA performs best**
- **In terms of cost, SARSA performs best**

Q/A

Thank You!