# Tin Yiu Lai

Australian Citizen

+61 420 894 010 ◇ oscar@tinyiu.com ◇ soraxas ◇ tin ◇ cs.tinyiu.com

## Personal Statement

I am an enthusiastic individual who persuades to exceed expectations. Collaboration and working as a team always help me to think from new angles. I am interested in solving complex challenges while developing elegant solutions and algorithms. The world of abstract thinking brings the beauty of simplicity. To me, engineering is about simplifying complexity.

## Education

**Doctor of Philosophy** *in Computer Science* — Mar 2018 – Jun 2022
*Artificial Intelligence, Machine Learning and Robotics* — *The University of Sydney*

- ▷ Doctoral thesis on—*Robot Learning and Planning with a Probabilistic Perspective*
- ▷ Research interests include statistical machine learning techniques, multiagent systems, motion planning and probabilistic predictions with applications in robotics

**Bachelor of Science *in Computer Science***, *combined with* — Mar 2013 – Nov 2017
**Bachelor of Engineering *in Structural*** *(Honours Class I)* — *The University of Sydney*

- ▷ Computer Science major core studies included:
  - Algorithms & Data structures
  - Computational Complexity
  - Information Theory
  - Formal Language Theory
  - Object-Oriented Design
  - Artificial Intelligence
- ▷ Civil Engineering specialised in *Structural*, core studies included:
  - Finite Element Analysis
  - Steel Structural Behaviour
  - Geotechnical Techniques
  - Partial Differential Equations
  - Fluid Behaviour
  - Reinforce Concrete Design

**Cherrybrook Technology High School**, Cherrybrook, NSW 2126, Australia — Jan 2006 – Dec 2012

HSC Subjects in:
- English
- Engineering
- Mathematics
- Mathematics Ext.1
- Japanese
- Chemistry
- Physics

- ▷ Rank 1st in school in *Maths., Engineering.* HSC Band 6/E4 in in *Maths., Maths. Ext. 1, Engineering, Japanese*

## Work & Experience

**Fait Corporation Pty Ltd** — Feb 2024 – Present
*Chief of Autonomy* — *Brisbane, Australia*

· Design autonomy system architecture for eVTOL aircraft, including vision, trajectory planning, control and optimisation

**Mission Systems Pty Ltd** — Jun 2022 – Jan 2024
*Computer and Machine Learning Scientist* — *Sydney, Australia*

· Design autonomy algorithms for defence-related robotics systems; applying ML in optimising for mission objectives

**The University of Sydney Business School** — Feb 2022 – Jan 2024
*Business Analytic Teaching Assistant* — *Sydney, Australia*

· Organise teaching materials on: *Time Series and Forecasting*, *Machine Learning and Data Mining in Business*, etc.

**Shoal Group Pty Ltd** — Dec 2021 – Jul 2022
*Machine Learning Engineer* — *Canberra, Australia*

· Systematic analysis of using simulation derived synthetic SONAR data from AUVs for underwater objection detection

**Department of Defence – Defence Innovation Network** — Dec 2021 – Apr 2022
*Shoal Group Machine Learning PhD Intern* — *Canberra, Australia*

· Initiative of the NSW Gov. with the Defence Science and Technology (DST) Group from the Australian Department of Defence, to utilise STEM PhD students' research skills on defence related projects

**School of Computer Science, University of Sydney** Jul 2019 – Jan 2024
*Computer Science Academic Staff* *Sydney, Australia*
· Teach, provide guidance, supervise exams, explain & answer questions on capstone projects and data science subjects

**The University of Sydney Library** Aug 2018 – Jun 2022
*Peer Learning Advisor* *Sydney, Australia*
· Provide peer to peer support, facilitate workshops, services, forums and online communities to engage and help students; prompt innovation technologies, e.g., 3D printer/scanner, CNC machine, vinyl cutter, recording studio, VR

**National Institute of Informatics (NII)** Jan 2019 – Mar 2019
*Invited Researcher, Unmanned aircraft system Traffic Management (UTM) lab* *Tokyo, Japan*
· Invited to develop a deep learning based computer vision search & rescue and surveillance model using embedded hardware
· Developed a real-time embedded model for simultaneous human detection and activity recognition from UAVs

**University of Sydney – Indigenous Tutorial Assistance Scheme (ITAS)** 2016 – 2019 (Seasonal)
*Indigenous Tutorial Assistance Scheme Tutor* *Sydney, Australia*
· Support indigenous students on subject concepts and exams—an academic initiative by Commonwealth Government

**AECOM** Dec 2016 – Feb 2017
*Geotechnical Intern* *138 Shatin Rural Committee Road, Hong Kong*
· Site monitoring on ELS; verifies force balance/rotational moments within struts;designs multi-stages excavation
· Involved in projects such as HK Metro Station Excavation, HK Airport Sub-sea Tunnel monitoring, etc.

**Freelance** Apr 2014 – Jan 2018 (Seasonal)
*Freelance Software Developer* *Remote / Sydney, Australia*
· Designs and maintains eBusiness service with SQL backend and web frontend; devised Java-based Android app for events

**University of Sydney – Club & Societies** Mar 2013 – Nov 2017
*Voluntary uni club executive* *Sydney, Australia*
· Organises, plans, and leads social activities to facilitate student engagement; supervises general meeting and AGM
· Involved in projects such as HK Metro Station Excavation, HK Airport Sub-sea Tunnel monitoring, etc.

**Meinhardt Group (C&S)** Dec 2015 – Feb 2016
*Structural Team Trainee* *33-35 Wong Chuk Hang Rd, Hong Kong*
· Amends Building Department contracts; modifies CADs; verifies building standards; models kinetic collision impacts
· Involved in projects such as Ocean Park stadium tender, Boiler upgrades, HK airport hangar design

**Self Employed** Nov 2012 – Aug 2013
*Private Tutor for High School students* *Sydney, Australia*
· Develops lessons and activities on Maths & Physics for improving students' study skills and test scores

## Awards, Grants & Scholarships

**University of Sydney Completion Stipend Scholarship** Jul 2022
*Scholarships Office* *Commonwealth Gov. of Australia & University of Sydney*
· Established to support HDR students to complete their research studies, funded by the Commonwealth Gov. of Australia

**Defence Innovation Network Internship Scholarship** Dec 2021 – Apr 2022
*Defence Innovation Network (DIN)* *Defence Science and Technology (DST) Group & NSW Gov.*
· Scholarship that funds PhD students who are partnered in the DIN Internship program—a university-led initiative to enhances NSW capacity on Defence R&D, for incorporating latest innovations within academics

**Paulette Isabel Jones Completion Stipend Scholarship** Dec 2021
*Scholarships Office* *University of Sydney*
· A gift from the late Paulette Isabel Jones to support Higher Degree by Research students in their research endeavour

**Postgraduate Research Support Scheme (PRSS)** June 2019; July 2020; Nov 2021
*Faculty of Engineering – Higher Degree Research Administration Centre* *University of Sydney*

· Provide direct support for postgraduate students on conference expenses, field costs, publication costs, etc.

**University of Sydney Postgraduate Awards (UPA)** Mar 2018
*Scholarships Office* *University of Sydney*
· Designed to assist with general living costs and are awarded to students of exceptional research potential to undertake a higher degree by research at the university

**Research Training Program (RTP) Scholarships** Mar 2018
*Department of Education and Training* *Commonwealth Gov. of Australia*
· RTP fees offset support and pays for the tuition fees of a higher degree by research (HDR) student

**University of Sydney Honour Roll** 2017
*2017 University of Sydney Honour Roll* *University of Sydney*
· Awarded to students of distinction through the conferral of graduates honours from the Faculty of Engineering and Information Technologies

**School of Information Technologies High Honour Roll** Apr 2016
*School of IT 2016 Awards Ceremony* *University of Sydney*
· Awarded to individuals with distinguishing results in IT unit of studies in 2015

**School of Civil Engineering Paddle Pop Stick Bridge Competition** Jun 2014
*School of Civil Engineering (joint sponsored by Robert Bird Group & Talis Civil Pty Ltd)* *University of Sydney*
· Competition on designing paddle pop stick bridges with maximum structural efficiency (best strength-to-mass ratio)
· Won competition with cash-prize: 2$^{nd}$ Prize $450 (overall) + Best on Afternoon $100 (class division)

**Distinguished Achievers Award** 2012
*2012 Higher School Certificate (HSC)* *NSW Board of Studies, Australia*
· Certificates for *Distinguish Achievement* (highest level of performance) in HSC: awarded for (i) *Mathematics*, (ii) *Mathematics Extension 1*, (iii) *Engineering Studies*, and (iv) *Japanese Beginners*

**High School Academic Award** 2012
*Year 12 Academic Award Ceremony* *Cherrybrook Technology High School*
· Academic Awards for ranking 1$^{st}$ in (i) *Mathematics*, and (ii) *Engineering Studies* in the entire school

## Academic Works

Tin Lai. Interpretable Medical Imagery Diagnosis with Self-Attentive Transformers: A Review of Explainable AI for Health Care. *Explainable Artificial Intelligence (XAI) in Biomedical Research and Clinical Practice,* Special Issue of *BioMedInformatics*, 4(1):113–126, 2024 [ article, arXiv ]

Tin Lai, Yukun Shi, Zicong Du, Jiajie Wu, Ken Fu, Yichao Dou, and Ziqi Wang. Supporting the Demand on Mental Health Services with AI-Based Conversational Large Language Models (LLMs). *Deep Learning Methods and Application for Bioinformatics and Healthcare,* Special Issue of *BioMedInformatics*, 4(1):8–33, 2024 [ article, arXiv ]

Tin Lai, Farnaz Farid, Abubakar Bello, and Fariza Sabrina. Ensemble Learning based Anomaly Detection for IoT Cybersecurity via Bayesian Hyperparameters Sensitivity Analysis. *Computing Research Repository (CoRR)*, 2023 [ arXiv ]

Tin Lai. Real-Time Aerial Detection and Reasoning on Embedded-UAVs in Rural Environments. *IEEE Transactions on Geoscience and Remote Sensing*, 61:1–7, 2023 [ article, arXiv ]

Xiaoting Xu, Tin Lai, Sayka Jahan, Farnaz Farid, and Abubakar Bello. A Machine Learning Predictive Model to Detect Water Quality and Pollution. *Machine Learning Perspective in the Convolutional Neural Network Era,* Special Issue of *Future Internet*, 14(11):324, 2022 [ article ]

Tin Lai. Discover Life Skills for Planning as Bandits via Observing and Learning How the World Works. In *IEEE/RSJ Proceedings of The International Conference on Intelligent Robots and Systems (IROS)*, pages 11360–11365. IEEE, 2022 [ article, arXiv ]

Tin Lai and Fabio Ramos. LTR*: Rapid Replanning in Executing Consecutive Tasks with Lazy Experience Graph. In *IEEE/RSJ Proceedings of The International Conference on Intelligent Robots and Systems (IROS)*, pages 8784–8790. IEEE, 2022 [ article, arXiv ]

Tin Lai. A Review on Visual-SLAM: Advancements from Geometric Modelling to Learning-Based Semantic Scene Understanding using Multi-Modal Sensor Fusion. *Simultaneous Localization and Mapping for Mobile Robot Navigation,* Special Issue of *Sensors*, 22(19):7265, 2022 [ article, arXiv ]

Hansel Hu, Tin Lai, and Farnaz Farid. Feasibility study of constructing a screening tool for adolescent diabetes detection applying machine learning methods. *Applications of Body Worn Sensors and Wearables*, Special Issue of *Sensors*, 22(16):6155, 2022 [ article ]

Weiming Zhi, Tin Lai, Lionel Ott, Edwin Bonilla, and Fabio Ramos. Learning Efficient and Robust Ordinary Differential Equations via Invertible Neural Networks. In *Proceedings of the 39th International Conference on Machine Learning (ICML)*, volume 162 of *Proceedings of Machine Learning Research*, pages 27060–27074. PMLR, 2022 [ article, arXiv, video ]

Weiming Zhi, Tin Lai, Lionel Ott, and Fabio Ramos. Diffeomorphic Transforms for Generalised Imitation Learning. In *Proceedings of The 4th Annual Learning for Dynamics and Control Conference (L4DC)*, volume 168 of *Proceedings of Machine Learning Research*, pages 508–519. PMLR, 2022 [ article ]

Tin Lai, Weiming Zhi, Tucker Hermans, and Fabio Ramos. L4KDE: Learning for KinoDynamic Tree Expansion. *Computing Research Repository (CoRR)*, 2022 [ arXiv ]

Tin Lai, Weiming Zhi, Tucker Hermans, and Fabio Ramos. Parallelised Diffeomorphic Sampling-based Motion Planning. In *Proceedings of the 5th Conference on Robot Learning (CoRL)*, volume 164 of *Proceedings of Machine Learning Research*, pages 81–90. PMLR, 2022 [ article, arXiv ]

Tin Lai and Fabio Ramos. Adaptively Exploits Local Structure with Generalised Multi-Trees Motion Planning. *IEEE Robotics and Automation Letters (RA-L)*, 7(2):1111–1117, 2022 [ article, arXiv ]

Xipei Wang, Haoyu Zhang, Yuanbo Zhang, Meng Wang, Jiarui Song, Tin Lai, and Matloob Khushi. Learning Non-Stationary Time-Series with Dynamic Pattern Extractions. *IEEE Transactions on Artificial Intelligence (TAI)*, 3(5):778–787, 2022 [ article, arXiv ]

Tin Lai. `sbp-env`: A python package for sampling-based motion planner and samplers. *Journal of Open Source Software*, 6(66):3782, 2021 [ article, arXiv ]

Tin Lai and Fabio Ramos. PlannerFlows: Learning Motion Samplers with Normalising Flows. In *IEEE/RSJ Proceedings of The International Conference on Intelligent Robots and Systems (IROS)*, pages 2542–2548. IEEE, 2021 [ article, arXiv ]

Weiming Zhi, Tin Lai, Lionel Ott, and Fabio Ramos. Trajectory Generation in New Environments from Past Experiences. In *IEEE/RSJ Proceedings of The International Conference on Intelligent Robots and Systems (IROS)*, pages 7911–7918. IEEE, 2021 [ article, arXiv ]

Weiming Zhi, Tin Lai, Lionel Ott, and Fabio Ramos. Anticipatory Navigation in Crowds by Probabilistic Prediction of Pedestrian Future Movements. In *Proceedings of The International Conference on Robotics and Automation (ICRA)*, pages 8459–8464. IEEE, 2021 [ article, arXiv ]

Tin Lai and Philippe Morere. Robust hierarchical planning with policy delegation. *Computing Research Repository (CoRR)*, 2020 [ arXiv ]

Tin Lai, Philippe Morere, Fabio Ramos, and Gilad Francis. Bayesian local sampling-based planning. *IEEE Robotics and Automation Letters (RA-L)*, 5(2):1954–1961, April 2020 [ article, arXiv ]

Tin Lai, Weiming Zhi, and Fabio Ramos. Occ-traj120: Occupancy maps with associated trajectories. *Computing Research Repository (CoRR)*, 2019 [ arXiv ]

Rúben Geraldes, Artur Gonçalves, Tin Lai, Mathias Villerabel, Wenlong Deng, Ana Salta, Kotaro Nakayama, Yutaka Matsuo, and Helmut Prendinger. UAV-based situational awareness system using deep learning. *IEEE Access*, 7:122583–122594, 2019 [ article, video ]

Tin Lai, Fabio Ramos, and Gilad Francis. Balancing global exploration and local-connectivity exploitation with rapidly-exploring random disjointed-trees. In *Proceedings of The International Conference on Robotics and Automation (ICRA)*, pages 5537–5543. IEEE, 2019 [ article, arXiv, video ]

Faham Tahmasebinia, Marjo Niemelä, Sanee Ebrahimzadeh Sepasgozar, Tin Lai, Winson Su, Kakarla Reddy, Sara Shirowzhan, Samad Sepasgozar, and Fernando Marroquin. Three-dimensional printing using recycled high-density polyethylene: Technological challenges and future directions for construction. *Buildings*, 8(11):165, 2018 [ article ]

Tin Lai. Numerical modelling of structural behaviour of continuously reinforced concrete pavement. Bachelor's Honours Thesis, The University of Sydney, Oct 2017 [ engrXiv ]

## Personal Strengths

**Key Skills**
Critical thinking in approaching challenges
Quick adaptation in unseen environment
Visualise complex problem w/ abstract thinking

**Language**
Bilingual in *English, Cantonese*
Basic in *Mandarin, Japanese*

## Technical Strengths

| | |
|---|---|
| **Computer Languages** | C, C++, Python, FORTRAN, Java, Rust, Go, LaTeX, PostgreSQL, HTML, PHP, jQuery, JavaScript, CoffeeScript, TypeScript, MATLAB, R, VBA, Shell Scripts (`POSIX shell/bash/fish/DOS batch`), Processing, Lisp, Haskell, ProLog, ANTLR4 |
| **Professional Applications** | AutoCAD, MatLab, Google Sketchup, Weka, Strand7, Abaqus FEA, RAPT, ETAB, SAFE, PLAXIS, SLOP/W, SEEP/W, Navisworks, Visual Studio, Robot Operating System (ROS) framework, MOOS-IvP |
| **General Software & Tools** | Microsoft Office suite, iWork, Adobe Photoshop/Illustrator |
| **Operating Systems** | Linux variants, Windows |
| **Miscellaneous** | Software configuration management, strong verbal and written communication skills, excellent troubleshooting and debugging skills, exceptional problem solving skills |