

RAY CODEN MERCURIUS

+1-647-712-0517 @ ray.mercurius@mail.utoronto.ca Toronto, ON

Website

<https://ceudan.github.io/>

Quora

<https://www.quora.com/profile/Ray-Coden-Mercurius>

SUMMARY

4th year engineering student at the University of Toronto working in the intersection of machine learning and transportation. Currently researching the application of reinforcement learning for traffic perimeter control. Enjoys competitive programming and data-driven projects.

EXPERIENCE

Research Assistant (Reinforcement Learning)

Data Driven Decision Making Lab 05/2022 - Ongoing

Research Topic: Reinforcement Learning for Traffic Perimeter Control

- Conduct literature review and guide research direction. Specifically, various dynamic control methods for spatially heterogeneous control, temporally heterogeneous control, multi-agent control. Understand deep theory of traffic control dynamics.
- Formulate research question and agent's task, hand code Proximal Policy Optimization and Double Deep Q-Network reinforcement learning algorithms, hyperparameter tuning, stat recording
- Design Aimsun traffic simulation environment, develop inter-application scripting software
- First Paper Submission in December 2022

Research Assistant (Software Developer)

University of Toronto Transportation Research Institute 05/2021 - 08/2021

Worked with postdoc on calibration of an Aimsun traffic model covering the GTHA with observed data from HERE Maps.

- Independently invented Python software to match over 100,000 roads and intersections across databases utilizing geospatial information (GeoPandas, shapely, GIS)
- Developed traffic model calibration software leveraging DEAP Genetic Algorithm
- Data mined and processed raw traffic data

PROJECTS

Learning Reinforcement Learning via Car Racing

- Hand coded Proximal Policy Optimization and Double Deep Q-Network Algorithms
- Applied novel solution, simplified learnable relationship by separating thrust and steering actions to independently trained networks and moving speed estimation away from actor/critic models
- Obtained **highest test score** and **2nd lowest training cost** amongst top implementations on OpenAI's official car racing leaderboard

Alphanumeric CAPTCHA Solver

- Leveraged OpenCV image processing and trained custom CNN for object recognition and character segmentation, classified individual characters via CNN transfer learning
- Achieved accuracy of 71% per entire CAPTCHA and 91% per individual character, these are high given CAPTCHAs are designed to be unbeatable by software

Match Road Sections across Databases

- Created new software for the University of Toronto Transportation Research Institute to match over 100,000 spatially encoded roadways on GeoPandas across HERE Maps and Aimsun simulation databases
- Invented custom algorithm utilizing distance metric and path finding to match roads, leveraged custom dataset to allow for 2 dimensional geographic based queries in log(N) time

EDUCATION

Major: Civil (Transportation) Engineering
Minor: Machine Intelligence

University of Toronto

2023 STEM GPA 3.76 / 4.0

AWARDS

- 15th/83 ICPC East Central North America Regionals
- 9th place University of Toronto Undergraduate Competitive Programming Tryouts
- Highest Test Score OpenAI Official Car Racing Leaderboard
- Konrad Group Digital Innovation Scholarship

SKILLS

Programming

Python C/C++ Matlab

ML Framework

Pytorch Scikit-Learn

Technology

Git/Github LaTeX Aimsun Simulator

ArcGIS RLlib OpenAI

RELEVANT COURSEWORK

Digital Computation and Programming (A+)

Computer Science I (A+)

Computer Science II (A+)

Data Structures and Algorithms (A+)

Intro to Artificial Intelligence (A+)

Intro to Machine Learning (A-)

Applied Fundamentals of Machine Learning (A-)

Neural Networks and Deep Learning (A+)

Transportation I (A+)

Transportation II (A+)