BINGNAN CHEN

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About Me

A Ph.D. student in Computer Science and Engineering at the Hong Kong University of Science and Technology (HKUST), where I also completed my MPhil degree. Prior to that, I received my bachelor's degree from the University of Science and Technology of China (USTC).
My research interests focus on database optimization algorithms, query processing and query optimization under the supervision of Prof. Ke Yi.

Education

- **The Hong Kong University of SCience and Technology** *Sept., 2023*
  Doctor of Philosophy (PhD) Hong Kong, China
- **The Hong Kong University of SCience and Technology** *Sept., 2021*
  Master of Philosophy (MPhil) Hong Kong, China
- **University Of Science and Technology of China** *Sept., 2017*
  Computer Science Bachelor Hefei, China

Research

- **Engineering Yannakakis$^+$ in DuckDB: From Theory to Practice** *Mar. 2025 - Nov. 2025*
  Tools: C++
  ◦ Develop and integrat **Yannakakis$^+$** into the core query optimizer of DuckDB, a push-based, vectorized, and pipeline-interpreted OLAP database system. This implementation replaces the native dynamic programming join optimizer with a **greedy GYO-based plan enumerator** tailored for acyclic queries, employs **Bloom filters** to replace expensive semi-joins, and leverages DuckDB's advanced statistics and cost models for **hybrid CBO/RBO** plan selection. The system demonstrates that output-sensitive join algorithms can be made both asymptotically optimal and practically efficient in modern analytical engines.
- **Yannakakis$^+$: An optimization algorithm for SPJA queries** *Sept. 2023 - Sept. 2024*
  Tools: Python, Java & Scala
  ◦ We proposes **Yannakakis$^+$**, a practical variant of the classic Yannakakis algorithm for evaluating acyclic conjunctive queries with aggregations. It preserves the theoretical guarantees of **O(N+M)** time on free-connex queries and **O(min(NM, F))** on general acyclic queries, while reducing constant factors by interleaving selective **aggregation-joins** with a reduced number of **semi-joins** and by optimizing the plan selection in a tailored search space. The approach yields pure relational DAG plans built from standard operators and is implemented as a plug-in for multiple SQL engines, showing substantial speedups across a wide range of queries and datasets.
- **Quorion: Interactive Web UI System for Query Rewriting** *Sept. 2024 - Mar. 2025*
  Tools: Python, Java & Scala
  ◦ We present **Quorion**, a system that rewrites SPJA SQL queries into sequences of SQL statements that implement next-generation join/aggregate plans with theoretical guarantees, notably **Yannakakis$^+$** for acyclic queries, as well as GHD- and GYO-based reductions for broader cases. The system includes a cost- and rule-based optimizer, a **plan visualization** interface for selecting join trees, and a portable execution model that targets existing DBMSs (DuckDB, PostgreSQL, MySQL) via JDBC. A motivating example and a brief demonstration workflow suggest substantial performance gains on certain hard queries without modifying DBMS internals.
- **Flexway O-Sort: Oblivious sorting algorithm under SGX.** *Aug. 2022 - May. 2023*
  Tools: C++, SGX
  ◦ **Flexway O-Sort** is an optimal oblivious (data-independent, memory access patterns do not reveal any information about the input data even to an untrusted observer) sorting algorithm designed for secure hardware enclaves. It achieves $O(N \log N)$ work and optimal page swaps through a novel **flexway butterfly network** and a **p-way MergeSplit** that runs efficiently and is **enclave-friendly**. The algorithm is **parallelizable** under secure settings, and significantly outperforms prior oblivious sorts.

Experience

- **Alibaba Cloud [🌐]** *Aug. 2023 - Feb. 2024*
  Research Intern Hangzhou, China
  ◦ Design and implement the Yannakakis$^+$ algorithm, which is an improved version of Yannakakis algorithm with theoretical guarantees and better practical performance.
- **SenseTime [🌐]** *Jan. 2021 - Jul. 2021*
  Research Intern Beijing, China
  ◦ Design operators and compilation optimizations in deep learning frameworks.

PUBLICATIONS

C=CONFERENCE, J=JOURNAL, S=IN SUBMISSION, T=THESIS

[C.1] Qichen Wang*, **Bingnan Chen***, Binyang Dai, Ke Yi, Feifei Li, and Liang Lin. Yannakakis$^+$: Practical Acyclic Query Evaluation with Theoretical Guarantees. In Proceedings of the 2025 International Conference on Management of Data (Berlin, Germany) (SIGMOD '25) *(* equal contribution)* [pdf].

[C.2] **Bingnan Chen**, Binyang Dai, Qichen Wang, Ke Yi. Query running too slow? Rewrite it with Quorion!. In Proceedings of the 51st International Conference on Very Large Data Bases, Demo Track (London, United Kingdom), (VLDB '25) [pdf].

[C.3] Tianyao Gu, Yilei Wang, Afonso Tinoco, **Bingnan Chen**, Ke Yi, and Elaine Shi. Flexway O-Sort: Enclave-Friendly and Optimal Oblivious Sorting. In Proceedings of the 34th USENIX Security Symposium (Seattle, Washington, United States) (USENIX Security 2025) [pdf].

SKILLS

- **Programming Languages:** C++ & C, Python, Java, Scala, SQL, HTML & CSS & JSP, Verilog & System Verilog
- **Web Technologies:** Docker, Git, OOP, Django, Vue, Flask
- **Database Systems:** DuckDB, PostgreSQL, SparkSQL, MySQL
- **Data Science & Machine Learning:** PyTorch