Yingcong Tan

https://yingcongtan.github.io/ Google Scholar/Yingcong Tan Github/Yingcong Tan

EDUCATION

Postdoctoral Fellow in Artificial Intelligence and Operations Research 2022-2023
University of Toronto, Toronto, Ontario, Canada
Advisor: Dr. Christopher Beck

Postdoctoral Fellow in Inverse Optimization and Active Learning 2021-2022
Concordia University, Montréal, Québec, Canada
Advisor: Dr. Daria Terekhov, Dr. Andrew Delong

Ph.D. in Industrial Engineering 2017-2021
Concordia University, Montréal, Québec, Canada
Advisor: Dr. Daria Terekhov, Dr. Andrew Delong

M.Eng. in Industrial Engineering 2015 - 2016
Concordia University, Montréal, Québec, Canada

Bachelor of Applied Science in Engineering Science 2007 - 2012
University of Toronto, Toronto, Ontario, Canada

AWARDS & SCHOLARSHIPS

Concordia Accelerator Award, *Concordia University* ($5,000) 2020

Concordia Merit Scholarship, *Concordia University* ($10,000) 2018-2019

Best Paper Award, *GERAD* (Scientific Writing Student Competition) 2018

Conference and Exposition Award, *Concordia University* ($3,000) 2018-2020

Student Travel Scholarship, Canadian Artificial Intelligence Association ($500) 2018

F.A. Gerard Prize, *Concordia University* (Graduation Prize) 2017

Power Corporation of Canada Grad. Fellowship, *Concordia University* ($5,000) 2017

REFERRED CONFERENCE PUBLICATION

[1] Tan, Y.*, Delong, A., & Terekhov, D. (2020). *Learning Linear Programs from Optimal Decisions.* In Neural Information Processing Systems (Spotlight paper, top 20% of the accepted papers, top 5% of the submitted papers).

[2] Tan, Y.*, Delong, A., & Terekhov, D. (2019). *Deep Inverse Optimization.* Integration of Constraint Programming, Artificial Intelligence, and Operations Research, CPAIOR 2019, Thessaloniki, Greece, June 4-7 2019, (pp. 540-556).

[3] Tan, Y.*, & Terekhov, D. (2018). *Logic-Based Benders Decomposition for Two-Stage Flexible Flow Shop Scheduling with Unrelated Parallel Machines.* In Advances in Artificial Intelligence: 31st Canadian Conference on Artificial Intelligence, CAI2018, Toronto, ON, Canada, May 8-11, 2018, (pp. 60-71).

[4] Tan, Y.* (2018). *Automated Scheduling: Reinforcement Learning Approach to Algorithm Policy Learning.* Extended Abstract. In Advances in Artificial Intelligence: 31st Canadian

Conference on Artificial Intelligence, Canadian AI 2018, Toronto, ON, Canada, May 8-11, 2018, (pp. 335-338).

REFERRED JOURNAL PUBLICATION

[**5**] Marzolini, S.*, Swardfager, W., Alter, D. A., Oh, P. I., **Tan, Y.**, & Goodman, J. M. (2015). *Quality of Life and Psychosocial Measures Influenced by Exercise Modality in Patients with Coronary Artery Disease.* European Journal of Physical and Rehabilitation Medicine, 51(3), 291-299.

WORKING PAPERS

[**6**] **Tan, Y.***, Delong, A., & Terekhov, D.. *A Comparison of Duality-Based Models for Inverse Linear Optimization.*

[**7**] Bianco, G. L.*, Zhang, J., **Tan, Y.**, & Beck, C. (2023). *Solving Vehicle Routing Problems with QUBO Hardware.*

[**8**] Zhang, J.*, **Tan, Y.***, Bianco, G. L., Takanaga Y., Takita Y., & Beck, C.. *Route Schedule Decomposition and Large Neighborhood Search for Pickup and Delivery Problem with Transfer Scheduling.*

[**9**] Pichugina, O.*, **Tan, Y.***, & Beck, C.. *Deriving Compact QUBO Models via Multilevel Constraint Transformation.*

[**10**] Pichugina, O.*, **Tan, Y.***, & Beck, C.. *Quadratic Unconstraint Binary Optimization Models for Solving SAT Problems.*

[**11**] Zheng L.*, **Tan, Y.**, & Beck, C.. *Learning the Discount Factor in Inverse Reinforcement Learning with Applications in Animal Behavior and Vehicle Routing Problems.*

[**12**] **Tan, Y.***, Bianco, G. L., Tao C., & Beck, C.. *Mathematical Programming Models for Recurring Multi-Airplane Seat Replacement Planning Problems with Re-configurable Passenger and Cargo Capacities.*

RESEARCH EXPERIENCE

Postdoctoral Fellow Aug. 2022 - Aug. 2023
TIDEL Lab, University of Toronto, Toronto, Ontario, Canada
Advisor: Dr. J. Christopher Beck

My work primarily focused on three areas: complex vehicle routing problems, inverse reinforcement learning and quadratic unconstrained binary optimization (QUBO) models.

- In collaboration with a post-doc, a Ph.D. student, and industrial partners, study the complex vehicle routing problems, particularly the pickup-and-delivery problem with transfer scheduling. Developed a decomposition-based exact method and a large neighbourhood search algorithm (see [8]).
- In collaboration with two post-docs, investigate the use of quadratic unconstrained binary optimization (QUBO) models and a specialized computing architecture, namely the Fujitsu Digital Annealer in solving combinatorial optimization problems, such as *vehicle routing problems* (VRP) and *boolean satisfiability problems* (SAT) (see [7], [9], [10]).
- Co-supervise a master student on *Learning the Discount Factor in Inverse Reinforcement*

Learning with Application to Animal Behaviour (see [11]).

- Motivated by ongoing research projects at TIDEL, initiate a project to study the seat replacement problem, which adjusts the passenger and cargo transportation capacities by adding/removing seats to serve remote communities in northern Canada. In particular, I developed a mixed-integer programming model, two constraint programming models and a dynamic programming model (see [12]) and analyzed their performances experimentally.

Postdoctoral Fellow Sep. 2021 - Jul. 2022
Concordia University, Montréal, Québec, Canada
Advisor: Dr. Daria Terekhov, Dr. Andrew Delong

- In collaboration with Dr. Ivan Contreras, Dr. Andrew Delong, Dr. Daria Terekhov, and one master student, we studied the Amazon Last Mile Delivery Research Challenge and formulated it as an inverse travelling salesman problem with a novel bi-level formulation.
- Following my Ph.D. thesis, I investigate the use of active learning in the pipeline of solving inverse optimization problems in two directions: 1). reduce the amount of training data needed, and 2). sample training data with higher quality.

Research Intern Apr. - Aug. 2021
Zhejiang Lab, Zhejiang, China
Advisor: Zhouchen Lin, Peking University, Beijing, China

- Motivated by the problem of hyper-parameter optimization, I studied the convergence conditions of the first-order gradient methods in solving a bi-level optimization problem with a constrained upper-level problem.

Ph.D. Research Jan. 2017 - Feb. 2021
Concordia University, Montréal, Québec, Canada
Advisor: Dr. Daria Terekhov, Dr. Andrew Delong

- My Ph.D. research focused on the inverse linear optimization problem (ILOP), which aims to infer the model coefficients from (near-)optimal solutions. By framing it as a learning problem, we developed gradient-based algorithms with four different ways of computing the gradients, including a closed-form expression (see [1], [2]).

PROFESSIONAL EXPERIENCE

Senior Product Developer in Operations Research Sept. 2023 - present
IBS Software, Montréal, Québec, Canada

Work in the OR development team for the crew rostering scheduling software for the aviation industry (https://www.ad-opt.com/crew-rostering/). The primary responsibility is to facilitate ongoing product development tasks, including but not limited to providing prompt responses to clients' bug reports, providing agile modification on existing products to respect changes in regulation policies and employment agreements, and developing and implementing new features to satisfy client-specific needs.

Project Coordinator Feb. 2013 - Aug. 2014
Cardiovascular Rehabilitation and Prevention Program
Toronto Rehabilitation Institute, Toronto, Ontario, Canada

Facilitated daily administration and management tasks and ongoing program development to ensure the post-treatment caring service is flexible and easy to access for cardiovascular

patients, including administration tasks, event planning, volunteer recruiting, training and supervision, and patient communications.

RESEARCH PRESENTATION

Farsighted or myopic? Evaluating reward discount factors to explain and predict animal decision-making.

Teichroeb JA, Zheng L, Tan Y, Arseneau-Robar TJM & Beck JC. Animal Behavior Society, London, Ontario, June 25-29, 2024.

A Comparison of Duality-Based Models for Inverse Linear Optimization.

Tan, Y., Delong, A., & Terekhov, D. Canadian Operational Research Society conference, Montréal, Québec, Canada, May 29-31, 2023.

Learning Linear Programs: Inverse Optimization as a Form of Machine Learning.

Tan, Y. IE Seminar series, University of Toronto, March 2023.

Learning Linear Programs from Optimal Decisions.

Tan, Y., Terekhov, D. & Delong, A. Conference on Neural Information Processing Systems, December 6-12, 2020.

Deep Inverse Optimization.

Tan, Y., Delong, A., & Terekhov, D. International Conference on the Integration of Constraint Programming, Artificial Intelligence, and Operations Research, Thessaloniki, Greece, June 4-7, 2019.

Tan, Y., Delong, A., & Terekhov, D. Journées de l'Optimisation, Montréal, Québec, Canada, May 13-15, 2019.

Decomposition-Based Exact Algorithms for Two-Stage Flexible Flow Shop Scheduling with Unrelated Parallel Machines.

Tan, Y., & Terekhov, D. Canadian Operational Research Society conference, Halifax, Nova Scotia, Canada, June 4-7, 2018.

Tan, Y., & Terekhov, D.. Canadian Conference on Artificial Intelligence, Toronto, ON, Canada, May 8-11, 2018.

Automated Scheduling: Reinforcement Learning Approach to Algorithm Policy Learning.

Tan, Y. Canadian Conference on Artificial Intelligence, Toronto, ON, Canada, May 8-11, 2018.

TEACHING EXPERIENCE

Teaching Certificates

- **Perspective Professor In Training Program** 2023
  University of Toronto, Toronto, Ontario, Canada
- **Graduate Seminar in University Teaching** 2022
  Concordia University, Montréal Québec, Canada

Guest Lecturer 2021

Concordia University, Montréal, Québec, Canada

Course title: INDU6611 (Applied Industrial System Analytics).

Lecture title: *Neural Networks and Recent Research in the Integration of Neural Networks*

and Optimization Models.

Teaching Assistant 2017-2020
Concordia University, Montréal, Québec, Canada

- INDU 480 Cases in Industrial Engineering
  Department of Mechanical, Industrial and Aerospace Engineering
- COMP6321 Machine Learning
  Department of Computer Science and Software Engineering
- INDU6231 Scheduling Theorem
  Department of MEechanical, Industrial and Aerospace Engineering

MENTORING

Master Thesis
Litong Zheng, *University of Toronto, Toronto, Ontario, Canada*

Thesis: *Learning the Discount Factor in Inverse Reinforcement Learning with an Application to Animal Behaviour.*
Co-supervision with Prof. Christopher Beck.
Graduated in Sept. 2023.

Undergraduate Research Project
Nima Sajedi, *Concordia University, Montréal, Québec, Canada*

Project: *An Analysis of Inverse Optimization Methods for Parametric Linear Problems.*
Co-supervision with Prof. Daria Terekhov.
Received A+ in ENGR412 (Honours Research Project)

ACADEMIC SERVICE

Academic Reviewer

Transportation Research Part b	2021
Journal of Computers & Operations Research	2019
International Journal of Production Research.	2017

Graduate Student Committee 2016 - 2020
Dept. of Mechanical, Industrial and Aerospace Engineer
Concordia University, Montréal, Quebec, Canada

- Organized 30+ graduate seminars (30+ talks); 10+ department-wide networking events and 3 Ph.D. Student Poster Competitions
- Completed several funding applications (+10K granted).

Team Lead of Question Creation & Automation 2016 - 2019
The Operations Research Challenge (TORCH)
Concordia University, Montréal, Quebec, Canada

TORCH is an annual one-day competition for high school students to solve real-world problems in operations research. It is co-hosted by graduate students from Concordia University, University of Toronto and University of Waterloo.

- Co-led a group of graduate students at Concordia University, the University of Toronto and the University of Waterloo to develop questions for the TORCH competition.

- Led a group of 3-4 graduate students at Concordia University to develop a Python script to validate the submitted solutions automatically.

Clinic Exercise, & Research Volunteer 2010-2014
Cardiovascular Prevention and Rehabilitation Program
Toronto Rehabilitation Institute, Toronto, Ontario, Canada

REFERENCE

Dr. Christopher Beck, Postdoctoral Fellow Supervisor
Professor, University of Toronto
jcb@mie.utoronto.ca

Dr. Daria Terekhov, Ph.D. and Postdoctoral Fellow Supervisor
Former Associate Professor, Concordia University
dterekho@gmail.com

Dr. Andrew Delong, Ph.D. and Postdoctoral Fellow Supervisor
Former Assistant Professor, Concordia University
andrew.delong@gmail.com

CITIZENSHIP

I am a permanent resident of Canada