Graph Analysis and Graph Databases

Semyon Grigorev

Saint Petersburg State University

April 16, 2022

Group Info

- Lead: Semyon Grigorev
  - PhD (2016), Associate professor (2016, SPbSU)
  - dblp: https://dblp.org/pid/181/9903.html
  - s.v.grigoriev@spbu.ru
- PhD students: 2
- Master students: 2
- Bachelor students: 4

Group Info

- Lead: Semyon Grigorev
  - PhD (2016), Associate professor (2016, SPbSU)
  - dblp: https://dblp.org/pid/181/9903.html
  - s.v.grigoriev@spbu.ru
- PhD students: 2
- Master students: 2
- Bachelor students: 4
- Research areas
  - High-performance graph analysis
  - Formal languages constrained path querying
  - Graph databases and graph query languages

High-Performance Graph Analysis

- Linear algebra based algorithms for graph analysis
  - Parallel algorithms on CPU and GPGPU
  - Sparse linear algebra
  - GraphBLAS API

High-Performance Graph Analysis

- Linear algebra based algorithms for graph analysis
  - Parallel algorithms on CPU and GPGPU
  - Sparse linear algebra
  - GraphBLAS API
- Research directions
  - GraphBLAS-based algorithms design, implementation and evaluation
  - Integration of algorithms to graph databases
  - Portable multi-GPGPU implementation of GraphBALS-like API

High-Performance Graph Analysis

- Linear algebra based algorithms for graph analysis
  - Parallel algorithms on CPU and GPGPU
  - Sparse linear algebra
  - GraphBLAS API
- Research directions
  - GraphBLAS-based algorithms design, implementation and evaluation
  - Integration of algorithms to graph databases
  - Portable multi-GPGPU implementation of GraphBALS-like API
- Collaboration
  - GraphBLAS community
  - LDBC community

High-Performance Graph Analysis: Results

- Tools
  - Spla: sparse linear algebra framework for multi-GPU computations based on OpenCL
  - SPbLA: library of GPGPU-powered sparse boolean linear algebra operations
  - LDBC Graphalytics extension for evaluation of formal language constrained path querying
- Papers
  - SPbLA: The Library of GPGPU-Powered Sparse Boolean Linear Algebra Operations (GrAPL@IPDPS)
  - Evaluation of the context-free path querying algorithm based on matrix multiplication (GRADES-NDA@SIGMOD)

Formal Language Constrained Path Querying (FLPQ)

- Formal languages as path constraints
  - Regular path querying (RPQ)
  - Context-free path querying (CFPQ)
  - Applications
    - Graph analysis
    - Interprocedural static code analysis
    - Graph database querying

Formal Language Constrained Path Querying (FLPQ)

- Formal languages as path constraints
  - Regular path querying (RPQ)
  - Context-free path querying (CFPQ)
  - Applications
    - Graph analysis
    - Interprocedural static code analysis
    - Graph database querying
- Research directions
  - New algorithms development
  - Complexity analysis
  - High performance algorithms implementation and evaluation

Formal Language Constrained Path Querying (FLPQ)

- Formal languages as path constraints
  - Regular path querying (RPQ)
  - Context-free path querying (CFPQ)
  - Applications
    - Graph analysis
    - Interprocedural static code analysis
    - Graph database querying
- Research directions
  - New algorithms development
  - Complexity analysis
  - High performance algorithms implementation and evaluation
- Collaboration
  - LDBC community
  - RedisGraph team
  - Neo4j team

FLPQ: Results

- Tools
  - GLL4Graph: CFPQ for Neo4j
  - CFPQ for RedisGraph
  - CFPQ_PyAlgo: set of GrpapBLAS-based FLPQ algorithms
- Papers (> 10)
  - Multiple-Source Context-Free Path Querying in Terms of Linear Algebra (EDBT, Core A)
  - Context-free path querying by matrix multiplication (GRADES-NDA@SIGMOD)
  - Parser combinators for context-free path querying (Scala@ICFP)