Ruslan Shaydulin

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Web: shaydul.in Google Scholar: https://scholar.google.com/citations?user=PxOuGGcAAAAJ

Profile

PhD candidate in computer science, expecting to graduate in May 2020. My research focusses around the intersection between (hyper)graph problems, optimization, machine learning, quantum and high-performance computing. I have extensive experience designing and implementing hybrid quantum-classical algorithms, with particular interest in variational and decomposition-based approaches (including multilevel).

Peer-reviewed Publications

Sami Khairy, **Ruslan Shaydulin**, Lukasz Cincio, Yuri Alexeev, Prasanna Balaprakash. Learning to Optimize Variational Quantum Circuits to Solve Combinatorial Problems. In *Proceedings of Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-20) (to appear),* 2020. **Acceptance rate: 20.6%**

Sami Khairy, **Ruslan Shaydulin**, Lukasz Cincio, Yuri Alexeev, Prasanna Balaprakash. Reinforcement-Learning-Based Variational Quantum Circuits Optimization for Combinatorial Problems. In *Proceedings of the Machine Learning and the Physical Sciences workshop at Conference on Neural Information Processing Systems (NeurIPS 2019),* 2019. (link) Preprint: arXiv:1911.04574

Ruslan Shaydulin, Yuri Alexeev. Evaluating Quantum Approximate Optimization Algorithm: A Case Study. In *Proceedings of the 2nd International Workshop on Quantum Computing for Sustainable Computing (QCSC 2019) (in conjunction with 10th International Green and Sustainable Computing Conference (IGSC 2019)),* 2019 DOI: 10.1109/IGSC48788.2019.8957201

Sami Khairy, **Ruslan Shaydulin**, Lukasz Cincio, Yuri Alexeev, Prasanna Balaprakash. Reinforcement Learning for Quantum Approximate Optimization. *Research Poster, Supercomputing '19,* 2019 (available in Proceedings)

Ruslan Shaydulin, Ilya Safro, and Jeffrey Larson. Multistart Methods for Quantum Approximate Optimization. In *Proceedings of 2019 IEEE High Performance Extreme Computing Conference (HPEC),* 2019 **Best Student Paper** (of ~50 student papers). DOI: 10.1109/HPEC.2019.8916288

Ruslan Shaydulin, Hayato Ushijima-Mwesigwa, Christian F.A. Negre, Ilya Safro, Susan M Mniszewski, and Yuri Alexeev. A Hybrid Approach for Solving Optimization Problems on Small Quantum Computers. *Computer*, 52(6):18–26, 2019. **Cover Feature.** DOI: 10.1109/MC.2019.2908942

Ruslan Shaydulin, Hayato Ushijima-Mwesigwa, Ilya Safro, Susan Mniszewski, and Yuri Alexeev. Network Community Detection on Small Quantum Computers. *Advanced Quantum Technologies*, 2(9):1900029, 2019. DOI: 10.1002/qute.201900029

Ruslan Shaydulin, Hayato Ushijima-Mwesigwa, Ilya Safro, Susan Mniszewski, and Yuri Alexeev. Community Detection Across Emerging Quantum Architectures. In *Proceedings of the 3rd International Workshop on Post Moore's Era Supercomputing (in conjunction with Supercomputing '18)*, 12-14, 2018. Preprint arXiv:1810.07765

Ruslan Shaydulin and Ilya Safro. Aggregative Coarsening for Multilevel Hypergraph Partitioning. *In Proceedings of 17th International Symposium on Experimental Algorithms (SEA 2018)*, 103:2:1–2:15, 2018. DOI: 10.4230/LIPIcs.SEA.2018.2

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Ruslan Shaydulin, Jie Chen, and Ilya Safro. Relaxation-Based Coarsening for Multilevel Hypergraph Partitioning. *Multiscale Modeling & Simulation*, 17(1):482–506, 2019. DOI: [10.1137/17M1152735](10.1137/17M1152735)

Online Preprints and In-Submission Works

Hayato Ushijima-Mwesigwa, **Ruslan Shaydulin**, Christian F. A. Negre, Susan Mniszewski, Yuri Alexeev, Ilya Safro. Multilevel Combinatorial Optimization Across Quantum Architectures. *In submission.* Preprint: arXiv:1910.09985

Zirou Qiu, **Ruslan Shaydulin**, Xiaoyuan Liu, Yuri Alexeev, Christopher S. Henry, Ilya Safro. Network Alignment by Propagating Reliable Similarities. *In submission.* Preprint: arXiv:1911.05486

Justin Sybrandt, **Ruslan Shaydulin**, Ilya Safro. Hypergraph Partitioning With Embeddings. *In submission.* Preprint: arXiv:1909.04016

Ruslan Shaydulin, Caleb Thomas, Paige Rodeghero. Making Quantum Computing Open: Lessons from Open-Source Projects. Preprint: arXiv:1902.00991

Ruslan Shaydulin, Justin Sybrandt. To Agile, or not to Agile: A Comparison of Software Development Methodologies. Preprint: arXiv:1704.07469

Education

Clemson University, SC   **Summer 2020 (expected)**
PhD candidate in Computer Science, advisor: Ilya Safro
Master of Science in Computer Science en route to PhD   **Fall 2019**
Research in algorithms, high performance computing, big data analysis and quantum computing
Relevant coursework: Design & Analysis of Algorithms, Data Mining, Distributed & Cluster Computing, Parallel Architecture, Network Science

Moscow Institute of Physics and Technology   **Summer 2016**
Department of Control and Applied Math,
Bachelor of Science in Applied Mathematics and Physics
Minor: Computer Science and Data Analysis

Work Experience

Research Aide, Argonne National Laboratory   **Summer 2018, 2019**
• Developed quantum-accelerated frameworks for network community detection and graph partitioning under the supervision of Yuri Alexeev
• Co-authored 6 papers on quantum optimization and machine learning (5 first author)
• Contributed to multiple proposals

Research Intern, Parallels LABs   **Winter 2014 - Summer 2016**
• Improved stability and security of SmartMail macOS email client by isolating potentially unstable parts as separate services
• Added features to UI of iQuickMark iOS app

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Contributed Talks and Posters

Information Science and Technology Institute Seminar *Los Alamos National Laboratory*   **Nov 26, 2019**
Gave talk "Practical Optimization on Near-term Quantum Computers"

Supercomputing '19 *Denver, CO*   **Nov 17-22, 2019**
Gave talk "Hybrid Quantum-Classical Algorithms for Graph Problems: Forging a Path to Near-Term Applications" at the [Clemson booth](#) and at the [SC Theater](#)

Quantum Computing Seminar *Oak Ridge National Laboratory*   **Nov 4, 2019**
Gave talk "Practical Optimization on Near-term Quantum Computers"

International Green and Sustainable Computing Conference (IGSC 2019) *Alexandria, VA*   **Oct 22, 2019**
Presented poster "Reinforcement Learning for Quantum Approximate Optimization"

Chicago Quantum Exchange Meeting *University of Chicago*   **June 12, 2019**
Presented poster "Practical Quantum Approximate Optimization"

SIAM Conference on Computational Science and Engineering (CSE19) *Spokane, WA*   **Feb 25-28, 2019**
Presented poster ["Quantum Local Search for Graph Community Detection"](#)

Quantum Computing Tutorial *Argonne National Laboratory*   **Dec 10-11, 2018**
Gave talk ["QAOA Algorithm Introduction"](#)

Supercomputing '18 *Dallas, TX*   **Jul 25-27, 2018**
Gave talk "Community Detection Across Emerging Quantum Architectures" at Clemson booth

Quantum Computing Workshop *Argonne National Laboratory*   **Jul 25-27, 2018**
Presented preliminary results on ["Machine Learning on Near-Term Quantum Computers"](#)

32nd Clemson Mini-Conference on Discrete Mathematics and Algorithms *Clemson University*   **Nov 4, 2017**
Presented poster "Relaxation-Based Coarsening for Multilevel Hypergraph Partitioning"

58th Scientific Conference *Moscow Institute of Physics and Technology*   **Nov 23–28, 2015**
Gave talk "IPC (Inter-Process Communication) in OS X"

Leadership and Service

Supercomputing '19 *Denver, CO*   **Nov 17-22, 2019**
Student volunteer, run tutorials, technical program session and Birds-of-Feather

SIAM Conference on Parallel Processing for Scientific Computing (PP20) *Seattle, WA*   **Feb 12-15, 2020**
Led and co-organized a minitutorial ["Combinatorial Optimization on Quantum Computers"](#)

SIAM Conference on Parallel Processing for Scientific Computing (PP20) *Seattle, WA*   **Feb 12-15, 2020**
Co-organized a minisymposium "Recent Advances and Trends in Hybrid Quantum-Classical Algorithms"

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~~Quantum Computing Tutorial~~ *Argonne National Laboratory*   ~~May 14, 2019~~

Led and co-organized a [hands-on tutorial for Qiskit, a framework for quantum computing](#)

Mathematics Teacher, Summer School *Kostroma, Russia*   **Summer 2014**

School administrator, organized extracurricular activities.

Teaching

Network Science CPSC 8480 *Clemson University*   **Fall 2018, 2019**

Teaching Assistant responsible for grading and answering students' questions during office hours

Design and Analysis of Algorithms CPSC 8400 *Clemson University*   **Spring 2019**

Teaching Assistant responsible for grading and answering students' questions during office hours

Algorithms and Data Structures CPSC 2120 *Clemson University*   **Spring 2019**

Teaching Assistant responsible for running the lab section, grading and answering students' questions during office hours

Mathematics Teacher, Summer School *Kostroma, Russia*   **Summer 2014**

Created and taught a course on basics of graph theory, combinatorics and number theory to middle and high school students.

Languages and Technologies

C , Python

Prior experience: C++, MATLAB, Objective-C, Swift, Bash, IBM QISKit, Rigetti PyQuil

Limited prior experience: R, SQL, yacc, bison, AWS, Google Cloud Engine

Technologies and tools: Git, Xcode for iOS/OSX UI/Backend, TCP/IP, UNIX/Linux, MPI

Honors and Awards

- International Green and Sustainable Computing Conference (IGSC 2019) student travel award, *recipient*
- Best Student Paper at IEEE HPEC 2019 (of ~50 student papers), *recipient*
- IBM Teach-the-Qiskit-Teacher training program, *selected to represent Argonne National Laboratory*
- Upsilon Pi Epsilon CS Honor Society, *member*
- Supercomputing '19 Student Volunteer Travel award, *recipient*
- SIAM CSE '19 Broader Engagement Travel award, *recipient*
- Clemson CCIT Supercomputing '17, '18 and '19 travel award, *recipient*
- Clemson Graduate Travel Grant, Spring '19, *recipient*
- Moscow Institute of Physics and technology Abramov scholarship – Top 300 students in the university, based on high academic achievement, *recipient*