Benjamin (Ben) Wesley Priest

CONTACT INFORMATION

Postdoctoral Researcher
Center for Applied Scientific Computing
Lawrence Livermore National Laboratory

Cell: +1-937-681-1935
E-mail: priest2@llnl.gov

RESEARCH INTERESTS

Efficient analysis of large, dynamic datasets: sketching, streaming algorithms, machine learning, high performance computing, graph algorithms, numerical linear algebra, compressed sensing, graph theory, optimization, network analysis, and theory of deep learning.

EDUCATION

Thayer School of Engineering at **Dartmouth College**, Hanover, VT, USA
Ph.D., Engineering (GPA 4.0) **09/2015 – 02/2019**
- Advisor: Professor George Cybenko
- Thesis: Sublinear Approximations of Vertex Centrality in Evolving Graphs

The Ohio State University, Columbus, OH, USA
B.S., Mathematics, (GPA 3.62 *Cum Laude*) **09/2011 – 06/2011**
B.S., Computer and Information Science, (GPA 3.62 *Cum Laude*) **09/2011 – 06/2011**

AWARDS

HPEC Graph Challenge
Graph Challenge Champion, 2019.

SECRYPT
Best Paper Award, 2018.

MIT Lincoln Laboratory
Lincoln Scholar Program recipient, 2015
- (declined)

The Ohio State University
- Phi Beta Kappa Inductee, 2010
- Bingham Award in Philosophy, 2010
- Kenneth Cummings Scholarship, 2008–2011
- Distinguished Merit Scholarship, 2007–2011
- Ohio Academic Scholarhship, 2007-2011

RESEARCH EXPERIENCE

Lawrence Livermore National Laboratory, Livermore, CA, USA
Center for Applied Scientific Computing. Supervisors: Dr. Geoff Sanders , Dr. Michael Schneider and Dr. Roger Pearce

Postdoctoral Researcher **04/2019 – Present**
- Wrote an efficient HPC software library implementing novel algorithms using random matrix projections to approximately cluster graphs according to their spectrum
- Built DegreeSketch, an HPC library for fast local query approximation in labeled graphs
- Designed and implemented software computing Gaussian Process kernels dual to the infinite width limit of deep neural networks
- Utilized GP neural kernels to solve problems in reinforcement learning and image classification, and working on applications to deep learning on quantum computing hardware

Computation Student Intern **05/2018 – 01/2019**
- Built novel distributed codes for estimating local triangle counts using cardinality sketches
- Developed sophisticated communication protocols in a big-data environment
- Designed YGM library for improving performance of HPC algorithms with irregular computational load

Dartmouth College, Hanover, NH, USA
Thayer School of Engineering. Advisor: Professor George Cybenko

Research and Teaching Assistant **09/2015 – 02/2019**
- Developed novel sublinear-space sketching algorithms to estimate popular centrality indices and local structural features including triangle counts in large distributed graphs
- Contributed to Moving Target and Adaptive Cyber Defense research, designing game- and graph-theoretic models to quantify and track advanced persistent threats
- Taught courses in applied machine learning, with an emphasis on deep learning while leading a team of TAs

MIT Lincoln Laboratory, Lexington, MA, USA
Cyber Analytics and Decision Systems. Supervisor: Dr. Kevin M. Carter

Assistant Research Scientist **08/2011 – 07/2015**

- Designed and implemented novel machine learning algorithms to educe human and machine behavior from network protocol traffic
- Planned and implemented cognitive multi-agent systems to perform high-fidelity network traffic generation for network-scale simulation experiments
- Evaluated moving target cyber defenses by building a multi-agent simulation platform

Air Force Institute of Technology, Wright-Patterson Air Force Base, OH, USA
Program Encryption Group. Supervisor: Professor J. Todd McDonald

Engineering Technician GS-05 **Summer, 2008 & 2009**

- Developed encryption metrics for circuits using abstract interpretation semantic models

FUNDED PROJECTS

[1] Co-PI, "Scalable Approximate Graph Clustering", LLNL LDRD 20-FS-037, $150,000, February 1, 2020 to September 30, 2020.

SELECTED PUBLICATIONS

[2] **Benjamin W. Priest**. DegreeSketch: Distributed Cardinality Sketches on Massive Graphs with Applications. 2020. arXiv:2004.04289.

[3] Iméne R. Goumiri, **Benjamin W. Priest**, and Michael D. Schneider. Reinforcement Learning via Gaussian Processes with Neural Network Dual Kernels. 2020. arXiv:2004.05198. [Submitted to IEEE Transactions on Neural Networks and Learning Systems]

[4] Matthew Otten, Iméne R. Goumiri, **Benjamin W. Priest**, and Michael D. Schneider. Quantum Machine Learning using Gaussian Processes with Performant Quantum Kernels. 2020. arXiv:2004.11280. [Submitted to Nature Communications]

[5] Trevor Steil, Scott McMillan, Geoffrey Sanders, Roger Pearce, and **Benjamin W. Priest**. Kronecker Graph Generation with Ground Truth for 4-Cycles and Dense Structure in Bipartite Graphs. In *2020 IEEE International Parallel and Distributed Processing Symposium Workshops*, IPDPSW. 2020.

[6] Roger Pearce, Trevor Steil, **Benjamin W. Priest**, and Geoffrey Sanders. One Quadrillion Triangles Queried on One Million Processors. In *Proceedings of the IEEE High Performance Extreme Computing Conference*, HPEC. **Graph Challenge Champion**. 2019.

[7] **Benjamin W. Priest**, Trevor Steil, Geoffrey Sanders, and Roger Pearce. You've Got Mail (YGM): Building missing asynchronous communication primitives. In *2019 IEEE International Parallel and Distributed Processing Symposium Workshops*, IPDPSW. 2019.

[8] Trevor Steil, **Benjamin W. Priest**, Geoffrey Sanders, Roger Pearce, Timothy La Fond, and Keita Iwabuchi. Distributed Kronecker graph generation with ground truth of many graph properties. In *2019 IEEE International Parallel and Distributed Processing Symposium Workshops*, IPDPSW. 2019.

[9] **Benjamin W. Priest**, Roger Pearce, and Geoffrey Sanders. Estimating edge-local triangle count heavy hitters in edge-linear time and almost-vertex-linear space. In *Proceedings of the IEEE High Performance Extreme Computing Conference*, HPEC. 2018.

[10] Luan Hoy Pham, Massimiliano Albanese, and **Benjamin W. Priest**. A quantitative framework to model advanced persistent threats. In *Proceedings of the 15th International Conference on Security and Cryptography*, SECRYPT. **Best Paper Award**. 2018.