

Tirthak Patel

CONTACT INFORMATION

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AREAS OF INTERESTS

Quantum Computing, High-Performance/Distributed Computing, Systems Optimization Trade-Offs

EDUCATION

🎓 **Northeastern University**, College of Engineering, Boston, MA, USA

Ph.D. in Computer Engineering

Sep 2017 – Aug 2022 (expected)

- **Advisor:** Prof. Devesh Tiwari (<https://web.northeastern.edu/tiwari>)
- **Selected Courses:** High-Performance Computing, Scalable and Sustainable System Design, Simulation and Performance Evaluation, Probabilistic System Modeling and Analysis, Machine Learning and Pattern Recognition, Statistical Inference, and Distributed Network Intelligence

🎓 **University of Toronto**, Faculty of Applied Science and Engineering, Toronto, ON, Canada

B.A.Sc. with Honours in Electrical Engineering

Sep 2012 – Jun 2017

- **Focus Areas:** Computer Software & Hardware, and Control Theory
- **Minor:** Robotics and Mechatronics, **Certificate:** Engineering Business
- **Selected Courses:** Algorithms and Data Structures, Quantum Mechanics, Computer Architecture, Operating Systems, Artificial Intelligence, Digital Systems Design, and Linear Algebra

RESEARCH EXPERIENCE

Northeastern University, Boston, MA, USA

Research Assistant

Sept 2017 – Present

- Investigate and develop solutions for quantum computing research in the fields of quantum simulation, compilation, optimization, and noisy hardware
- Develop solutions for issues affecting HPC jobs and systems: job scheduling, resource (compute, power, and storage) management, and trade-offs among performance, fairness, and efficiency
- Use data-driven learning and statistical inference to infer trends in HPC workloads and make suggestions and future predictions using data from HPC systems of different types and scales
- Mentor undergraduate and graduate students in the lab, familiarizing them to practical research requirements, technical skills, and publication methodology

AWARDS AND HONORS

16. Natural Sciences and Eng. Research Council of Canada (NSERC) Alexander Graham Bell Canada Graduate Scholarship (CGS D-3) *Sep 2019 – Aug 2022*
15. Best Student Paper / Best Paper Finalist at the 33rd IEEE/ACM SC Conference *Nov 2020*
14. Best Paper Finalist at the 39th IEEE ICCAD Conference *Nov 2020*
13. Northeastern University College of Engineering Outstanding Graduate Research Award *May 2020*
12. USENIX Award to attend the 18th USENIX FAST Conference *Feb 2020*
11. NSF Award to attend the 26th IEEE HPCA Conference *Feb 2020*
10. NSF Award to attend the 1st ACM Symposium on CS and Law *Oct 2019*
9. Award to attend the 3rd ACM Europe School for Data Science (*declined*) *Jul 2019*
8. NSF Award to attend the 28th ACM HPDC Conference *Jun 2019*
7. NSF Award to attend the 1st ACM-IMS Data Science Summit *Jun 2019*
6. Northeastern University PhD Network Award to attend the 56th ACM/ESDA/IEEE DAC Conference *Jun 2019*
5. Industry Award to attend the 30th IEEE/ACM SC Conference *Nov 2017*
4. Nominated for AMD's Intern-Of-The-Year Award *Aug 2016*
3. Ontario Center of Excellence TalentEdge Award *May – Aug 2014*
2. University of Toronto President's Scholarship *Sept 2012*
1. Walmart Canada Excellence Scholarship *Sept 2012*

21. “**BLISS: Auto-tuning Complex Applications Using A Pool of Diverse Lightweight Learning Models.**” Rohan Basu Roy, [Tirthak Patel](#), Devesh Tiwari, and Vijay Gadeppally. Conference on Programming Language Design and Implementation (**PLDI 2021**).
20. “**Examining Failures and Repairs on Supercomputers with Multi-GPU Compute Nodes.**” Amir Taherin, [Tirthak Patel](#), Devesh Tiwari, Giorgis Georgakoudis, and Ignacio Laguna. Conference on Dependable Systems and Networks (**DSN 2021**).
19. “**QRAFT: Reverse Your Quantum Circuit and Know the Correct Program Output.**” [Tirthak Patel](#), and Devesh Tiwari. International Conference on Architectural Support for Programming Languages and Operating Systems Storage and Analysis (**ASPLOS 2021**).[♣]
18. “**Operating Liquid-Cooled Large-Scale Systems: Long-Term Monitoring, Reliability Analysis, and Efficiency Measures.**” Rohan Basu Roy, [Tirthak Patel](#), Devesh Tiwari, Raj Kettimuthu, Paul Rich, Adam Scovel, and Bill Allcock. International Symposium on High-Performance Computer Architecture (**HPCA 2021**).
17. “**Experimental Evaluation of NISQ Quantum Computers: Error Measurement, Characterization, and Implications.**” [Tirthak Patel](#), Abhay Potharaju, Baolin Li, Rohan Basu Roy, and Devesh Tiwari. Conference on High-Performance Computing, Networking, Storage and Analysis (**SC 2020**).^{♣†}
16. “**VERITAS: Accurately Estimating the Correct Output on Noisy Intermediate-Scale Quantum Computers.**” [Tirthak Patel](#), and Devesh Tiwari. Conference on High-Performance Computing, Networking, Storage and Analysis (**SC 2020**).[♣]
15. “**Job Characteristics on Large-Scale Systems: Long-Term Analysis, Quantification, and Implications.**” [Tirthak Patel](#), Zhengchun Liu, Raj Kettimuthu, Paul Rich, William Allcock, and Devesh Tiwari. Conference on High-Performance Computing, Networking, Storage and Analysis (**SC 2020**).[♣]
14. “**DISQ: A Novel Quantum Output State Classification Method on IBM Quantum Computers using OpenPulse.**” [Tirthak Patel](#), and Devesh Tiwari. International Conference On Computer Aided Design (**ICCAD 2020**).^{♣†}
13. “**UREQA: Leveraging Operation-Aware Error Rates for Effective Quantum Circuit Mapping on NISQ-Era Quantum Computers.**” [Tirthak Patel](#), Baolin Li, Rohan Basu Roy, and Devesh Tiwari. USENIX Annual Technical Conference (**ATC 2020**).[♣]
12. “**What does the Power Consumption Behavior of HPC Jobs Reveal?**” [Tirthak Patel](#), Adam Wagenhäuser, Christopher Eibel, Devesh Tiwari, Timo Hönig and Thomas Zeiser. IEEE International Parallel and Distributed Processing Symposium (**IPDPS 2020**).
11. “**GIFT: A Coupon Based Throttle-and-Reward Mechanism for Fair and Efficient I/O Bandwidth Management on Parallel Storage Systems.**” [Tirthak Patel](#), Rohan Garg, and Devesh Tiwari. USENIX Conference on File and Storage Technologies (**FAST 2020**).[♣]
10. “**Uncovering Access, Reuse, and Sharing Characteristics of I/O-Intensive Files on Large-Scale Production HPC Systems.**” [Tirthak Patel](#), Suren Byna, Glenn K. Lockwood, Nicholas J. Wright, Philip Carns, Rob Ross, and Devesh Tiwari. USENIX Conference on File and Storage Technologies (**FAST 2020**).[♣]
9. “**Making Disk Failure Predictions SMARTer!**” Sidi Lu, Bing Luo, [Tirthak Patel](#), Yongtao Yao, Devesh Tiwari, and Weisong Shi. USENIX Conference on File and Storage Technologies (**FAST 2020**).
8. “**CLITE: Efficient and QoS-Aware Co-location of Multiple Latency-Critical Jobs for Warehouse Scale Computers.**” [Tirthak Patel](#), and Devesh Tiwari. International Symposium on High-Performance Computer Architecture (**HPCA 2020**).[♣]
7. “**Revisiting I/O Behavior in Large-Scale Storage Systems: The Expected and the Unexpected.**” [Tirthak Patel](#), Suren Byna, Glenn Lockwood, and Devesh Tiwari. Conference on High-Performance Computing, Networking, Storage and Analysis (**SC 2019**).[♣]

6. **“PERQ: Fair and Efficient Power Management of Power-Constrained Large-Scale Computing Systems with Provable Guarantees.”** [Tirthak Patel](#), and Devesh Tiwari. Conference on High-Performance Parallel and Distributed Computing (**HPDC 2019**).[♣]
5. **“What does Vibration do to Your SSD?”** Janki Bhimani, [Tirthak Patel](#), Ningfang Mi, and Devesh Tiwari. Design Automation Conference (**DAC 2019**).[♣]
4. **“Shiraz: Exploiting System Reliability and Application Resilience Characteristics to Improve Large Scale System Throughput.”** Rohan Garg, [Tirthak Patel](#), Gene Cooperman, and Devesh Tiwari. Conference on Dependable Systems and Networks (**DSN 2018**).
3. **“Machine Learning Models for GPU Error Prediction in a Large Scale HPC System.”** Bin Nie, Ji Xue, Saurabh Gupta, [Tirthak Patel](#), Christian Engelmann, Evgenia Smirni, and Devesh Tiwari. Conference on Dependable Systems and Networks (**DSN 2018**).
2. **“Understanding and Analyzing Interconnect Errors and Network Congestion on a Large-Scale HPC System.”** Mohit Kumar, Saurabh Gupta, [Tirthak Patel](#), Michael Wilder, Weisong Shi, Song Fu, Christian Engelmann, and Devesh Tiwari. Conference on Dependable Systems and Networks (**DSN 2018**).
1. **“Failures in Large Scale Systems: Long-Term Measurement, Analysis, and Implications.”** Saurabh Gupta, [Tirthak Patel](#), Christian Engelmann, and Devesh Tiwari. Conference on High-Performance Computing, Networking, Storage and Analysis (**SC 2017**).

JOURNAL
PUBLICATIONS

2. **“Study of Interconnect Errors, Network Congestion, and Applications Characteristics for Throttle Prediction on a Large Scale HPC System.”** Mohit Kumar, Saurabh Gupta, [Tirthak Patel](#), Michael Wilder, Weisong Shi, Song Fu, Christian Engelmann, and Devesh Tiwari. Journal of Parallel and Distributed Computing (**JPDC 2021**).
1. **“Resilience and Coevolution of Preferential Interdependent Networks.”** Auroop Ganguly, Tanay Mehta, [Tirthak Patel](#), Ravi Sundaram, and Devesh Tiwari. Journal of Social Networking and Mining (**IJSNM 2020**).

PROFESSIONAL
SERVICE

13. Member of the Student Editorial Board for the Journal of Systems Research (JSys) *2021*
12. Submissions & Web Chair for the IEEE Int. Symp. on Workload Characterization *2020*
11. Reviewer for the ACM Transactions of Storage Journal *Jun 2020*
10. Volunteer for the 32th IEEE/ACM SC Conference *Nov 2019*
9. External Reviewer for the 18th USENIX FAST Conference *Sep 2019*
8. External Reviewer for the 26th IEEE HPCA Conference *Sep 2019*
7. Reviewer for the Outstanding Graduate Student Award at Northeastern University *Mar 2019*
6. External reviewer for the 49th IEEE/IFIP DSN Conference *Jan 2019*
5. External reviewer for the 36th IEEE ICCD Conference *Jun 2018*
4. Reviewer for the RISE Graduate Innovator Award at Northeastern University *Apr 2018*
3. Volunteer for the 14th IEEE SELSE Workshop *Mar 2018*
2. Reviewer for the Outstanding Graduate Student Award at Northeastern University *Mar 2018*
1. Volunteer for the 30th IEEE/ACM SC Conference *Nov 2017*

TECHNICAL
SKILLS

Python, C++, C, MATLAB, Qiskit, Pennylane, Q#, R, Linux, Bash, C Shell, CUDA, Verilog HDL, HTML, CSS, Javascript, Git, L^AT_EX, OpenMP, MPI, TensorFlow, Pandas, Keras, Matplotlib

PROFESSIONAL
EXPERIENCE

Advanced Micro Devices Inc. (AMD), Markham, ON, Canada

ASIC Block Synthesis Owner

May 2015 – Aug 2016

- Performed block-level synthesis and fixed any failures in the process
- Performed high-level floorplan experiments to successfully improve flop-to-flop timing and area results for tiles of several APU and dGPU chips
- Collaborated with the RTL designers, physical designers and verification teams situated at various AMD campuses to meet chip optimization targets under strict deadlines
- Created Perl and C Shell scripts for the team to automate tasks such as publishing results to website, verifying register values, and extracting version control information
- Trained several new hires and helped familiarize them with design flow

PathCore Inc. (Engineering Research Program), Toronto, ON, Canada

Web Developer

May 2014 – Aug 2014

- Created a web viewer to enable PathCore's clients (doctors and pathologists) to access medical images from any remote location as opposed to only nodes on the hospital network
- Defined and wrote a new interface to enable the web viewer to communicate with PathCore's DICOM PACS (image reservoir) in order to obtain and display pathology images efficiently
- Self-learned web development frameworks, and browser-side and server-side languages
- Designed a web portal and database with the following features: registration for new users, login and session time-out functionalities, search and query for images, search history maintenance, and bookkeeping of images and related metadata

ADDITIONAL
WORK
EXPERIENCE

Learna Brampton, Brampton, ON, Canada

Math and Physics Tutor

Jul 2017 – Aug 2017

- Improved academic performance of students by teaching in a one-on-one setting and catering to their specific learning requirements

University of Toronto Engineering Stores, Toronto, ON, Canada

Marketing Director

Jun 2013 – Apr 2014

- Increased store sales by successfully implementing marketing strategies which improved outreach and generated renewed interest in store merchandise