

Ziyue LI (Bonald)

Ph.D. in Data Science and Machine Learning
Department of Industrial Engineering and Decision Analytics (IEDA)
The Hong Kong University of Science and Technology
Email: zlibn@connect.ust.hk
Website: <https://bonaldli.github.io>
Tel: +852 69964596

Education

Ph.D. in Industrial Engineering and Decision Analytics *09.2017-09.2021*
The Hong Kong University of Science and Technology Hong Kong
- **Concentration:** Data Science; Machine learning models & algorithms; Statistics.
- **Others:** Interpretable Machine Learning, NLP, Trustworthy AI.
- **Advisor:** Prof. Fugee Tsung, collaborating with Prof. Hao Yan (Arizona State University, U.S.A), and Prof. Chen Zhang (Tsinghua University, China)

Exchanging in Mechanical and Manufacturing Engineering *2015-2015*
University of New South Wales Sydney, Australia
- China Scholarship Council (CSC) Scholarship (Distinguished)

Bachelor of Engineering in Mechanical Engineering *2013-2017*
Bachelor of Economics in Finance *2015-2017*
Xi'an Jiaotong University Xi'an, China
- GPA: 3.76/4.3 Ranking: 6th/255, Top 5%
- Outstanding Graduates Award, National Scholarship

Research Interests

My research interests focus on big data analytical methodologies for real-world problems. The goal is to build up novel models that preserve the innate data structure, and **combines the machine learning models with domain/human knowledge**, for higher accuracy, efficiency, explainability, and interpretability. My current research includes transfer learning (multi-task learning), anomaly detection, spatiotemporal big data and tensor techniques (tensor decomposition, completion), knowledge graph and topic models (NLP), and so on. Those works have been published in top-tier scientific venues (AAAI, IEEE ICDE, CASE, KDD, TKDD), awarded with best conference/student paper awards, and applied to smart mobility, NLP, and manufacturing.

Selected Awards

- **Best Applied Paper Award**, INFORMS Data Mining and Decision Analytics Workshop (2021): Finalist.
- **2nd Runners-up**, HKUST Three Minute Thesis Competition (2021).
- **Best Student Paper Award**, INFORMS Data Mining Section (2020): Finalist, selected out of 40 submissions.
- **Best Student Paper Award**, INFORMS Quality, Statistics, and Reliability (QSR) Section (2020): Finalist, selected out of 26 submissions.
- **Best Conference Paper Award**, IEEE International Conference on Automation Science and Engineering (CASE) (2020): Selected out of 500 submissions.
- **HKUST Excellent Research Award** (2017): Highly-selective.
- **1st Runners-up, Audience Award**, Hackathon@UST - Uber Smart Transportation (2018).
- **Hong Kong Ph.D. Fellowship Scholarship Award** (2017-2020): Highly-selective and prestigious, 2 recipients in IEDA.

- **National First Prize**, “Challenge Cup” National Curricular Academic Science and Technology Contest (2015): A data-driven study for land transfer in rural China (Applied Economics).

Research Experience

Artificial Intelligence & Ethics

04.2021 - 07.2021

RWTH Aachen, Germany; TU Delft, Netherlands; Politecnico di Milano, Italy.

- Research in responsible trustworthy AI for social good (algorithm fairness, diversity, non-discrimination).

Graph-regularized / Graph embedding tensor topic model 2019 - present

Keywords: interpretable ML, NLP, generative model, big data, graph-structure

- Developed high-dimensional tensor topic models (LDA, DMM model)
- Incorporated external information as graph to improve model interpretability
- Sped up learning via online variational EM algorithm with stochastic gradient

Distributed Machine Learning System @ Bell Labs Germany 2019-2020

Keywords: big data system, cloud computing, serverless machine learning

- System latency analysis and component profiling
- Designed and executed machine learning model training and inference in a serverless system, with data/model parallelism.

Tensor decomposition & completion prediction on graph data 2018 - 2020

Keywords: smart transport, big data, time-series data, spatiotemporal data, graph

- Developed tensor decomposition based prediction with 2D-ARIMA model, and low-rank tensor completion based prediction for spatiotemporal data
- Incorporated graphs structure to improve the prediction accuracy
- Adopted block coordinate descent algorithm for efficient learning

Transfer learning for anomaly detection

2017 - 2019

Keywords: small data analysis, cold-start, transfer learning, multi-task learning

- Proposed hybrid transfer learning model with parameter transfer and feature representation transfer approach
- Proposed a decomposition model for data profile to detect anomaly accurately

Conference Publications

[C1] **Z. Li**, H. Yan, C. Zhang, and F. Tsung, “‘Choose A Table’: Tensor Dirichlet Process Multinomial Mixture Model with Graphs for Passenger Trajectory Clustering”. the 36th AAAI Conference on Artificial Intelligence, 2022, *under review*.

[C2] **Z. Li**, “Tensor Topic Models with Graphs and Applications on Individualized Travel Patterns”, 2021 IEEE 37th International Conference on Data Engineering (ICDE), Crete, Greece, 2021, accepted (*oral*) and published.

- **Best Applied Paper Award**, INFORMS Data Mining and Decision Analytics Workshop 2021, **Finalist**.
- ICDE: Top-tier conference in data mining (acceptance rate 19.1%).

[C3] **Z. Li**, H. Yan, C. Zhang and F. Tsung, “Long-Short Term Spatiotemporal Tensor Prediction for Passenger Flow Profile” in IEEE 16th International Conference on Automation Science and Engineering (CASE), 2020, published.

- **Winner of IEEE CASE 2020 Best Conference Paper Award**.

[C4] **Z. Li**, N. D. Sergin, H. Yan, C. Zhang, and F. Tsung, “Tensor Completion for Weakly-Dependent Data on Graph for Metro Passenger Flow Prediction” Pro-

ceedings of the AAAI Conference on Artificial Intelligence, 2020, accepted (*oral*) and published.

- **Best Student Paper Award**, Quality, Statistics, and Reliability (QSR) Section, INFORMS 2020, **Finalist Award**.
- AAAI: Top-tier conference in machine learning, AI (acceptance rate 20.6%).

[C5] D. Li, Z. Yu, **Z. Li**, R. Zhao, “**RANG-AT&T: RoAd Network Graph Augmented Transformer for Trajectory Representation Learning**”. the 36th AAAI Conference on Artificial Intelligence, 2022, *under review*.

[C6] Z.Yu, D. Li, **Z. Li**, R. Zhao, “**Trajectory-guided Contrastive Representation Learning on Road Network Graph**”. the 36th AAAI Conference on Artificial Intelligence, 2022, *under review*.

Journal Publications

[J1] **Z. Li**, H. Yan, C. Zhang, and F. Tsung, “**Individualized Passenger Travel Pattern Multi-Clustering based on Graph Regularized Tensor Latent Dirichlet Allocation**”. Data Mining and Knowledge Discovery, Springer, *submitted*.

- **Best Student Paper Award**, Data Mining, INFORMS 2020, **Finalist Award**.

[J2] **Z. Li**, K. Zhang, H. Yan and F. Tsung, “**Profile Decomposition based Hybrid Transfer Learning for Cold-start Data Anomaly Detection**”. The ACM Transactions on Knowledge Discovery from Data (TKDD), 2021, *under review*.

[J3] **Z. Li**, H. Yan, C. Zhang and F. Tsung, “**Long-Short Term Spatiotemporal Tensor Prediction for Passenger Flow Profile**” IEEE Robotics and Automation Letters, 2020.

[J4] F. Tsung, **Z. Li**, “**Discussion of 'A novel approach to analysis of spatial and functional data over complex domains'**” Quality Engineering, 2020, published.

Working Papers

[W1] **Z. Li**, H. Yan, C. Zhang, and F. Tsung, “**Tensor Dirichlet Process Multinomial Model with Graph Embedding for Individual Passenger Clustering**,” working paper.

[W2] N. stoimenova, **Z. Li**, A. Angelucci, F. Berardinucci, “**Conceptual Exploration into the Fairness Challenges of Developing AI Systems: a Case Study on Corporate Wellness Programs**”, working paper.

[W3] M. Li, **Z. Li**, and F. Tsung, “**Spatiotemporal Attention-based Auto-Encoder for Dynamic Metro Station Clustering**,” working paper.

Teaching Experience

Teaching Assistant, MATH5470-Statistical Machine Learning (PG) *Spring, 2021*

- Took charge of tutorials covering contents of supervised learning such as regression, classification, regularization, neural networks and support vector machine; and unsupervised learning such as random forests.

Teaching Assistant, IEDA2200-Engineering Management (UG) *Spring, 2020*

- Took charge of all tutorials covering contents of production line optimization, time-series forecasting, inventory management and manufacturing strategy.

Co-instructor, IEDA3270-Quality Engineering (UG) *Spring, 2019*

- Led all lab experiments including statistics, factorial design, control charts, and regression models.

Teaching Assistant, EEMT5220-Six Sigma Quality Management (PG) *Fall, 2018*

- Took charge of all tutorials covering contents of statistical analysis, hypothesis testing, statistical process control.

Industry Experience *Researcher* *09.2021 - present*
Hong Kong Science and Technology Park, SenseTime Hong Kong

- Machine learning research in smart cities and manufacturing.

Project Manager *09.2020 - present*
Hong Kong Metro MTR Co.-HKUST R&D Project Hong Kong

- Research collaboration with MTR and Computer Science Dept, HKUST, developing an Intelligent Transport System (ITS) based on data-driven methods.

Cloud Computing Scientist (Intern) *09.2019 - 02.2020*
Nokia Bell Labs **Stuttgart, Germany**

Keywords: *cloud computing, distributed system, FaaS, machine learning system*

- Research in serverless computing, machine learning systems based on Amazon Web Service (AWS), and Bell Labs KNIX MicroFunctions.
- Conducted data transmission latency analysis and serverless system component profiling and optimization;
- Conducted serverless machine learning inference and training (regression, NLP, image recognition based on ResNet, MXNet, TensorFlow) in AWS and KNIX.

Competitions **Finalist Award in Belt & Road Justice LawTech Hackathon** *08.2018 - 10.2018*
HK Law Society Hong Kong

- Legal service recommender system based on NLP and Semantic & Cognitive analysis for domestic workers.

Top 10 in Global Big Data Competition *07.2018 - 08.2018*
JD.com Beijing, China

- Quantile boosting time-series prediction model with effective feature engineering and representation methods and improved forecast accuracy by 72%.

1st-Runners-up, Audience Award in Hackathon@UST *04.2018 - 05.2018*
Uber Smart Transportation Hong Kong

- Developed facial recognition model and integrated into vehicles to achieve facial car door unlocking, underage driving detection, and drowsy driving detection.

Invited Talks 1. **Session Chair**, "*Knowledge-integrated Data-driven Smart Transportation*" *10.2021*
Session Chair INFORMS Data Mining section 2021 Anaheim, California, U.S.A

2. **Invited Presenter**, "*Individualized Passenger Travel Pattern Multi-Clustering based on Tensor Latent Dirichlet Allocation with Graph Structure*" *11.2020*
INFORMS Annual Meeting 2020 National Harbor, Maryland, U.S.A

3. **Invited Presenter**, "*Tensor Completion for Weakly-dependent Data on Graph for Metro Passenger Flow Prediction*" *10.2019 and 01.2020*
Data Science Symposium Waseda University Tokyo, Japan
INFORMS Annual Meeting 2019 Seattle, Washington, U.S.A

4. **Invited Presenter**, "*Transfer-learning-based Anomaly Detection for Monitoring Profiles in the 'Start-up' State*" *11.2018*
INFORMS Annual Meeting 2018 Phoenix, Arizona, U.S.A

Research Grants & Collaboration	1. PI , project “Multi-stage process monitoring and optimization based on big data analytics and machine learning”, FSPM02202003 03.2021 - present
	2. PM/PI , R&D collaboration with Arizona State University, Tsinghua University in “Data-driven Smart Transportation” 11.2018 - present
	3. PI , project “Trial: A Big Data Trial Scheme for Smart Transportation Crowd Monitoring”, HK-ITT/007/19GP 09.2019 - present
	4. CO-I , project “Statistical Transfer Learning with Applications to Quality Control and Monitoring”, HK-RGC 16201718 01.2019 - present
	5. PI , project “Statistical Learning, Prediction and Monitoring Methods for Urban Rail Transit Systems”, HK-RGC 16203917 01.2018 - 12.2020
Other Awards	• Honored Graduate Award , Xi'an Jiaotong University 2017
	• Regional First Prize , 7th Mechanical Innovation & Design Competition 2016
	• National Scholarship , Xi'an Jiaotong University 2016
	• 1st-Runners-up Award , XJTU Entrepreneurship Competition 2015
	• National Encourage Scholarships , Xi'an Jiaotong University 2014, 2015
Skills	• Python • R • Matlab • AWS • C++ • Hadoop, Map-Reduce
	• TensorFlow • PyTorch • Keras • Scikit-learn
	• Psychology • Consulting • Public Speaking
	• English (Fully Professional) • German (B2, Fluent) • Chinese (Native)
Reference	• Prof. Fugee Tsung (Ph.D. Supervisor) Chair Professor, Acting Dean Department of Industrial Engineering and Decision Analytics The Hong Kong University of Science and Technology, Hong Kong <i>Email</i> : season@ust.hk, <i>Phone</i> : +852 2358-7097
	• Prof. Hao Yan (Research Collaborator, Co-Supervisor) Assistant Professor School of Computing, Informatics & Decision Systems Engineering Arizona State University, U.S.A <i>Email</i> : haoyan@asu.edu, <i>Phone</i> : +1 (480) 727-0556
	• Prof. Chen Zhang (Research Collaborator, Co-Supervisor) Associate Professor Department of Industrial Engineering, Tsinghua University, China <i>Email</i> : zhangchen01@tsinghua.edu.cn, <i>Phone</i> : +86-10-62796135