Benjamin (Ben) Wesley Priest

CONTACT INFORMATION

Postdoctoral Researcher
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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.

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

Computing Scientist **02/2021 – present**

- Co-designed `MuyGPs`, a cross-validation and nearest neighbors-based Gaussian process training algorithm
- Developed `MuyGPyS`, a pure numpy implementation of `MuyGPs`, which supports several research efforts at LLNL including cosmology, climate, and orbital emulation

Postdoctoral Researcher **04/2019 – 02/2021**

- Wrote `croquis`, an efficient HPC software library implementing novel algorithms using random matrix projections to embed and approximately cluster massive graphs
- Built `DegreeSketch`, an HPC library for fast local query approximation in labeled graphs
- Developed high performance software scalably approximating Gaussian Process inference, including 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 and communication patterns

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

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*) **09/2007 – 06/2011**

B.S., Computer and Information Science, (GPA 3.62 *Cum Laude*) **09/2007 – 06/2011**

AWARDS

HPEC Graph Challenge
Graph Challenge Champion, 2020.
Graph Challenge Champion, 2019.

SECRYPT
Best Paper Award, 2018.

MIT Lincoln Laboratory
Lincoln Scholar Fellowship, 2015

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

FUNDED PROJECTS

[1] Co-I, "MuyGPs: Non-Stationary Gaussian Processes at HPC Scales", LLNL LDRD ER, $850,000/year. October 1, 2021 to September 30, 2024.

[2] Co-I, "Scalable Uncertainty Quantification Using Gaussian Processes Surrogate Models", LLNL LDRD 21-FS-037, $100,000. January 1, 2021 to September 30, 2021.

[3] Co-I, "Interactive Exploratory Graph-Enabled Data Analytics at HPC Scales", LLNL LDRD 21-ER-020, $500,000/year. October 1, 2020 to September 30, 2022.

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

SELECTED PUBLICATIONS

[5] Trevor Steil, Tahsin Reza, Keita Iwabuchi, **Benjamin W. Priest**, Geoff Sanders, and Roger Pearce. Tripoll: Computing Surveys of Triangles in Massive-Scale Temporal Graphs with Metadata. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, SC. 2021. arXiv:2107.12330.

[6] Imène R. Goumiri, Amanda L. Muyskens, Michael D. Schneider, **Benjamin W. Priest**, and Robert E. Armstrong. Star-Galaxy Separation via Gaussian Prcesses with Model Reduction. In *Proceedings of the Advanced Maui Optical and Space Surveillance Technologies Conference*, AMOS. 2020. arXiv:2010.06094.

[7] **Benjamin W. Priest**, Alec Dunton, and Geoffrey Sanders. Scaling Graph Clustering with Distributed Sketches. In *Proceedings of the IEEE High Performance Extreme Computing Conference*, HPEC. **Graph Challenge Champion**. 2020. arXiv:2007.12669.

[8] Iméne R. Goumiri, **Benjamin W. Priest**, and Michael D. Schneider. Reinforcement Learning via Gaussian Processes with Neural Network Dual Kernels. In 2020 IEEE Conference on Games. CoG. 2020. arXiv:2004.05198.

[9] 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.

[10] 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.

[11] **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.

[12] 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.

[13] **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.

[14] 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.