UNIVERSITY OF SOUTH FLORIDA

Defense of a Doctoral Dissertation

PsiDB: A Framework for Batched Query Processing and Optimization

by

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For the Ph.D. degree in Computer Science and Engineering

Techniques based on sharing data and computation among queries have been an active research topic in big data management systems. While work in this area developed algorithms and systems that are shown to be effective, there is a lack of logical foundation for query processing and optimization. In this research, we present PsiDB, a system model for processing a large number of database queries in a batch. The key idea is to generate a single query expression that returns a global relation containing all the data needed for individual queries. For that, we propose the use of a type of relational operators called ψ-operators in combining the individual queries into the global expression.

We tackle the algebraic optimization problem in PsiDB by developing equivalence rules to transform concurrent queries with the purpose of revealing query optimization opportunities. Centering around the ψ -operator, our rules not only covered many optimization techniques adopted in existing batch processing systems but also revealed new optimization opportunities. We also sketch our vision on the development of a query optimizer following the PsiDB strategy and highlight the key challenges in PsiDB system implementation. Experiments conducted on an early prototype of PsiDB show a significant performance improvement over a mainstream commercial DBMS.

Examining Committee

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Publications

1. **Mehrad Eslami**, Yicheng Tu, " PsiDB: An Algebraic Framework for Batched Query Processing and Its Implementation" Patent assigned number 19A010, 2019.
2. **Mehrad Eslami**, Yicheng Tu, Hadi Charkhgard, Zichen Xu "PsiDB: A Framework for Batched Query Processing and Optimization" 2019 IEEE Big Data 2019, Los Angeles, CA, USA, December 9th, 2019.
3. **Mehrad Eslami**, Vahid Mahmoodian, Iman Daryarian, Hadi Charkhgard, Yicheng Tu, "Query Batching Optimization in Database Systems", Computers & Operations Research, 2020, Under Review.

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