QUantum algorithms for massive DATA

Academic partners

Cyril Gavoille, LaBRI - Frédéric Magniez, IRIF - Simon Martiel, Bull

Industrial partner

Coordinates

https://www.irif.fr/~magniez/qudata/
Quantum algorithms
- The first generation of quantum algorithms has mostly addressed theoretical problems
- A second generation of quantum algorithms has made the field ripe for concrete applications, in part due to the recent development of new quantum algorithmic techniques for linear algebra

Quantum technology
- In a near future, will emerge at first few devices manipulating limited quantum resources
  a mixed network of classical and quantum computing devices

Today problems
- An unprecedented amount of data is being constantly generated
- Already many efficient classical algorithms

Project goal
- A comprehensive analysis
  of the potential of quantum computing
  for processing massive data sets
Emerging directions

Machine learning and optimization
- Quantum machine learning: iterative methods, neural networks,…
- Optimization: linear/semi-definite programming, dynamic programming

Models with restricted access to data
- Huge data, small memory
- Distributed input
- Delegated computation

Quantum software and resource optimization
- Real data sets / use cases
- Quantum error correction
3 complementary groups

**IRIF-LIP6: Quantum information**
- Algorithms, complexity, cryptography
- Classical algorithms for massive data
  - Streaming, Sampling, Distributed
- Communication complexity
- Quantum cloud computing, delegated quantum computation

**LaBRI: Distributed computing**
- Distributed algorithms, routing protocols
- Information theory
- Non-locality of quantum information
- Quantum error correcting codes

**ATOS/Bull**
- HPC, Big Data
- Machine learning
- Quantum computer simulator, “ATOS Quantum Learning Machine”
  - Models for quantum hardware
Kickoff meeting - Today

- 10h-10h30: Bertrand MARCHAND (Atos)
  General overview of the Atos QC platform
- 10h30-11h: Anupam PRAKASH (IRIF)
  A quantum interior-point method for SDPs and LPs
- 11h30-12h: Alessandro LUONGO (Atos and IRIF)
  Quantum machine learning algorithms
- 13h30-14h: Simon MARTIEL (Atos)
  Overview of Atos research activities on NISQ
- 14h-14h30: Dominik LEICHTLE (LIP6)
  Post-quantum digital signatures
- 15h-15h30: Ghazal KACHIGAR (LaBRI)
  Distributed coloring with non-local resources
- 15h30-16h: Yassine HAMOUDI (IRIF)
  Quantum Chebyshev's inequality and applications

Thematic meeting - February 20-21, 2019

- Focus on quantum distributed computing.