Jiacheng Wu

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Research Interests

My current research interests lie in the broad areas of system research, such as big data systems, relational DBMS and deep learning platforms, etc. I am familiar with the architectures of several data platforms, especially MySQL, ClickHouse and Apache Spark. Meanwhile, I am very interested in building data-intensive systems that can efficiently scale in modern computing environments.

Education

- M.S. Department of Computer Science and Technology, Tsinghua University, 2018.09 - 2021.06.
  GPA: 3.89/4.0; Rank: 11/149.
- B.E. College of Software, Nankai University, 2014.09 - 2018.06.
  GPA: 93/100; Rank: 1/99

Selected Projects

Topic: The New Architecture of OLTP Databases on Many Cores (Ongoing)
[Work at Institute of Computing Technology, Chinese Academy of Sciences]

- Accelerate real-world RDBMS (e.g., MySQL) by exploiting 1) main memory OLTP engine 2) SQL compilation, and 3) many-core systems, e.g., a server with hundreds of CPU cores.
- Identify bottlenecks of existing databases on many cores and propose a new architecture, which separates the transaction processing into compilation and execution phases, to deal with bottlenecks.
- Complete a baseline porting of main memory OLTP engine (Zen) to work with MySQL and continue implementing and testing the new architecture.

Topic: Updatable Learned Indexes [Work at Tsinghua University with Institute of Computing Technology, Chinese Academy of Sciences]

- Propose a brand new updatable learned index with precise key-to-position mapping, eliminating the "last-mile" search in nodes and ensuring lookup/insert cost with theoretical guarantees.
- Devise a linear time algorithm to obtain the model which evenly distributes the mapping as much as possible and a light-weight adjust strategy to keep the index tree height bounded.
- Participate in implementing the index (https://github.com/Jiacheng-WU/lipp) for experiments and finish a research papar [3].

Topic: Efficient Parallel Datalog Evaluation [Work at University of California at Los Angeles]

- Propose a new coordination strategy to improve parallel Datalog evaluation in the shared-memory environment.
- Devise and Implement a prototype system ($\sim$ 20k of C++ code) with extensive optimizations to improve the overall performance. The results outperform existing solutions by one to two orders of magnitude.
- Write a paper and submit it to SIGMOD 2022 [1], whose current status is accept with sheperding.

Topic: Large-scale Learning on Spark with Datalog [Work at University of California at Los Angeles]

- Develop a declarative machine learning framework with Datalog as the query interface.
- Propose and implement a series of optimization techniques for aggregates in recursive Datalog programs by modifying the internal query engine of Spark SQL ($\sim$ 1k of Scala/Java code).
- Help in writing a research paper, which is accepted by the VLDB Journal [4].

Topic: Extensible Template Library for Big Data Shuffles. [Work at University of Pennsylvania]

- Provide an extensible shuffle library usable across big data systems and network environments.
- Introduce parameterized shuffle templates populated by sampling functions to dynamically adapt different workloads and layouts.
- Conduct experiments based on Apache Spark by modifying the internal source code ($\sim$ 4k lines of Scala/Java code) and participate in writing a research paper [2].

Topic: Improving Dynamically-Generated Code Performance on Dynamic Binary Translators.
[Work at University of Minnesota, Twin Cities]

- Propose an approach to optimize DBT systems for guest applications with DGC which preserves, reuses the DBT code, and retranslates only when needed.
- Implement a prototype based on such an approach on an existing DBT system HQEMU to demonstrate the feasibility ($\sim$ 1k lines of C code) and the effectiveness of the proposed approach.
- Help with the experiment part for a research paper [11].

Publication and Manuscript

1. **Jiacheng Wu**, Jin Wang, Carlo Zaniolo. Optimizing Parallel Recursive Datalog Evaluation on Multicore Machines. Submitted to ACM Special Interest Group in Management Of Data (**SIGMOD**) 2022. Current Status: Accept with Shepherding (Minor Revision).
2. **Jiacheng Wu**, Yong Zhang, Shimin Chen, Yu Chen, Jin Wang, Chunxiao Xing. Updatable Learned Index with Precise Positions. Proc. VLDB Endow. 14(8):1276-1288, 2021.
3. Qizhen Zhang, **Jiacheng Wu**, Yucheng Lu, Simran Arora, Ang Chen, Vincent Liu, Boon Thau Loo. Templating Shuffles. Current Status: Manuscript.

4. Jin Wang, **Jiacheng Wu**, Mingda Li, Jiaqi Gu, Ariyam Das, Carlo Zaniolo. Formal Semantics and High Performance in Declarative Machine Learning using Datalog. VLDB J. 30(5):859-881, 2021.
5. Yu Chen, Yong Zhang, **Jiacheng Wu**, Jin Wang, Chunxiao Xing. Revisiting Data Prefetching for Database Systems with Machine Learning Techniques. IEEE International Conference on Data Engineering (**ICDE**) 2021, pages: 2165-2170. (short paper)
6. Yong Zhang, **Jiacheng Wu**, Jin Wang, Chunxiao Xing. A Transformation-Based Framework for KNN Set Similarity Search. IEEE Trans. Knowl. Data Eng. 32(3): 409-423, 2020.
7. **Jiacheng Wu**, Yong Zhang, Yu Chen, Chunxiao Xing. A Progressive Approach for Computing the Earth Mover's Distance. Database Systems for Advanced Applications (**DASFAA**) 2020, pages: 122-138.
8. Jin Wang, Guorui Xiao, Jiaqi Gu, **Jiacheng Wu**, Carlo Zaniolo. RASQL: A Powerful Language and its System for Big Data Applications. ACM International Conference on Management of Data (**SIGMOD**) 2020, pages: 2673-2676. (demo)
9. **Jiacheng Wu**, Yong Zhang, Jin Wang, Chunbin Lin, Yingjia Fu, Chunxiao Xin. Scalable Metric Similarity Join Using MapReduce. IEEE International Conference on Data Engineering (**ICDE**) 2019, pages: 1662-1665. (short paper)
10. Bo Ren, **Jia-Cheng Wu**, Ya-Lei Lv, Ming-Ming Cheng, Shao-Ping Lu. Geometry-Aware ICP for Scene Reconstruction from RGB-D Camera. J. Comput. Sci. Technol. 34(3): 581-593, 2019.
11. Wenwen Wang, **Jiacheng Wu**, Xiaoli Gong, Pen-Chung Yew. Improving Dynamically-Generated Code Performance on Dynamic Binary Translators. 14th ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments (**VEE**), pages: 17-30, 2018.
12. Jin Zhang, Yuxuan Li, Chengjun Sun, Haoxiang Yang, **Jiacheng Wu**, Xiaoli Gong. XoT: A Flexible Block I/O Data Transfer Protocol for Xen. Security, Privacy, and Anonymity in Computation, Communication, and Storage (**SpaCCS**) 2017, pages: 791-800. (workshop)

Research Experience

- Research Staff. Chinese Academy of Sciences. 2021.06 - Current.
  Advisor: Professor Shimin Chen.
- Research Intern. University of California, Los Angeles. 2019.07-2019.09, 2020.01-2020.07 (remotely).
  Advisor: Professor Carlo Zaniolo.
- Research Intern. University of Pennsylvania. 2018.07-2018.09.
  Advisor: Professor Boon Thau Loo and Professor Vincent Liu.
- Research Intern. University of Minnesota, Twin Cities. 2017.07-2017.09.
  Advisor: Professor Pen-Chung Yew.

Honors and Awards

- Siebel Scholar, Class of 2021.
- Outstanding Graduates. Nankai University, 2018.
- National Scholarship for Undergraduate Student (top 1%) three times: 2015, 2016, 2017.

MISC

English Test Score

- TOEFL: 100 (R: 29, L: 27, S: 20, W: 24)
- GRE: 322 (V: 152, Q: 170, AW: 3.5)

Teaching Experience

- TA. Introduction to Database Management System. Tsinghua University, 2019-Autumn.

Academic Service

- PC Member: AAAI 2021

Skills

- Languages: C/C++, Scala, Java, Python, Bash, SQL
- Tools: Spark, MySQL, CUDA, Pytorch, TensorFlow, LaTeX

References

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