Neil G. Dickson

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I live for difficult challenges that have the potential to change the world. I specialize in software performance optimization and high-performance simulations. I love to explore and advance new realms.

Work Experience

Senior Software Engineer

NVIDIA, Toronto, ON & Remote, Jan. 2020-Present

- I currently work on nvCOMP, which is a GPU data compression library in CUDA and C++, and DGL, which is an open source Graph Neural Network (GNN) library in Python (e.g. PyTorch), C++, and CUDA.
- I worked almost 2 years in the Omniverse group on various projects related to geometry processing in C++ and CUDA.

3D Software Developer

SideFX, Toronto, ON, Feb. 2012-Nov. 2019

- I developed and optimized performance of Houdini, software used for major film and game VFX and procedural geometry. I redesigned and implemented a wide variety of core geometry processing data structures and algorithms, primarily in C++, with some Python, used in a codebase of a few million lines, and also used directly by some customers. As needed, I aimed for faster performance, including multithreading and vectorizing, for lower memory use, for more functionality, and for better stability.
- I helped customers with questions, bugs, and requests for enhancement (RFEs), made regression tests, and wrote documentation for the components of the software I added.

Software Developer and Quantum Algorithms Researcher

D-Wave Systems Inc., Burnaby, BC, Jun. 2009-Jan. 2012

- I optimized AQUA@home distributed, multithreaded quantum physics and classical physics simulation software, achieving 10x speedups on several different applications in addition to multithreading, in C++, x86 assembly language, and CUDA.
- I managed simulations deployed on 15,000+ volunteer computers, as well as volunteer relations.
- I designed and analysed 4 new quantum optimization algorithms.
- I designed 3 major experiments to examine and characterize quantum computers.

Education

Bachelor of Computer Science, Minor in Mathematics, Co-op Option

Carleton University, Ottawa, ON, 2004-2009

- Completed, 11.9 of 12.0 CGPA, Corresponding letter grade: A+
- Carleton University Medal in Computer Science

Other Activities

Principal Cellist

Strings Attached Orchestra, Toronto, ON, Sept. 2017-Present

- I lead the cello section, run sectional rehearsals, help the other cellists with bowings, fingerings, etc.
- I also conduct the orchestra and help direct them to improve when the conductor is unavailable.

Selected Publications and Talks

(more complete list available upon request)

Fast Winding Numbers for Soups and Clouds

Published at SIGGRAPH 2018, August 2018

- Presents a fast multipole-like approximation of generalized winding numbers for arbitrary triangle meshes or oriented point clouds
- I derived the approximation for triangle meshes, and implemented, optimized, and tested it.

Page Array Data Structures for Flexibility and Performance (Technical Talk)

Presented at SIGGRAPH 2018, August 2018

- Presented data structures with page sharing, constant-value page compression, and copy-on-write, for representing geometry data of many different types in a time- and memory-efficient way that still permits parallel modification and other optimizations.
- I designed and implemented these, replacing the previous geometry data structures in Houdini.

Entanglement in a Quantum Annealing Processor

Published in Physical Review X, May 2014

- Experimentally demonstrates persistent quantum entanglement, even at thermal equilibrium, in an 8-qubit subset of a quantum computer
- I designed a mathematical construct used experimentally to help demonstrate entanglement.

Thermally Assisted Quantum Annealing of a 16-Qubit Problem

Published in Nature Communications, May. 2013

- Experimentally demonstrates that thermal noise does not break quantum annealing, and can even be used to gain a significant performance advantage
- I designed and ran the experiment.

Elimination of Perturbative Crossings in Adiabatic Quantum Optimization

Published in New Journal of Physics, July 2011

- Gives simple construction to eliminate effect causing quantum optimization to take exponential time
- (single-author paper)

Importance of Explicit Vectorization for CPU and GPU Software Performance

Published in Journal of Computational Physics, June 2011

- Heavily optimizing both CPU and GPU Metropolis Monte Carlo simulations casts doubt on assumption that compilers optimize adequately and fairness of CPU vs. GPU performance comparisons
- I performed the optimizations and performance experiments.

Quantum Annealing with Manufactured Spins

Published in Nature, May 2011

- Demonstrates that an 8-qubit quantum computer uses quantum physics, not classical, to compute
- I optimized and managed the distributed, multi-threaded simulations of the quantum processor.

Does Adiabatic Quantum Optimization Fail for NP-complete Problems?

Published in Physical Review Letters, Feb. 2011

- Invalidates claims adiabatic quantum optimization of NP-complete problems takes exponential time
- I worked closely with the co-author in developing the analyses and examples.