

### About me

My research focuses on core areas of computer science, specifically heuristic search and automated planning, with strong connections to urban computing, the Internet of Things, and robotics. During my PhD research, I developed high-performance algorithms for path planning in various environments. This experience gives me a deep understanding of complex planning algorithms, creative thinking to improve them, and a broader view of techniques in the AI.

Beyond research, I have also been involved in a diverse range of software projects. These experiences have equipped me with excellent engineering skills, including proficiency in implementation, problem-solving, and data analysis. As a software developer, I am proficient in C++ and Python and specialise in high-performance computing, low-level optimisation (cache-aware, SIMD, etc.), and Linux-based platforms.

### Research Interests

Other areas that interest me are multi-agent path planning, traffic optimisation, and general problem-solving techniques such as constraint programming, mixed integer programming, and local search. Additionally, I am open to modern techniques for data-driven tasks, such as predict+optimisation and machine learning.

### Education

2019–2023 : **PhD, Computer Science**, Monash University, Melbourne, Australia.

Supervisors: Daniel Harabor, Peter Stuckey

Dissertation title: *Improving Pruning and Compression Techniques in Path Planning*

2016–2018 : **Master in Information Technology**, Monash University, Melbourne, Australia.

Supervisors: David Taniar, Daniel Harabor

Dissertation title: *Fast Obstacle Spatial Query Processing on Navigation Mesh*

2010–2014 : **Bachelor in Art of Recording**, Xidian University, Xi'an China.

### Research Assistant Experience

04/2023 : **Battery on wheels**, Urban Computing Lab, to present.

Supervisor: Prof. Muhammad Aamir Cheema, Faculty of IT, Monash University

- Developing an efficient algorithm for sequential decision-making (charge/discharge) that takes into account both economic and ecological objectives for electric vehicles within a given trip plan.

- Skills: *Combinatorial Optimisation, Modelling, Python, MiniZinc, Gurobi*

10/2022 : **Time-dependent oracle for route planning**, Optimisation Group, 5 months.

Supervisor: Dr. Daniel Harabor, Faculty of IT, Monash University

- Developing a route planning software that is aware of real-time traffic conditions for the VIC Transportation Department and deploying it to a distributed system.

- It is a continuing project of *Customised shortest paths using a distributed reverse oracle (SoCS2021)*.

- Skills: *C++, Parallel Computing, Distributed System*

06/2021 : **Grid-based Pathfinding Competition**, Optimisation Group, 1 year.

Supervisor: Dr. Daniel Harabor, Faculty of IT, Monash University

- Developing dataset, solution validator and management tools for the upcoming GPPC (Grid-based Pathfinding Competition)

- Skills: *C++, Python, Shell Script (bash), Docker*

- 03/2017 : **Improving Constraint Programming Model by Log Analysis**, *Optimisation Group*, 4 months.  
 Supervisor: Dr. Guido Tack, *Faculty of IT, Monash University*  
 • Applying data mining to semi-structured logs generated by an optimisation solver to extract underlying information for the purpose of improving the model.  
 • Skills: *Data Mining, Constraint Programming, Python*
- 09/2016 : **Immersive Data Visualisation**, *SensiLab*, 5 months.  
 Supervisor: Dr. Tim Dwyer, *Faculty of IT, Monash University*  
 • Developing software to visualise 3D data points in virtual reality (VR) with interactive capabilities.  
 • Skills: *Unity, C#, Virtual Reality*
- 07/2016 : **Constraint Programming Profiler Visualisation**, *Optimisation Group*, 2 months.  
 Supervisor: Dr. Guido Tack, *Faculty of IT, Monash University*  
 • Profiling an optimisation model typically involves inspecting the search tree, which may contain millions of nodes. I have developed an efficient algorithm to reduce the rendering time of the visualiser from 200ms to 15ms, making it applicable and ensuring smooth operation with large datasets.  
 • Skills: *Constraint Programming, C++, Qt, Visualisation*

## Non-academic Projects

- 01/2021 : **Online Shopping Packing Optimisation**, *Consulting*.  
 • **Background** A business owner wanted to incorporate a "packaging recommendation" feature into their online shopping app for retailers, aiming to reduce delivery costs while reducing the need for manual intervention. In this application, numerous items were associated with various constraints and pricing policies. A team of software developers attempted to address the issue using an "if-then-else" approach but ultimately failed, resulting in an expenditure of 200k AUD, largely due to the long-tail nature of such applications.  
 • **Solution** My friend took over the project and consulted with me. From an optimiser's perspective, it's a small-scale bin-packing problem that has been well-studied. I quickly implemented a prototype, resulting in a satisfying and robust solution.  
 • Skills: *Combinatorial Optimisation, Modelling*
- 06/2018 : **Melbourne Datathon**, *PTV*, 3 months.  
 • Applying data mining on the PTV dataset of 1.8 billion Myki touch on/off  
 • **Highlight** I extracted some commuting patterns, which can be a guidance for better replacement bus plan and building new railways.  
 • Skills: *Item-set mining, Python (pandas, numpy), AWS*
- 02/2014 : **Backend Engineer**, 18 months.  
 • Building a user management backend for online business retailer.  
 • **Highlight** The main challenge lies in access control for a "long-tail" scenario, where a user may have multiple roles requiring numerous similar APIs to handle all possible combinations. To address this in an organised manner, I implemented a decorator at the backend, leveraging the built-in capabilities of *Flask* to automatically handle requests by a single API.  
 • Skills: *Python, Flask, AWS*

## Publications

### Conference

- 2023 **Shizhe Zhao**, Daniel Harabor, and Peter J. Stuckey. Reducing redundant work in jump point search. In *Proceedings of the 16th International Symposium on Combinatorial Search, SOCS 2023*. AAAI Press, 2023.
- 2023 Jinchun Du, Bojie Shen, **Shizhe Zhao**, Muhammad Aamir Cheema, and Adel N. Toosi. Efficient object search in game maps. In *Proceedings of International Joint Conference on Artificial Intelligence, IJCAI*, 2023.
- 2021 Arthur Maheo, **Shizhe Zhao**, Afzaal Hassan, Daniel Damir Harabor, Peter Stuckey, and Mark Wallace. Customised shortest paths using a distributed reverse oracle. In *Proceedings of the Eleventh International Symposium on Combinatorial Search, SOCS*, 2021.

- 2020 **Shizhe Zhao**, Mattia Chiari, Adi Botea, Alfonso Gerevini, Daniel Harabor, Alessandro Saetti, and Peter J. Stuckey. Bounded suboptimal path planning with compressed path databases. In Nir Lipovetzky, Eva Onaindia, and David Smith, editors, *Proceedings of the 30th International Conference on Automated Planning and Scheduling*. AAAI Press, 2020.
- 2019 Mattia Chiari, **Shizhe Zhao**, Adi Botea, Alfonso Gerevini, Daniel Harabor, Alessandro Saetti, Matteo Salvetti, and Peter J. Stuckey. Cutting the size of compressed path databases with wildcards and redundant symbols. In Nir Lipovetzky, Eva Onaindia, and David Smith, editors, *Proceedings of the 29th International Conference on Automated Planning and Scheduling*, pages 106–113. AAAI Press, 2019.
- 2018 **Shizhe Zhao**, David Taniar, and Daniel Damir Harabor. Fast k-nearest neighbor on a navigation mesh. In Vadim Bulitko and Sabine Storandt, editors, *Proceedings of the Eleventh International Symposium on Combinatorial Search, SOCS 2018, Stockholm, Sweden - 14-15 July 2018*, pages 124–132. AAAI Press, 2018.
- 2018 **Shizhe Zhao**, Daniel D Harabor, and David Taniar. Faster and more robust mesh-based algorithms for obstacle k-nearest neighbour. *arXiv preprint arXiv:1808.04043*, 2018.

## --- Honors & Awards

- 2016 IEEEExtreme Programming Competition, World Top 5
- 2016 International Collegiate Programming Contest (ACM/ICPC) South Pacific Ocean Regional Final, 7th
- 2016 International Collegiate Programming Contest (ACM/ICPC) South Pacific Ocean subregional, 2nd
- 2013 International Collegiate Programming Contest (ACM/ICPC) Asia Invitational Contest (Nanjing, China), Gold
- 2013 Math Contest in Modelling (MCM/ICM), Honorable Mention
- 2012 International Collegiate Programming Contest (ACM/ICPC) Asia Regional Contest (Changchun, China), Bronze

## --- Position of Responsibility

**Conference reviewer**, *ICAPS*, *AAAI*, *AAMAS*, *SoCS*.

- 2020–2021 **Organizer and Problem Setter**, *Digital Health Competition*.
- 2019–2021 **Coach**, *Competitive Programming Group*, Monash University.
- 2019–2020 **Organizer and Problem Setter**, *Monash Collegiate Programming Contest (MCPC)*.

## --- Teaching

- 2019–2021 **FIT3155: Advance Algorithm and Data Structure**, *Teaching Assistant*, Monash University.