DBSE Scientific Team Project

Teaching Compilers SQL

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May 17, 2024

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Introduction

Paper - "Michael Jungmair, André Kohn, and Jana Giceva. 2022. Designing an open framework for query optimization and compilation." [1]

Introduction

- Developing an experimental prototype with Python ML model to process SQL queries using IREE compiler.
- Prototype designed to support SQL processing across different hardware (CPU, GPU, TPU).
- Dynamic code generation has evolved SQL analytics in academia and industry over the past decade.
- Challenges persist in code generation without a consensus on query compiler design.
- Current systems emphasize performance over flexibility.

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First Results of Literature Research:

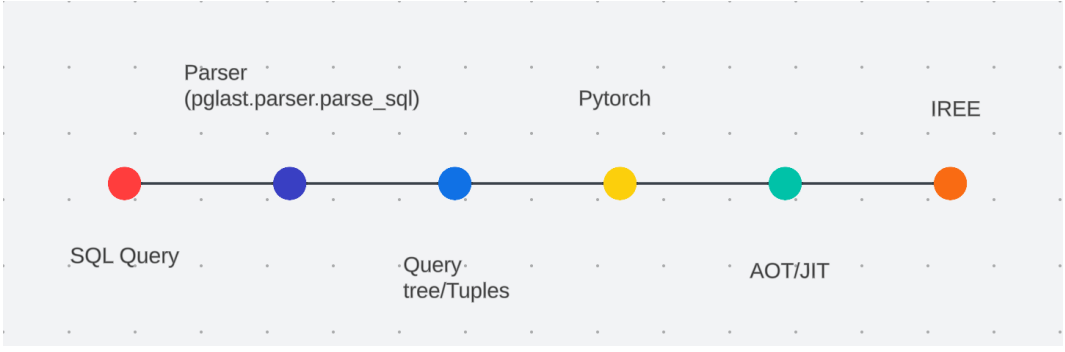

Figure: Roadmap for Query Processing

- PyTorch offers 2 workflows: JIT and AOT.
- JIT integration: Optimize PyTorch models/functions with TorchDynamo and IREE interactively.
- AOT toolkit: Define program structure in Python and export deployment-ready artifacts for IREE's deployment via API bindings.

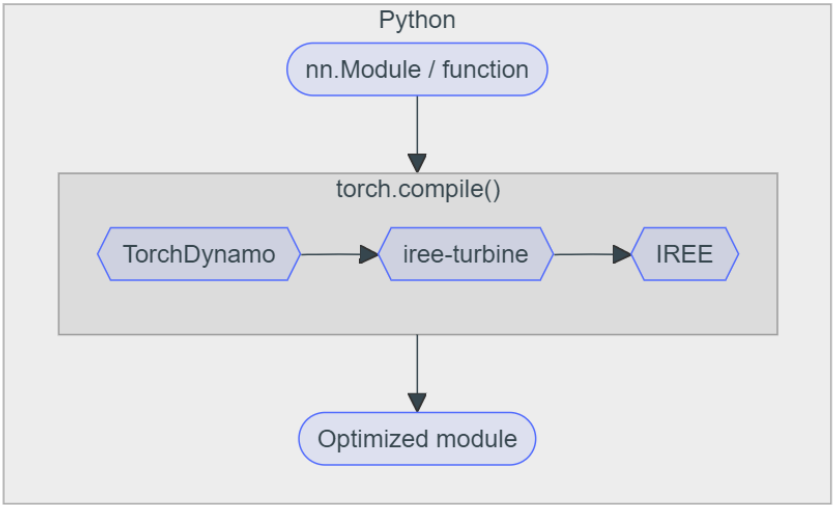

Figure: Just In Time (JIT) Workflow

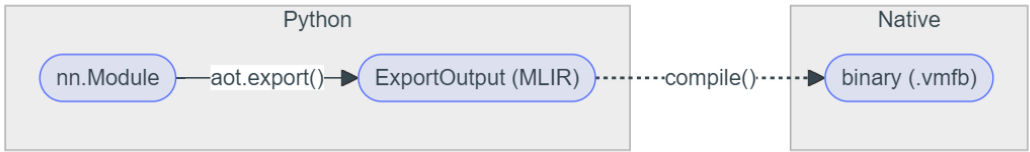

Figure: Ahead Of Time (AOT) Workflow

IREE

- IREE is an MLIR-based compiler and runtime for Machine Learning (ML) models.
- It lowers ML models to a unified IR for data center, mobile, and edge deployments.
- IREE's IR includes scheduling and execution logic for parallel pipelined hardware/APIs like Vulkan.
- The IR also encodes dense computation on hardware in hardware/API-specific binaries like SPIR-V.

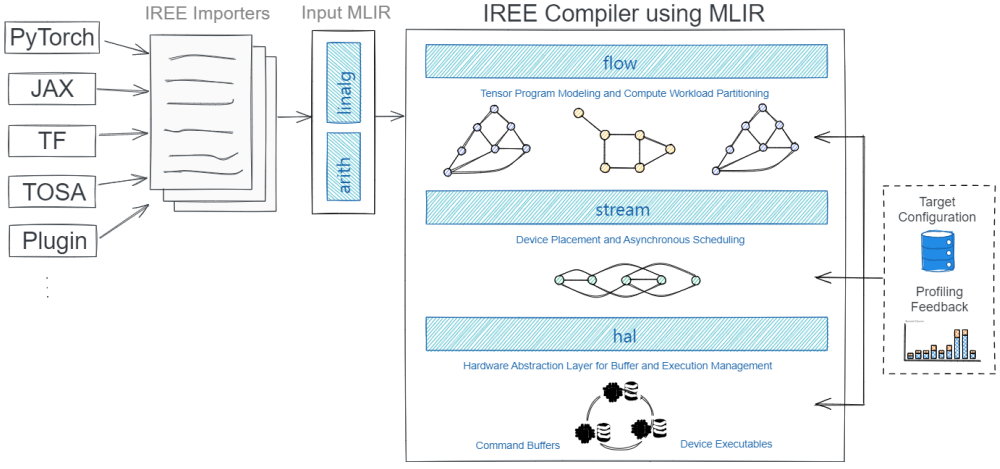

Figure: Project Architecture

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Schedule

- 1. First milestone: **16.05.2024** - Researching and formulating the project workflow
- 2. Second milestone: **05.06.2024** - Will submit initial paper draft with an introduction, background, and related work.
- 3. Third milestone: **02.07.2024** - Will submit revised paper draft with the proposed method.
- 4. Final milestone and Paper submission: **24.07.2024** - Will be ready for final paper submission.

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Conclusion

- Using PyTorch in ML frameworks for query processing.
- Passing PyTorch models to IREE compiler for compilation.
- Evaluating JIT and AOT workflows in PyTorch for optimal implementation.

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[1] Michael Jungmair, André Kohn and Jana Giceva. “Designing an Open Framework for Query Optimization and Compilation”. In: *Proc. VLDB Endow.* 15 (2022), pp. 2389–2401.