Formal Language Driven Data Analysis Research Group Report

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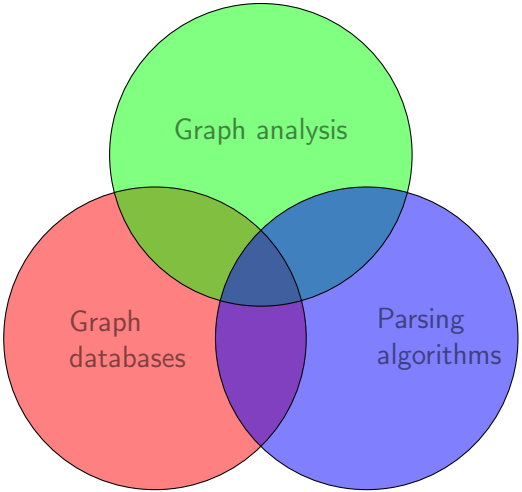
Research Area



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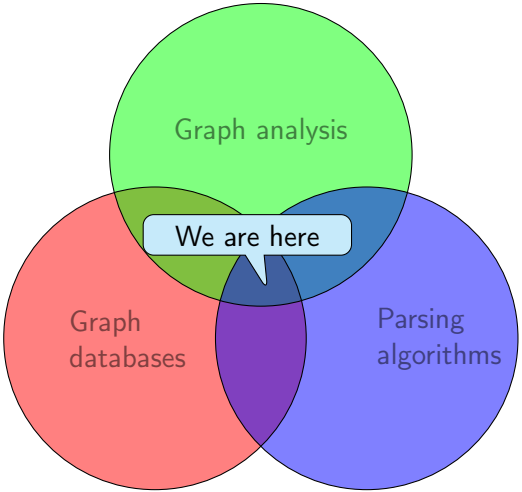
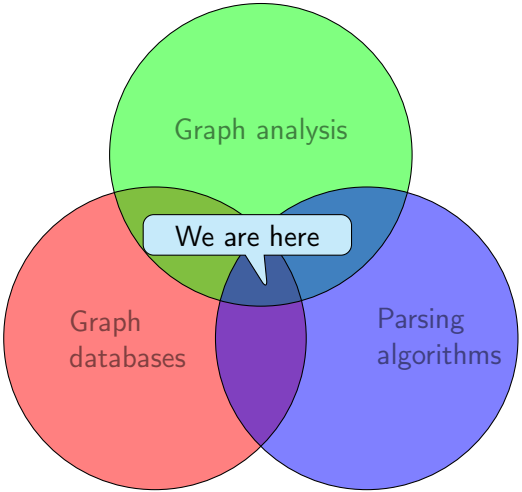


Research Area

Applications

- Code analysis
- Code querying
- Code parsing



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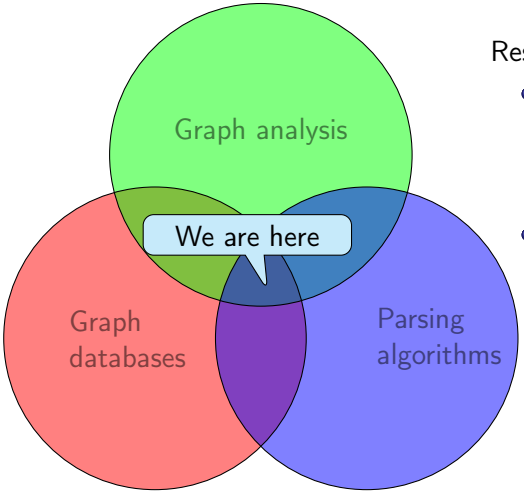

Research directions

- Graph algorithms
  - Dynamic graphs
  - Linear algebra
  - Path querying
- Formal languages
  - Languages classes and properties
  - Parsing algorithms
  - Formal language constrained path querying

Code Analysis and Querying

Huge software projects

- Millions LOC
- Complex structure
- Dynamic (IDE-level analysis)

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- Graph representation
- Query languages
- Query evaluation engines

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Graph analysis algorithms

- Performance
- Nontrivial techniques (esp. for dynamic graphs)

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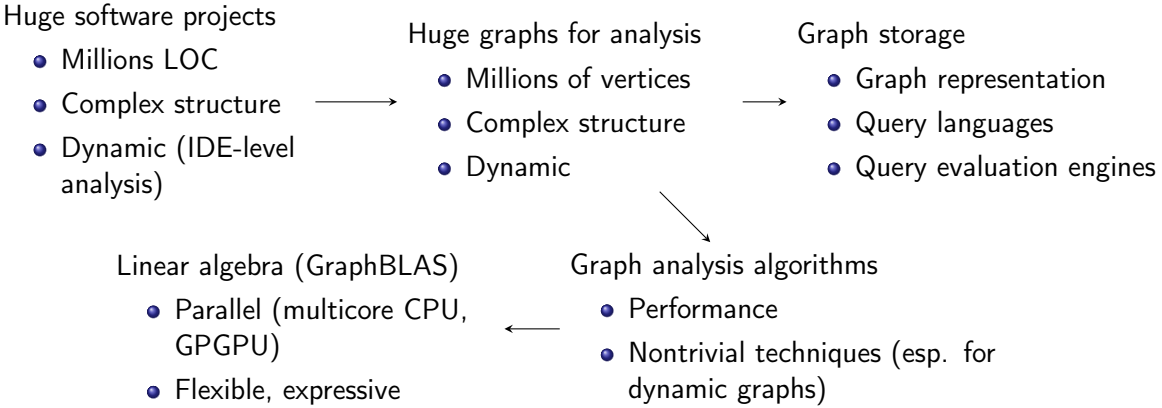

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Parsing for IDE

- Frequent code updates
- Partially correct code
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- Error recovery
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Language description

- Modern syntax support (ambiguity, formatting-sensitivity)
- Human-friendly

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Advanced parsing algorithms

- New formal classes of languages
- Error recovery
- Incrementalization
- Performance

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Results

Graph analysis for symbolic execution engine	Research prototype	• Graph extraction and update mechanism • Constrained shortest paths for dynamic graph

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Graph analysis for symbolic execution engine	Research prototype	• Graph extraction and update mechanism • Constrained shortest paths for dynamic graph
Graph querying algorithms	Research prototype	• New algorithms • Complexity analysis • Performance analysis
Sparse linear algebra library on GPGPU	Research prototype	• Operations implementation • Optimizations • Performance analysis

The Plan

Code querying for declarative code analysis

- Code querying and graph querying languages
  - CodeQL
  - Datalog
  - GQL
  - ...
- Query evaluation engines
  - Performance
  - Flexibility
- Graph analysis algorithms
  - Performance
  - Scalability
  - Incrementalization

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Parsing techniques and algorithms

- Language specification formalisms
- Error recovery techniques
- Reparsing techniques

Scholarships request (2022–2023 academic year, 9 months)

- Egor Orachyov
- Alexandra Istomina
- Kirill Garbar
- Denis Porsev
- 2-3 new students