Joe Waldy, PhD

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EXECUTIVE SUMMARY

I am passionate about the research, development and deployment of data-driven, optimization methods to solve real-world optimization problems specifically on how Artificial Intelligence (AI) and Operations Research (OR) methodologies can synergise to address increasingly dynamic real-world problems especially pertaining to routing and scheduling particularly in logistics, transportation, law enforcement and smart manufacturing domains. I have over 10 years of working experience in the domains of Data Science, Operations Research, IT project management, government procurement and public policy, and had deepened my technical and research expertise in AI by obtaining a PhD. I see myself as the bridge that connects the gap which often exist between business needs and technical solutions.

EXPERIENCE

Data Scientist | Optimization and Backend Engineer
SWAT Mobility   February 2025 – Present
- Research, develop and deploy new advanced features to address complex real-world routing optimization scenarios such as routing with pallet loading constraints and routing with temporal access restrictions. Translating these advanced optimization features into production-ready client solutions through implementing high-performance Python codebases and scalable API architectures
- Experimented and developed solution for routing with temporal access restrictions which is a prevalent challenge in routing large vehicles in major cities in South East Asia such as Bangkok and Manila.

Optimization Engineer | Data Science and AI Team
Hyundai Motor Group Innovation Center in Singapore   January 2023 – January 2025
- Developed and deployed a novel algorithm to measure the factory's Overall Equipment Effectiveness (OEE) and automate the root cause analysis process to identify delays in flexible cell-based car production.
- Developed an analytical tool to analyse, visualize and simulate performance of mobile robots operations.
- Developed and deployed OEE monitoring dashboard and mobile robots monitoring dashboard to aid in-production and post-production countermeasure and root cause analysis.
- Developed and implemented multi-agent pathfinding algorithms for Autonomous Mobile Robots (AMRs) in a Digital Twin simulator environment.
- Lead and drive research initiative to formulate and solve real-world multi-robot routing problem in smart factory as a Multi-Agent Pickup and Delivery Problem (MAPD).

Research Engineer
Singapore Management University   August 2022 – December 2022
- Designed, developed, integrated and implemented RL-based order assignment and routing algorithm for dynamic same-day delivery problem for AI Singapore and uParcel. (link)
- This research work has been published at the International Conference of Computational Logistics 2023.

PhD Candidate in Computer Science
Singapore Management University   August 2018 – December 2022
- My research focus is on how advanced AI techniques such as Machine Learning and Multi-Agent Systems can be infused with Classical OR techniques to solve complex, dynamic real-world combinatorial optimization problems specifically those pertaining to routing and scheduling. (thesis)
- I worked on an industry research project with Fujitsu-SMU Urban Computing and Engineering (UNiCEN) Corp Lab to enhance the scalability, solution quality and efficiency of the existing routing and scheduling engine of the Collaborative Urban Delivery Optimisation (CUDO) platform for commercial adoption.
- I interned with Home Team Science and Technology Agency (HTX) to propose and develop a learning-based approach to solve dynamic patrol routing and scheduling problem.
- I published 5 first-authored publications and 2 second-authored publications in reputable venues.

Senior Manager, Data Science
Ministry of Home Affairs Headquarters   February 2017 – July 2018
- Championed and executed the application of data science and data-driven methodologies using tools such as Tableau, geospatial analytics, and machine learning techniques to uncover insights from repositories of untapped data in the law enforcement domain.

Senior Manager, Operations Analysis & Improvement
Ministry of Home Affairs Headquarters   December 2013 – January 2017
- Solved complex problems in the law enforcement domain such as applying discrete-event simulation for strategic manpower planning and linear programming to develop a facility location optimisation model.

Staff Officer, Business Unit & Staff Development
Singapore Prison Service Technology Branch   June 2011 – November 2013
- Procured, managed projects and collaborated with vendors for the development of new IT systems.
- Developed training development framework, strategic IT plan and roadmap and internal ICT policies.
- Assisted Prisons Tech to achieve ISO/IEC 27001:2005 certification for management of data centre.

EDUCATION
PhD in Computer Science, Singapore Management University
- Majoring in Intelligent Systems and Optimization   GPA: 3.80/4.00
- Awarded SMU Presidential Doctoral Fellowship AY2021/2022 and Dean's List for AY2021/2022.

B.Eng (Industrial & Systems Engineering) | 2nd Class Honours (Upper), National University of Singapore
- Dean's List, Semester 2 2009/2010, Semester 1 and 2 2010/2011   GPA: 4.47/5.00
- Worked on a System Design Project with IBM Supply Chain Singapore to design a layout for new warehouse and perform simulation and analytical study to analyze its capability. (poster)

PUBLICATIONS
(details can be found in my Google Scholar page)
- Zhiqin Zhang, **Waldy Joe**, Yuyang Er and Hoong Chuin Lau. "When Routing Meets Recommendation: Solving Dynamic Order Recommendations Problem in P2P Logistics Platforms". In *ICCL 2023*. (paper)
- **Waldy Joe** and Hoong Chuin Lau. "Learning to Send Reinforcements: Coordinating Multi-Agent Dynamic Police Patrol Dispatching and Rescheduling via Reinforcement Learning". In *IJCAI 2023*. (paper|code)
- Songhan Wong, **Waldy Joe** and Hoong Chuin Lau. "Dynamic Police Patrol Scheduling with Multi-Agent Reinforcement Learning". *In LION17*. (paper)
- **Waldy Joe** and Hoong Chuin Lau. "Coordinating Multi-party Vehicle Routing with Location Congestion via Iterative Best Response". *In SN Computer Science 2023*. (paper)
- **Waldy Joe**, Hoong Chuin Lau and Jonathan Pan. "Reinforcement Learning Approach to Solve Dynamic Bi-objective Police Patrol Dispatching and Rescheduling Problem". In *ICAPS 2022*. (paper|poster)
- **Waldy Joe** and Hoong Chuin Lau. "Coordinating Multi-Party Vehicle Routing with Location Congestion via Iterative Best Response". *In EUMAS 2021*. (paper)
- **Waldy Joe** and Hoong Chuin Lau. "Deep Reinforcement Learning Approach to Solve Dynamic Vehicle Routing Problem with Stochastic Customers". In *ICAPS 2020*. (paper|video)

TECHNICAL SKILLS

Programming Language	Python, Java, JavaScript, C++
Data Science Tools	Numpy, Pandas, scikit learn and PyTorch
Optimization/Operations Research	Optimization Software: SCIP, CBC, CPLEX, Gurobi and Google OR-Tools Simulation Software: Automod and ExtendSim
Data Visualisation/BI Tools	Tableau
Geospatial	QGIS and worked with onemap.sg API and geospatial data from data.gov.sg
Collaborative Tools	Gitlab, Bitbucket, Jira
Workflow and Automation	Windmill
Application Deployment	FastAPI, Docker, Harbor, Kubernetes, Django
IoT Platform	PTC ThingWorx