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 introduced effective and efficient learned spatial indexing methods (VLDB, ICDE, TKDE). Since finishing in 2023 I have focused on benchmarking RL-based indexing against traditional methods and applying large language models to spatial workloads. Prior to academia, I was a software engineer at Baidu, gaining a strong foundation in algorithms, database systems, and large-scale data processing.

Research Interests

- Learned & hybrid spatial indexes, cost modeling, and drift-aware benchmarking
- GenAI for database tooling (plan summarization, RAG copilots, human-in-the-loop tuning)
- Reinforcement learning for query optimization, adaptive storage, and resource allocation
- Responsible ML/GenAI evaluation, interpretability, and reproducible experimentation

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

- Conduct research under Prof. Renata Borovica-Gajic's DECRA project on AI for Databases, spanning spatial indexing, data layout optimization, and cardinality estimation.
- Designed efficient data layouts, PostgreSQL extensions, and benchmarking frameworks for RL-enhanced indexes; two ICDE 2026 papers under submission.
- Built GenAI explainers for optimizer plans (GPT-4 + retrieval) and mentored MS students on reproducibility and benchmarking.

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

- Processed NFT transaction data (**Python**, **BigQuery**, **dbt**), managed token wallets, and authored ranking systems using PageRank-like models.
- Built core components of the **databeast** intelligence platform, detecting wash trading and market anomalies.
- Delivered GenAI wallet briefings that combine GPT-4 reasoning with curated graph features, reducing analyst triage time by 40%.

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**, **Google Cloud**, and Midjourney.
- *Project Two:* Designed a **C-language coding style checker** (Python + AST rules) to detect common student errors and auto-suggest fixes.

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

- Developed features for Baidu's enterprise IM platform (**infoflow**), including new message protocols and voice-assistant modules.
- Optimized backend storage/retrieval efficiency by 20% and shipped UI enhancements that improved responsiveness.
- Partnered with research teams to integrate telemetry and experimentation hooks supporting ML-driven personalization.

Publications

- **Guanli Liu**, Renata Borovica-Gajic, Hai Lan, Zhifeng Bao. "Benchmarking RL-Enhanced Spatial Indices Against Traditional, Advanced, and Learned Counterparts." *ICDE*, 2026.
- Lankadinee Rathuwadu, **Guanli Liu**, Christopher Leckie, Renata Borovica-Gajic. "CoLSE: A Lightweight and Robust Hybrid Learned Model for Single-Table Cardinality Estimation using Joint CDF." *ICDE*, 2026.
- Kaan Gocmen, **Guanli Liu**, Renata Borovica-Gajic. "Advancing Spatial Keyword Queries: From Filters to Unified Vector Embeddings." *ADC*, 2025.
- Ruiyi Hao, **Guanli Liu**, Renata Borovica-Gajic. "LLM-Enhanced Processing of Complex Spatial Queries." *ADC*, 2025.
- **Guanli Liu**, Lars Kulik, Christian S. Jensen, Tianyi Li, Renata Borovica-Gajic, Jianzhong Qi. "Efficient Cost Modeling of Space-filling Curves." *VLDB*, 2025.
- **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.
- **Guanli Liu**, Jianzhong Qi, Christian S. Jensen, James Bailey, Lars Kulik. "Efficiently Learning Spatial Indices." *ICDE*, 2023.
- Jianzhong Qi, **Guanli Liu**, Christian S. Jensen, Lars Kulik. "Effectively Learning Spatial Indices." *VLDB*, 2020.
- Yu Gu, **Guanli Liu**, Jianzhong Qi, Hongfei Xu, Ge Yu, Rui Zhang. "The Moving K Diversified Nearest Neighbor Query." *TKDE*, 2016.

Teaching

- **INFO20003 – Database Systems (UoM)**: Prepared 2025 S2 teaching materials; will deliver tutorials/lectures this upcoming semester.
- **COMP90018 – Android Application Development (UoM)**: Tutor (2019–2023) covering tutorials, student support, and marking.
- **COMP90041 – Programming and Software Development (UoM)**: Tutor (2019–2023) responsible for tutorials and assessment.

Research Service

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

Supervision

- **Kaan Gocmen** (Master's, UoM) — Advancing Spatial Keyword Queries; publication at *ADC 2025*.
- **Ruiyi Hao** (Master's, UoM) — LLM for Spatial Queries; publication at *ADC 2025*.

Engineering Skills

- **Programming:** Python, Java, C++ with strong design/algorithms background.
- **Data Management:** PostgreSQL, MySQL, MongoDB, BigQuery; PostgreSQL extension development.
- **Cloud & Tooling:** Google Cloud Platform, Docker/Kubernetes, GitHub Actions, benchmarking harnesses.
- **Machine Learning:** TensorFlow, PyTorch, TorchLib, scikit-learn, RL environments, GenAI APIs.