Qiyu Zhuang

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Research Interests

- **Transaction processing**: distributed transaction processing, isolation level selection
- **Cloud databases**: serverless functions for database systems, disaggregation architecture

Education

- **Renmin University of China** — Beijing, China
  Ph.D. in Computer Science; Advisor: Prof. Xiaoyong Du and Prof. Wei Lu; GPA: 3.86 — *Sept. 2022 – present*
- **Huazhong University of Science and Technology** — Wuhan, China
  B.E. in Computer Science and Technology; Advisor: Prof. Hai Jin; GPA: 3.93 — *Sept. 2018 – Jun. 2022*

Publications

- **Qiyu Zhuang**, Xinyue Shi, Shuang Liu, Wei Lu, Zhanhao Zhao, Yuxing Chen, Tong Li, Anqun Pan, Xiaoyong Du, *GeoTP: Latency-aware Geo-Distributed Transaction Processing in Database Middlewares*. IEEE International Conference on Data Engineering (***ICDE***, to be appeared), 2025.
- Zhanhao Zhao, Hongyao Zhao, **Qiyu Zhuang**, Wei Lu, Haixiang Li, Meihui Zhang, Anqun Pan, Xiaoyong Du, *Efficiently Supporting Multi-Level Serializability in Decentralized Database Systems*, IEEE Transactions on Knowledge and Data Engineering (***TKDE***), 2023.
- **Qiyu Zhuang**, Wei Lu, Shuang Liu, Yipeng Sun, Yuxing Chen, Xinyue Shi, Zhanhao Zhao, Anqun Pan, Xiaoyong Du, *TxnSails: Achieving Serializable Transaction Scheduling with Self-Adaptive Isolation Level Selection*, in process.
- Xinyue Shi, **Qiyu Zhuang**, Wei Lu, Shuang Liu, Shiming Yang, Zhaoyang Zhang, Xiaoyong Du, Wenlong Ma, Wenliang Zhang, *SeamlessDB: a Cloud-Native Database for Resilient Failover with Breakpoint Resumption*, in process

Experience

- **Key Laboratory of Data Engineering and Knowledge Engineering (DEKE):** — Beijing, China
  Research and Teaching Assistant — *Sept. 2022 - present*

  Research Assistant
  - **GeoTP** - I designed and implemented **a latency-aware geo-distributed transaction processing approach in database middleware**. The core idea is to minimize latency and reduce the lock contention span of distributed transactions. To achieve this, we present a latency-aware scheduling mechanism that postpones the lock acquisition time of some subtransactions. Furthermore, we enhance it with heuristic optimizations for high-contention workloads.
    The code is available at https://github.com/dbiir/GeoTP.
  - **TxnSails** - I designed and implemented TxnSails, **a middle-tier approach that achieves both serializable scheduling under low isolation levels and high performance for dynamic workloads based on transaction templates**. It introduces a unified method to enforce the commit order consistent with the dependency order to ensure serializable scheduling. Additionally, it adopts a graph deep learning model to predict the optimal isolation levels to improve performance adaptively.
    The code is available at https://github.com/dbiir/TxnSailsServer.
  - **SeamlessDB** - I participated in the design of **a cloud-native database, SeamlessDB, for efficient failover handling with breakpoint resumptions**. It introduces a three-layer disaggregation architecture, persisting transactional execution context in the state layer, enabling efficient transaction breakpoint resumption. Guided by a self-adaptive cost model, our operator-level breakpoint resumption mechanism achieves minimal context persisting cost and breakpoint resuming cost.

Teaching Assistant *- Programming Language / Introduction to Database System:*

- Help students become familiar with the programming language and data structures, such as C/C++; guide students to design and develop database application platforms.

Project

- **Distributed Transaction Processing Key Technologies for TDSQL** Developer
  Renmin University of China, Tencent Inc. *Jun. 2022 - Jun.2023*
  - **Contributed to the design of multi-level serializability concepts**: the *strict serializability* combining the linearizability and the serializability and the *sequential serializability* combining the sequential consistency and the serializability.
  - **Participated in the design of the BDTA concurrency control algorithm** based on bidirectional timestamp adjustment. BDTA automatically adjusts transaction commit timestamps, minimizing false rollbacks and effectively improving the performance of distributed transactions.
  - **Extended Greenplum** to support multi-level serializability, including both strict serializability and sequential serializability. Furthermore, we applied the BDTA concurrency control algorithm to Greenplum to enhance its performance. The source code is available at https://github.com/dbiir/WooKongDB.
- **A Relational Database System Proto for Educational Purpose** Developer
  Renmin University of China *Jun. 2022 - present*
  - **Participated in building an educational database kernel platform, RucBase**, inspired by Bustab and PostgreSQL. This platform was designed to support comprehensive experimental exercises tailored to course requirements.
  - **Extended RucBase into a cloud-native version** by implementing a disaggregated architecture for storage and compute nodes, enabling independent scaling and improving system elasticity.
  - **Currently expanding Rucbase into a cloud-native HTAP system** by integrating a columnar storage system and an analytical engine to support hybrid transaction and analytical processing workloads.

Patents

- Wei Lu; Xiaoyong Du; Tong Li; **Qiyu Zhuang**; Yuxing Chen; Anqun Pan, A distributed transaction processing method, apparatus, device, and storage medium, 2023070505CN, Sep. 2023.

Programming Skills

- **Languages**: Mandarin Chinese (Native), English (Fluent).
- **Coding**: C, Java, Python, Rust. Familiar with database middleware, such as Apache ShardingSphere and Apache ScalarDB; open-source database, such as PostgreSQL.

Honors and Awards

- First-class Student Scholarship, Renmin University of China 2022-2023