Guanli Liu

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Profile

I am a postdoctoral researcher specializing in learned spatial indexing and machine learning-driven query optimization. My PhD research introduced effective and efficient learned spatial indexing methods, published in top-tier conferences (VLDB, ICDE, TKDE). Since completing my PhD in December 2023, I have focused on benchmarking reinforcement learning-based indexing against traditional spatial indexes and exploring LLM applications in spatial indexing. Before academia, I was a Software Engineer, developing a strong foundation in algorithm design, database systems, and large-scale data processing.

Education

PhD in Computer Science, *The University of Melbourne*, Australia 2019 – 2023

M.S. in Computer Technology, *Northeastern University*, China (GPA: 3.5 / Top 10%) 2013 – 2015

B.Eng. in Software Engineering, *Northeastern University*, China (GPA: 3.4 / Top 20%) 2009 – 2013

Research and Work Experience

Postdoctoral Research Fellow, **The University of Melbourne**, Australia Feb. 2024 – Present

Conducting research on **AI for Databases**, focusing on spatial indexing, reinforcement learning-based optimization, and LLM applications in query processing. Developed a benchmark for comparing RL-based and traditional spatial indexes. Responsibilities include developing novel indexing models, mentoring students, and publishing in top-tier venues.

Data Scientist, **nftDb** , Australia Feb. 2023 – Feb. 2024

Processed and analyzed NFT transaction data (**Python**, **BigQuery**, **Dbt**), managed token wallets, and developed a ranking system using PageRank. Built key components of the foundational data platform (**databeast**), identifying trading patterns and market anomalies.

Research Assistant, **The University of Melbourne**, Australia Aug. 2022 – Aug. 2023

- *Project One:* Developed an AI-assisted system for reducing reading interruptions using **GPT API** and **Google Cloud**.
- *Project Two:* Designed a **C language coding style checker** to detect common errors using Python.

Software Engineer, **Baidu**, China Jul. 2015 – Aug. 2017

Developed features for Baidu's Instant Messaging platform (**infoflow**), focusing on improving communication efficiency and user experience. Designed new message protocols and voice-assistant modules to enhance real-time interactions. Contributed to backend optimizations, improving data storage and retrieval efficiency. Additionally, worked on refining the UI to provide a more seamless and responsive user experience.

Publications

- **Guanli Liu, Lars Kulik, Christian S. Jensen, Tianyi Li, Renata Borovica-Gajic, Jianzhong Qi**. "Efficient Cost Modeling of Space-filling Curves." *Proc. VLDB Endow.*, 2024. Introduces an optimized cost model for space-filling curves, improving query efficiency in spatial databases.
- **Guanli Liu**. "Learning Spatial Indices Efficiently." *University of Melbourne*, 2023. My PhD thesis consolidates research on learned spatial indexes, proposing novel training and adaptation techniques.
- **Guanli Liu, Jianzhong Qi, Lars Kulik, Kazuya Soga, Renata Borovica-Gajic, Benjamin I. P. Rubinstein**. "Efficient Index Learning via Model Reuse and Fine-tuning." *ICDEW*, 2023. Explores transfer learning for learned indexes, reducing training costs while maintaining high accuracy.
- **Guanli Liu, Jianzhong Qi, Christian S. Jensen, James Bailey, Lars Kulik**. "Efficiently Learning Spatial Indices." *ICDE*, 2023. Proposes an efficient learned spatial index framework that minimizes storage costs while ensuring query efficiency.

- **Jianzhong Qi, Guanli Liu, Christian S. Jensen, Lars Kulik**. "Effectively Learning Spatial Indices." *Proc. VLDB Endow.*, 2020. Foundational work applying machine learning to spatial indexing, demonstrating improved query performance over R-trees.
- **Yu Gu, Guanli Liu, Jianzhong Qi, Hongfei Xu, Ge Yu, Rui Zhang**. "The Moving K Diversified Nearest Neighbor Query." *IEEE TKDE*, 2016. Proposes a new query type for retrieving diverse and spatially distributed nearest neighbors in moving object databases.

Research Service

- **Conference Reviewer:** CIKM 2024, VLDB 2026/2026 (Shadow Reviewer), KDD 2025
- **Journal Reviewer:** Transactions on Spatial Algorithms and Systems (TSAS) from 2022

Supervision

- **Master's Students:** Co-supervising one Master's student on research projects related to spatial indexing and database systems

Engineering Skills

- **Programming:** Proficiency in Python and Java, with supplementary knowledge of C++
- **Data Management:** Experience with MySQL, MongoDB, PostgreSQL, and BigQuery
- **Cloud Computing:** Experienced in deploying applications and managing data on Google Cloud Platform
- **Machine Learning:** Hands-on experience with TensorFlow, PyTorch, TorchLib, and Scikit-learn
- **Algorithmic Knowledge:** Solid understanding of fundamental data structures and algorithms