

Research Statement – Kwan Hui LIM

1. Overview

My research lies at the intersection of **Artificial Intelligence (AI)**, **Data Mining**, **Urban Analytics** and **Social Computing**, with a focus on designing intelligent systems that enhance decision-making, urban resilience, and societal well-being. I study how digital traces from social media, sensors, and organizational platforms can be mined and modeled to generate actionable insights. By developing and integrating techniques from deep learning, large language models (LLMs), recommender systems, and optimization, my work advances both theory and practice across multiple domains.

The unifying theme of my research is to build **intelligent, fairness-aware, and explainable AI systems** that support real-world decision-making. My research contributions span three core areas: (i) **Itinerary and Sequence Recommendation**, (ii) **Urban Analytics**, and (iii) **Social Computing**.

2. Research Achievements

Over the past decade, I have established an internationally recognized research program at the intersection of Artificial Intelligence, Social Computing, Urban Analytics and Data Science. Some key achievements include:

- **Recognition & Awards:** Ranked among the ***World's Top 2% Scientists in Artificial Intelligence*** (Stanford University list) for four consecutive years (2022–2024 for annual impact and 2025 for career impact). Nominated for the Asian Young Scientist Fellowship (2024) and shortlisted for the Singapore NRF Fellowship (2019) and Melbourne School of Engineering PhD Thesis Prize (2018). Awarded the Google PhD Fellowship in Machine Learning (2016), four selected among all PhD students in Australia.
- **Research Leadership and Funding:** Secured ***S\$11.1M in research funding***, with S\$7.9M from external agencies (NRF, MND, DSO, MOE) and S\$3.2M in internal grants. I have led projects of S\$2.3M as PI, while contributing as Co-PI on major interdisciplinary programs exceeding S\$8.8M.
- **Scholarly Impact:** Published ***over 100 peer-reviewed papers*** in top international conferences and leading journals, resulting in **more than 3,000 citations** and advancing both theoretical foundations and applied innovations in AI and data science.
- **Research Mentorship:** Supervised to completion a total of 6 PhD students, 10 Masters students, and over 50 undergraduate students, in addition to being the Chair/Member of PhD Examination Committee for over 50 PhD students.
- **Industry & Policy Impact:** Collaborated with organizations such as HDB, URA, DSO National Laboratories, City of Melbourne, and Defence Science and Technology

Group (Australia) translating research into operational systems for urban anomaly detection, campaign tracing, and intent detection. These projects demonstrate direct contributions to national resilience, urban innovation, and organizational decision-making.

Together, these achievements demonstrate my ability to conduct research that is academically rigorous, industry-relevant, and societally impactful, qualities that I will continue to bring to my future research and academic leadership.

3. Research Contributions

My research contributions can be grouped into three interconnected domains: **Itinerary and Sequence Recommendation, Urban Analytics, and Social Computing**. Across these areas, my work has advanced novel algorithms, methodological innovations, and real-world applications that balance technical rigor with societal and organizational impact. Together, these contributions demonstrate a cohesive research program that bridges theory and practice while addressing pressing challenges in business, society, and urban environments.

A. Itinerary & Sequence Recommendation

The proliferation of geo-tagged photos and social media enables the construction of fine-grained spatial and temporal representations of user trajectories. My research leverages this wealth of location-based data to address complex challenges in personalized and group-oriented itinerary recommendation. By integrating advanced techniques from data mining, machine learning, and optimization, I have developed novel algorithms that enhance both user experience and operational efficiency.

I pioneered the integration of transformer-based deep learning with fairness-aware policies, creating the first joint model for personalized POI recommendation and fair allocation of visitors [ASOC'23]. I also published comprehensive surveys covering optimization and deep learning for itinerary planning [ASOC'24] and the intersection of operations research with personalized trip planning [KAIS'19]. My contributions include developing queue-aware itinerary recommendation systems that combine reinforcement learning, queuing models, and optimization [SIGIR'17, PAKDD'21, DMKD'22]. I also proposed adaptive methods that adjust POI visit durations to user preferences [KAIS'18, IJCAI'15, KAIS'22] and techniques for crowd avoidance in urban environments using pedestrian sensor data [CIKM'16]. In addition, I have extended itinerary recommendation research by integrating large language models (LLMs) into recommendation systems [CIKM'25, PRICAI'25], demonstrating the potential of generative AI to significantly enhance adaptability and explainability.

For group-oriented tourism, I addressed problems of group tour formation, itinerary planning, and tour guide assignment using optimization and game-theoretic approaches [ICAPS'16]. I further developed globally crowd-optimized itinerary recommendation frameworks for constrained environments such as theme parks [ECMLPKDD'20, JBD'25]. More recent work focuses on contextual deep learning methods that incorporate demographics [RecTour'23], consumer reviews [BigData'23], and user sentiments [BigData'19], ensuring recommendations are not only accurate but also context-aware and inclusive. Collectively,

these advances contribute to both theory and practice in recommender systems, improving tourism experiences while addressing fairness, crowd management, and operational efficiency.

B. Urban Analytics

My research in urban analytics brings together expertise from computer science, urban planning, and environmental studies to address critical challenges in smart and sustainable cities. In collaboration with HDB, I developed an automated anomaly detection system for residential estates using LLMs applied to sensor and social media data. This system supports predictive maintenance and manpower-efficient estate management. I also devised social geolocation models for detecting estate-related events [AAAI'22, ECIR'23], including lightweight geolocation methods with contrastive learning for data-scarce scenarios.

With collaborators from DST Group in Australia, I created unsupervised real-time event detection systems for urban settings [BigData'19, JBD'21]. My broader contributions include advancing urban crowdsensing methods that utilize social media data for city-scale situational awareness [BigData'20]. I have also published high-impact journal work on real-time spatio-temporal event detection on geotagged social media [JBD'21], which demonstrates the scalability of urban event detection methods. Additionally, I studied location-centric communities using social-spatial links with temporal constraints [ECIR'15], offering new approaches to modeling urban social interactions.

In the area of environmental sustainability, I analyzed urban heat islands using multi-modal spatial analysis [BigData'20], offering insights into mitigating climate effects in urban spaces. I also applied sentiment analysis of geo-tagged tweets to assess the emotional impact of green spaces [WWW'18, SmartCity'19], providing actionable knowledge for urban planners. Further, my research on functional zone identification [EPB'24] integrates location and amenity data to model urban dynamics, supporting improved planning and resource allocation. Importantly, through collaborations with HDB and URA, I translated these research outputs into operational smart estate analytics systems [ASONAM'25, IJCNN'24], contributing directly to Singapore's Smart Nation initiatives. Collectively, these works advance the use of AI in sustainability, resilience, and urban innovation, bridging academic research with practical societal impact.

C. Social Computing

My work in social computing integrates data mining and machine learning with applications in national security, crisis analytics, marketing, and workforce analysis. In collaboration with DSO National Laboratories, I developed methods for detecting user intent and tracing information campaigns on social media [JCDL'24], which are now being adapted into national systems for enhanced defense. I also designed crisis detection frameworks such as CrisisBERT [HT'21] and COVID-19 analysis systems like TweetCOVID [IUI'21, ASONAM'20], which support real-time situational awareness during emergencies.

More recently, I have extended social computing research by incorporating LLMs into multi-turn intent classification and conversational dialogue generation. My work on intent-driven dialogue generation [CIKM'25] and linguistics-adaptive retrieval for multi-turn classification

[EMNLP'24] demonstrates how LLMs can improve the adaptability and robustness of conversational AI systems. These advances highlight the potential of generative AI to support nuanced human-computer interactions, with applications in customer engagement, digital governance, and organizational decision-making.

I also contributed to occupational analytics by developing job title embedding models (Title2Vec [JBD'22]) and skill-based recommendation systems (SkillRec [ICCAE'23]), which inform job market analysis and career development. Interdisciplinary collaborations with marketing researchers validated customer satisfaction theories using Twitter conversation data, linking computational approaches with organizational behavior and marketing science. These efforts demonstrate how social computing can address both societal challenges and strategic needs, bridging AI research with public good and organizational effectiveness.

4. Future Research Plan

Looking ahead, I will extend my research program across the following directions:

- **Itinerary & Sequence Recommendation:** I plan to expand this line of research by focusing not only on personalization but also on broader notions of social good such as fairness, responsible AI, and sustainability. A central goal will be to bridge AI methods (e.g., personalized recommendation, deep learning, reinforcement learning, and LLMs) with operations research approaches (fairness policies, optimization, constraint satisfaction). By combining these perspectives, I aim to continue spearheading next-generation recommender systems [EJOR'25, TORS'25] that deliver adaptive, explainable, and socially responsible recommendations across domains such as tourism, education, and e-commerce.
- **Urban Analytics:** I will continue to explore the application and development of AI techniques to tackle pressing urban challenges related to sustainability, privacy, and urban resilience. This includes both applied and fundamental research, from smart estate management to city-scale event detection. Importantly, I plan to develop privacy-preserving techniques for urban data analytics, extending our recent contributions [CIKM'25], to ensure that urban AI solutions remain responsible and ethical while delivering actionable insights. This work will advance the dual agenda of better understanding our urban environment and building trustworthy AI systems for urban innovation.
- **Social Computing:** While AI systems have developed rapidly in capability, more work is needed in areas of AI governance and resource sustainability. To address this, I will further explore lightweight and efficient models [MMM'25] that reduce the computational footprint of large-scale AI systems, as well as methods to incorporate fairness in decision-making systems [ASONAM'25]. These research directions will ensure that advances in social computing are not only technologically robust but also sustainable, equitable, and aligned with societal values.

A unifying focus across these directions will be the development of **responsible AI systems** that balance innovation with fairness, transparency, efficiency, and real-world impact.

5. References

- [1] Junhua Liu, Aldy Gunawan, Kristin L. Wood and Kwan Hui Lim. Optimizing Group Utility in Itinerary Planning: A Strategic and Crowd-Aware Approach. *Journal of Big Data*. In Press.
- [2] Junhua Liu, Yong Keat Tan, Bin Fu and Kwan Hui Lim. From Intents to Conversations: Generating Intent-Driven Dialogues with Contrastive Learning for Multi-Turn Classification. *Proceedings of the 34th ACM International Conference on Information and Knowledge Management (CIKM'25)*. pp. to appear. Nov 2025.
- [3] Wenchuan Mu and Kwan Hui Lim. Bayesian Privacy Guarantee for User History in Sequential Recommendation Using Randomised Response. *Proceedings of the 34th ACM International Conference on Information and Knowledge Management (CIKM'25)*. pp. to appear. Nov 2025.
- [4] Wenchuan Mu and Kwan Hui Lim. Bayesian Privacy Guarantee for User History in Sequential Recommendation Using Randomised Response. *Proceedings of the 34th ACM International Conference on Information and Knowledge Management (CIKM'25)*. pp. to appear. Nov 2025.
- [5] Kunrong Li and Kwan Hui Lim. RALLM-POI: Retrieval Augmented LLM for Zero-shot Next POI Recommendation with Geographical Reranking. *Proceedings of the 22nd Pacific Rim International Conference on Artificial Intelligence (PRICAI'25)*. pp. to appear. Nov 2025.
- [6] Junhua Liu, Roy Ka-Wei Lee and Kwan Hui Lim. Understanding Fairness-Accuracy Trade-offs in Machine Learning Models: Does Promoting Fairness Undermine Performance?. *Proceedings of the 17th International Conference on Advances in Social Networks Analysis and Mining (ASONAM'25)*. pp. to appear. Aug 2025.
- [7] Wenchuan Mu, Menglin Li and Kwan Hui Lim. A Social Data-Driven System for Identifying Estate-related Events and Topics. *Proceedings of the 17th International Conference on Advances in Social Networks Analysis and Mining (ASONAM'25), Demonstration Track*. pp. to appear. Aug 2025.
- [8] Dang Viet Anh Nguyen, Aldy Gunawan, Mustafa Misir, Kwan Hui Lim and Pieter Vansteenwegen. Deep Reinforcement Learning for Solving the Stochastic E-Waste Collection Problem. *European Journal of Operational Research*. Accepted to appear. In Press.
- [9] Sajal Halder, Kwan Hui Lim, Jeffrey Chan and Xiuzhen Zhang. Deep Learning of Dynamic POI Generation and Optimisation for Itinerary Recommendation. *ACM Transactions on Recommender Systems*. Accepted to appear. In Press.
- [10] Wenchuan Mu and Kwan Hui Lim. Data-free Functional Projection of Large Language Models onto Social Media Tagging Domain. *Proceedings of the 31st International Conference on MultiMedia Modeling (MMM'25)*. pp. to appear. Jan 2025.
- [11] Wenchuan Mu, Junhua Liu and Kwan Hui Lim. Fast Bibliography Pre-Selection via Two-Vector Semantic Representations. *Proceedings of the 2024 ACM/IEEE Joint Conference on Digital Libraries (JCDL'24)*. pp. to appear. Dec 2024.
- [12] Glenn Jin Wee Chia and Kwan Hui Lim. Analysing and Predicting Success of Crowdfunding Campaigns. *Proceedings of the 2024 ACM/IEEE Joint Conference on Digital Libraries (JCDL'24), Poster Track*. pp. to appear. Dec 2024.
- [13] Junhua Liu, Yong Keat Tan, Bin Fu and Kwan Hui Lim. Linguistics-Adaptive Retrieval Augmentation for Multi-Turn Intent Classification. *Proceedings of the 2024 Conference on Empirical Methods in Natural Language Processing (EMNLP'24), Industry Track*. pp. to appear. Nov 2024.
- [14] Wei Chien Benny Chin, Yuming Fu, Kwan Hui Lim, Thomas Schroepfer and Lynette Cheah. Identifying Urban Functional Zones by Analysing the Spatial Distribution of Amenities. *Environment and Planning B: Urban Analytics and City Science*. Volume 51, Issue 6, pp. 1274-1289. Sage. Jul 2024.
- [15] Wenchuan Mu and Kwan Hui Lim. Label-Free Topic-Focused Summarization Using Query Augmentation. *Proceedings of the 2024 International Joint Conference on Neural Networks (IJCNN'24)*. pp. 1-8. Jun 2024.
- [16] Sajal Halder, Kwan Hui Lim, Jeffrey Chan and Xiuzhen Zhang. A Survey on Personalized Itinerary Recommendation: From Optimisation to Deep Learning. *Applied Soft Computing*. Volume 152, Article 111200, pp. 1-14. Elsevier. Feb 2024.
- [17] Ngai Lam Ho, Roy Ka-Wei Lee and Kwan Hui Lim. SBTRec - A Transformer Framework for Personalized Tour Recommendation Problem with Sentiment Analysis. *Proceedings of the 2023 IEEE International Conference on Big Data (BigData'23)*. pp. 5790-5798. Dec 2023.
- [18] Sajal Halder, Kwan Hui Lim, Jeffrey Chan and Xiuzhen Zhang. Capacity-Aware Fair POI Recommendation Combining Transformer Neural Networks and Resource Allocation Policy. *Applied Soft Computing*. Volume 147, Article 110720, pp. 1-13. Elsevier. Nov 2023.
- [19] Ngai Lam Ho, Roy Ka-Wei Lee and Kwan Hui Lim. BTRec: BERT-based Trajectory Recommendation for Personalized Tours. *Proceedings of the Workshop on Recommenders in Tourism (RecTour'23)*, in-conjunction with the 17th ACM Conference on Recommender Systems (RecSys'23). pp. 29-38. Sep 2023.

- [20] Menglin Li, Kwan Hui Lim, Teng Guo and Junhua Liu. A Transformer-based Framework for POI-level Social Post Geolocation. *Proceedings of the 45th European Conference on Information Retrieval (ECIR'23)*. pp. 588-604. Apr 2023.
- [21] Xiang Qian Ong and Kwan Hui Lim. SkillRec: A Data-Driven Approach to Job Skill Recommendation for Career Insights. *Proceedings of the 15th International Conference on Computer and Automation Engineering (ICCAE'23)*. pp. 40-44. Mar 2023.
- [22] Ngai Lam Ho and Kwan Hui Lim. POIBERT: A Transformer-based Model for the Tour Recommendation Problem. *Proceedings of the 2022 IEEE International Conference on Big Data (BigData'22)*. pp. 5925-5933. Dec 2022.
- [23] Sajal Halder, Kwan Hui Lim, Jeffrey Chan and Xiuzhen Zhang. Efficient Itinerary Recommendation via Personalized POI Selection and Pruning.. *Knowledge and Information Systems*. Volume 64, Issue 4, pp. 963–993. Springer. Apr 2022.
- [24] Sajal Halder, Kwan Hui Lim, Jeffrey Chan and Xiuzhen Zhang. POI Recommendation with Queuing Time and User Interest Awareness. *Data Mining and Knowledge Discovery*. Volume 36, Issue 6, pp. 2379-2409. Springer. Nov 2022.
- [25] Junhua Liu, Yung Chuen Ng, Zitong Gui, Trisha Singhal, Lucienne T. M. Blessing, Kristin L. Wood and Kwan Hui Lim. Title2Vec: A Contextual Job Title Embedding for Occupational Named Entity Recognition and Other Applications. *Journal of Big Data*. Volume 9, Article 99, pp. 1-16. Springer London. Sep 2022.
- [26] Menglin Li and Kwan Hui Lim. Geotagging Social Media Posts to Landmarks Using Hierarchical BERT (Student Abstract). *Proceedings of the Thirty-Sixth AAAI Conference on Artificial Intelligence (AAAI'22)*. pp. 12999-13000. Feb 2022.
- [27] Trisha Singhal, Junhua Liu, Lucienne T. M. Blessing and Kwan Hui Lim. Analyzing Scientific Publications using Domain-Specific Word Embedding and Topic Modelling. *Proceedings of the 2021 IEEE International Conference on Big Data (BigData'21)*. pp. 4965-4973. Dec 2021.
- [28] Junhua Liu, Trisha Singhal, Lucienne T.M. Blessing, Kristin L. Wood and Kwan Hui Lim. CrisisBERT: A Robust Transformer for Crisis Classification and Contextual Crisis Embedding. *Proceedings of the 32nd ACM Conference on Hypertext and Social Media (HT'21)*. pp. 133-141. Aug 2021.
- [29] Yasmeen George, Shanika Karunasekera, Aaron Harwood and Kwan Hui Lim. Real-time Spatio-temporal Event Detection on Geotagged Social Media. *Journal of Big Data*. Volume 8, Article 91, pp. 1-28. Springer London. Jun 2021.
- [30] Sajal Halder, Kwan Hui Lim, Jeffrey Chan and Xiuzhen Zhang. Transformer-based Multi-task Learning for Queuing Time Aware Next POI Recommendation. *Proceedings of the 25th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD'21)*. pp. 510-523. May 2021.
- [31] Jolin Shaynn-Ly Kwan and Kwan Hui Lim. TweetCOVID: A System for Analyzing Public Sentiments and Discussions about COVID-19 via Twitter Activities. *Proceedings of the 26th International Conference on Intelligent User Interfaces Companion (IUI'21), Demo Track*. pp. 58-60. Apr 2021.
- [32] Jerome Heng, Junhua Liu and Kwan Hui Lim. Urban Crowdsensing using Social Media: An Empirical Study on Transformer and Recurrent Neural Networks. *Proceedings of the 2020 IEEE International Conference on Big Data (BigData'20), Poster Track*. pp. 5695-5697. Dec 2020.
- [33] Marcus Yong and Kwan Hui Lim. Urban Heat Islands: Beating the Heat with Multi-Modal Spatial Analysis. *Proceedings of the 2020 IEEE International Conference on Big Data (BigData'20)*. pp. 4818-4827. Dec 2020.
- [34] Jolin Shaynn-Ly Kwan and Kwan Hui Lim. Understanding Public Sentiments, Opinions and Topics about COVID-19 using Twitter. *Proceedings of the 2020 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM'20), Multidisciplinary Track*. pp. 623-626. Dec 2020.
- [35] Junhua Liu, Kristin L. Wood and Kwan Hui Lim. Strategic and Crowd-aware Itinerary Recommendation. *Proceedings of the 2020 European Conference on Machine Learning and Knowledge Discovery in Databases (ECML-PKDD'20)*. pp. 69-85. Sep 2020.
- [36] Yun Ning Pek and Kwan Hui Lim. Identifying and Understanding Business Trends using Topic Models with Word Embedding. *Proceedings of the 2019 IEEE International Conference on Big Data (BigData'19), Poster Track*. pp. 6177-6179. Dec 2019.
- [37] Kwan Hui Lim, Jeffrey Chan, Christopher Leckie and Shanika Karunasekera. Tour Recommendation and Trip Planning using Location-based Social Media: A Survey. *Knowledge and Information Systems*. Volume 60, Issue 3, pp. 1247-1275. Springer. Sep 2019.
- [38] Kwan Hui Lim, Kate E. Lee, Dave Kendal, Lida Rashidi, Elham Naghizade, Yungang Feng and Jia Wang. Understanding Sentiments and Activities in Green Spaces using a Social Data-driven Approach. *Smart Cities: Issues and Challenges: Mapping Political, Social and Economic Risks and Threats*. pp. 77-107. Elsevier. Jun 2019.

- [39] Kwan Hui Lim, Kate E. Lee, Dave Kendal, Lida Rashidi, Elham Naghizade, Stephan Winter and Maria Vasardani. The Grass is Greener on the Other Side: Understanding the Effects of Green Spaces on Twitter User Sentiments. Proceedings of the 2018 Web Conference Companion (WWW'18), Cognitive Computing Track. pp. 275-282. Apr 2018.
- [40] Kwan Hui Lim, Jeffrey Chan, Christopher Leckie and Shanika Karunasekera. Personalized Trip Recommendation for Tourists based on User Interests, Points of Interest Visit Durations and Visit Recency. Knowledge and Information Systems. Volume 54, Issue 2, pp. 375-406. Springer-Verlag London. Feb 2018.
- [41] Kwan Hui Lim, Jeffrey Chan, Shanika Karunasekera and Christopher Leckie. Personalized Itinerary Recommendation with Queuing Time Awareness. Proceedings of the 40th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR'17). pp. 325-334. Aug 2017.
- [42] Xiaoting Wang, Christopher Leckie, Jeffery Chan, Kwan Hui Lim and Tharshan Vaithianathan. Improving Personalized Trip Recommendation to Avoid Crowds Using Pedestrian Sensor Data. Proceedings of the 25th ACM International Conference on Information and Knowledge Management (CIKM'16). pp. 25-34. Oct 2016.
- [43] Kwan Hui Lim, Jeffrey Chan, Christopher Leckie and Shanika Karunasekera. Towards Next Generation Touring: Personalized Group Tours. Proceedings of the 26th International Conference on Automated Planning and Scheduling (ICAPS'16). pp. 412-420. Jun 2016.
- [44] Kwan Hui Lim, Jeffrey Chan, Christopher Leckie and Shanika Karunasekera. Personalized Tour Recommendation based on User Interests and Points of Interest Visit Durations. Proceedings of the 24th International Joint Conference on Artificial Intelligence (IJCAI'15). pp. 1778-1784. Jul 2015.