Summary of CV (I)

Seungeon Baek

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- E-mail: bsewo5959@gmail.com
- Github: https://github.com/SeungeonBaek/
- Blog: Team blog / Personnel blog

Education

- Master of Science in Automotive Engineering
  - College of Engineering, Hanyang University (2018~2020)
- Bachelor of Engineering in automotive Engineering
  - College of Engineering, Hanyang University (2012~2018)
- Graduation of Science of High School
  - Incheon Science High School (2010~2012)

Awards

- Awarded, the grand prize at 2017 HYU Capstone Design Fair
  - Affiliation: Hanyang University, Seoul, Korea

Presentation

- Presented, **CCTV AI 영상분석을 활용한 심층강화학습 기반 연동 그룹 오프셋 신호최적화(평택 45번 국도 사례)**
  - ITS session, 한국ITS학회 2023 춘계 학술 대회
- Presented, **Multi-agent Reinforcement Learning in Cooperative Environment with Continuous Action Space**
  - AI session, 한국시뮬레이션학회 2021 춘계학술대회
- Presented, **Personalized Speed Planning System Using a Statistical Driver Model in Car-following Situations.**
  - International ITS session., 한국자동차공학회 2019 춘계학술대회

Summary of CV (II)

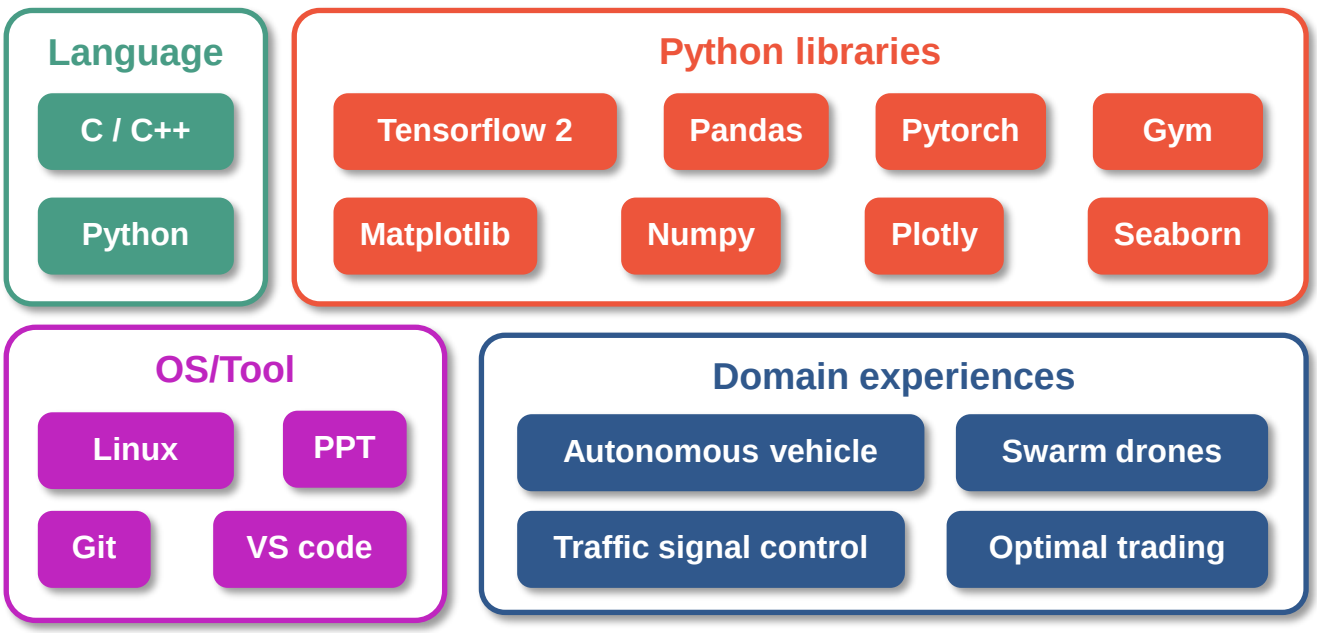
Publication

- Publicated, Shin, J., Kim, H., **Baek, S**., Sunwoo, M., & Han, M. (2019). **Rule-based alternator control using predicted velocity for energy management strategy**. Journal of Dynamic Systems, Measurement, and Control, 141(12).
- Publicated, **Baek, S.E**., Kim, H.S. & Han, M. **Personalized Speed Planning Algorithm Using a Statistical Driver Model in Car-following Situations**. Int.J Automot. Technol. 23, 829–840 (2022).

Patents

- Applied, 교차로의 현시와 관련된 제어신호를 생성하는 방법 및 장치(Korea)
- Applied, 강화학습을 활용한 교통 신호 연동그룹의 실시간 신호 최적화 방법 (Korea)
- Applied, APPARATUS AND METHOD FOR CONTROLLING TRAFFIC SIGNALS OF TRAFFIC LIGHTS IN SUB-AREA BY REINFORCEMENT LEARNING MODEL(US)

Technical skills



Interests

- Reinforcement Learning
  - Risk-sensitive RL(Safe RL)
  - Multi-Agent RL(MARL)
  - Learn to adapt to the real world
    - Meta RL
- Graph Neural Network
  - State representation for RL
  - Modeling for relation with agents in MARL

Summary of CV (III)

Activities

- Ran a tech blog and Co-ran a team tech blog
  - DL/RL related contents
    - MADDPG, OpenAI Five, GraphLSTM, DM Lab, What can RL do? and so on

- Enrolled, DL/RL algorithms in Papers with code
  - Enrolled various RL algorithms
    - TD3, QR-DQN, SIL, IQN PDQN(deleted), IDAC(deleted)

- Participated, reinforcement learning paper review study
  - Reviewed and implemented MADDPG(4th, 2021.04)
  - Reviewed and implemented gSDE (5th, 2021.08)
  - Reviewed Neural Combinatorial Optimization (6th, 2021.11)
  - Reviewed PDQN (7th, 2022.03)
  - Reviewed and implemented IDAC (8th, 2022.05)
  - Reviewed DeepNash (9th, 2022.11)
  - Reviewed SLAC (10th, 2023.04)

- Participated, DL/RL study of Pseudo-Lab
  - Studied, Multi-task learning and Meta-learning(CS330) (4th, 2022.05 - 2022.07)
  - Studied, Multi-task learning and Meta-learning(CS330) and Continual learning (5th, 2022.12 - 2023.02)
  - Studied, Model-based reinforcement learning (6th, 2023.04~)
  - Studied, Graph neural network(7th, 2023.08~)

- Led, Reinforcement Learning team of 딥러닝 논문 읽기 모임 (2023)
  - Participated RLhf (2023, 02)
  - Reviewed MMDQN (2023, 02)
  - Reviewed VariBAD (2023, 03)
  - Reviewed Does Zero-Shot RL Exist? (2023.06)
  - Reviewed TransDreamer (2023.07)
  - Reviewed Trajectory Transformer (2023. 08)
  - Reviewed SPLT Transformer (2023. 10)
  - Reviewed Online Decision Transformer (2023. 11)

- Led, Fundamental team of 딥러닝 논문 읽기 모임 (2024~)

Work Experiences (I) – Nota

- **Development of RL environment for traffic signal control**
  - Subject:
    - Design and development of RL environment for study related to traffic signal control
  - Duration: 2021.11 ~ 2023.06
  - Role:
    - Developing RL environment to learn traffic signal control using commercial simulation software
    - Developing the environment to support various actions and states for collaborating colleagues (applying object-oriented programming concepts such as factory method)
      - Discrete / Continuous / Hybrid action spaces
      - Diverse feature for state engineering
  - Skills:
    - AIMSUN(simulation software), Python(Gym, Numpy, Pandas), Redis

- **Design and implementation of a RL-based signal control model**
  - Subject:
    - Designing and developing a reinforcement learning-based traffic signal control model for real-world application
  - Duration: 2021.11 ~ 2023.06
  - Role:
    - Developing reinforcement learning model 1 (TD3, gSDE)
    - Developing reinforcement learning model 2 (GNN-based state representation + MMDQN + Risk-sensitive action selection)
    - Defining MDPs (State, Action, Reward) using variables applicable in the real world
  - Skills:
    - Python(Numpy, Tensorflow2, Keras, Tensorflow-probability)

- **Design and development of modules for the application of the learned model to the real-world**
  - Subject:
    - Designing and developing related modules for the application of the learned model to the real-world
  - Duration: 2021.11 ~ 2023.06
  - Role:
    - Designing, developing, and validating a pipeline to control the signal controller using the inferred actions from reinforcement learning
  - Skills:
    - Python, GCP

- ***Please note that visual materials are not attached as it is a major internal project.**

Work Experiences (II) – RTV

- **Construction of learning/simulation environment for swarm objects and development of integrated AI mission execution engine**
  - Subject:
    - Development of simulation env and RL env for swam intelligence research
  - Duration: 2020.03 ~ 2021.10
  - Role:
    - Designing and developing of 6-DOF drone model within the simulation environment
    - Designing and integrating various actions for the drone model's control in the simulation environment (continuous/discrete actions)
  - Skills:
    - MATLAB, Simulink, C++, Python(Gym, Numpy, Pandas), gRPC(C++, Python)

- **Design and implementation of RL-based single/multiple waypoint flight control for swarm drones**
  - Subject:
    - Learning example scenarios for validation of inhouse simulation/RL environment (single waypoint flight, multiple waypoint flight)
  - Duration: 2020.03 ~ 2021.10
  - Role:
    - Defining MDPs for example scenarios
    - Designing and RL models(PER-TD3, PPO-SIL)
    - Testing and stabilizing the simulation/RL environment
  - Skills:
    - MATLAB, Simulink, C++, Python(Gym, Numpy, Tf2, Keras, Seaborn, Matplotlib)

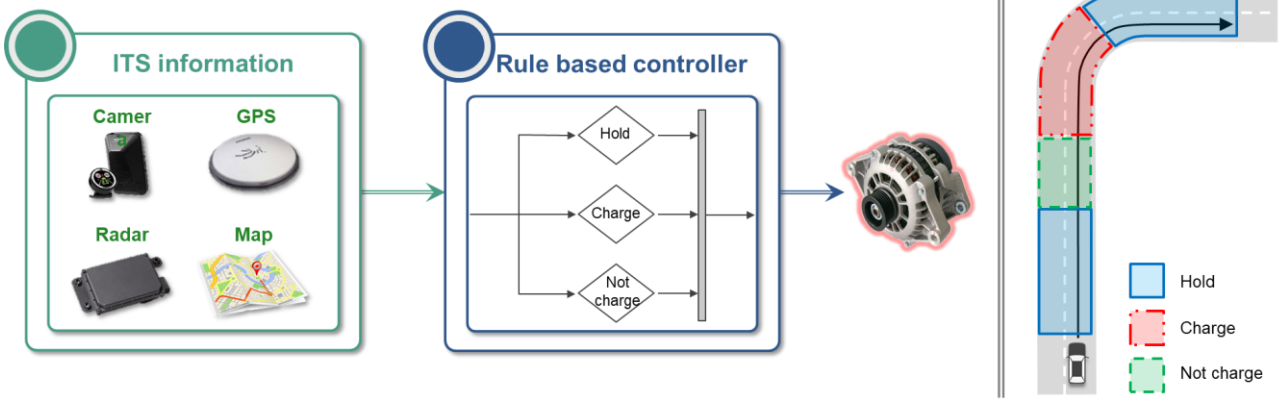
- **Design and implementation of RL-based escort mission execution model for swam drones**
  - Subject:
    - Learning example scenarios for validation of inhouse simulation/RL environment
  - Duration: 2020.03 ~ 2021.10 (REALTIMEVISUAL)
  - Role:
    - Defining MDPs for example scenarios
    - Designing and developing RL models (TD3, MATD3)
    - Testing and stabilizing the simulation/RL environment
  - Skills:
    - MATLAB, Simulink, C++, Python(Gym, Numpy, Tf2, Keras, Seaborn, Matplotlib)

- ***Please note that visual materials are not attached as it is a major internal project.**

Research Experiences – Graduate school

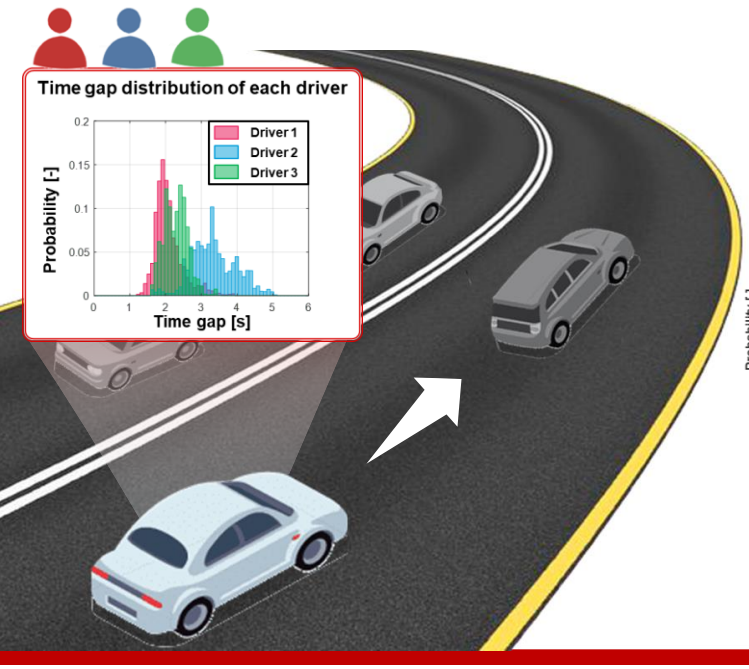
Rule-based Alternator Control using Predicted Velocity

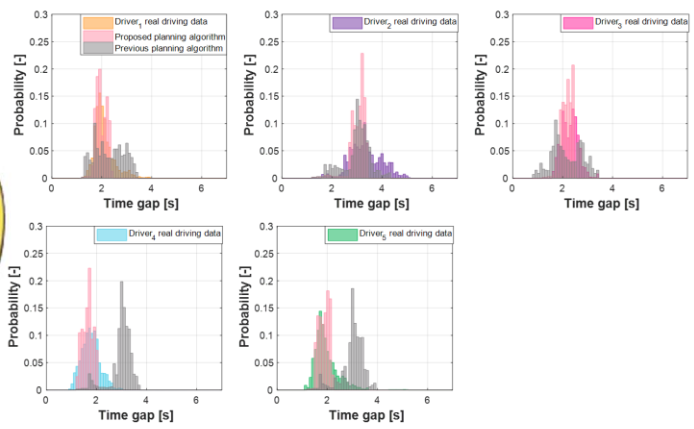
- Subject: Improvement of the fuel efficiency using ITS information
- Duration: 2018.01 ~ 2018.08
- Role: Algorithm validation and improvement in real-vehicle
- Output: co-author of SCIE Journal, Journal of Dynamic Systems, Measurement, and Control, Dec 2019, 141(12).



Personalized Speed Planning Algorithm using a Statistical Driver Model in Car-following Situations

- Subject: Design of personalized speed planning algorithm for accommodation of individual driver's driving style
- Duration: 2018.12 ~ 2019.11
- Role: Design of the algorithm in simulation(IPG CarMaker)
- Output: conference, main-author of SCIE Journal, International Journal of Automotive Technology volume 23, pages829–840 (2022)





Proposed algorithm

# of Driver	$K-L\ divergence$
1	0.1310
2	0.2976
3	0.2419
4	0.0817
5	0.2447

Previous algorithm

# of Driver	$K-L\ divergence$
1	0.3272
2	0.3272
3	0.4404
4	1.8168
5	2.0961

Project Experiences – Graduate school

- **Development of a RL environment for autonomous vehicle planning and control**
  - Subject:
    - Design and development of the RL env for autonomous vehicle planning and control research
  - Duration: 2018.09 ~ 2019.03
  - Role:
    - Developing the RL env for vehicle control using commercial simulation software
    - Developing a comm module to integrate MATLAB/Simulink-based low-level controllers and RL(Python)-based upper-level controllers or planning algorithms
  - Skills:
    - CarMaker(commercial simulator), MATLAB, Simulink, Python(Socket, Keras)

- **Development of a vehicle experimentation platform for personalized ADAS algorithm validation**
  - Subject:
    - Development and vehicle experimentation of a personalized ADAS(Autonomous Driving Assistance System) algorithm validation platform
  - Duration: 2019.03 ~ 2019.11
  - Role:
    - Designing and developing the personalized ADAS algorithms(Personalized speed planning algorithm)
    - Developing and validating of the vehicle control platform using ROS
  - Skills:
    - MATLAB, Simulink, C, C++, ROS(C++), Linux

- **Research on vehicle gear shifting based on distributed RL using actual driving data**
  - Subject:
    - Research on gearshift control algorithm utilizing real driving data and distributed RL framework(Ape-X DQfD)
  - Duration: 2019.03 ~ 2019.11
  - Role:
    - Calibrating vehicle model for gearshift control and obtaining the driving data
    - Supporting development of RL env/distributed RL env
  - Skills:
    - Cruise(commercial simulator), MATLAB, Simulink, Python(Socket)

- ***Due to space constraints, visual materials could not be included in this page**

Summary

- **Experiences in integrating various simulation envs and RL envs with algorithms**
  - Commercial simulator (CarMaker, Cruise, Aimsun)
  - Code-level simulation software (C++/Rust based software)

- **Acquired knowledge in RL theory and implementation**
  - RL taxonomy
    - Value-based model-free RL
      - DQN, Double DQN, DDDQN
      - QR-DQN, IQN, FQF, MMDQN
    - Model-based RL
      - Dyna, MPC, iLQR
      - AlphaGo, MuZero, Muesli
      - World Model, Dreamers
    - Imitation learning & Inverse RL
      - BC, GAIL, VAIL
    - Multi-agent RL
      - MADDPG, COMA, MAAC, HGAT
      - QMIX, QTRANS, MMDMIX
    - Policy-based model-free RL
      - PPO, PPG, SAC, IDAC, SIL, TQC
      - DDPG, TD3
    - Exploration methods
      - ϵ-greedy, UCB
      - gSDE, ICM, RND, NGU
    - Multi-task/Meta/Hierarchical RL
      - HER, UVFA, PEARL, variBAD
      - HIRO, DADS, Music
    - Offline RL
      - DT, Online DT, TT, IRIS
      - SPLT Transformer, GATO

- **RL-related research and work experience in various domains**
  - Planning and control of autonomous vehicles and swarm drones
  - Traffic signal control
  - Optimal order execution(day trading)

- **Performing literature reviews and various external activities to follow the latest technology**
  - Personnel / Team tech blog
  - DL/RL paper review study
    - Leading various study group
    - ML theory study
    - Reinforcement learning
    - Multi-task/Meta-learning
    - Graph neural network