

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 <ul style="list-style-type: none">- 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 <i>Cum Laude</i>) 09/2007 – 06/2011 B.S., Computer and Information Science, (GPA 3.62 <i>Cum Laude</i>) 09/2007 – 06/2011	
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 <ul style="list-style-type: none">- 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 <ul style="list-style-type: none">- 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 <ul style="list-style-type: none">- 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 <ul style="list-style-type: none">- Designed and implemented novel machine learning algorithms to deduce 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

**TECHNICAL
EXPERTISE**

Mathematics

Applied Mathematics
Real Analysis
Measure Theory
Graph Theory
Combinatorics

Computer Science and Engineering

Distributed & parallel algorithms
Streaming algorithms & sketching
Data structures

Data Science and Processing

Probability & Random Variables
Statistics & Estimation
Machine learning & deep learning
Numerical Optimization
Stochastic Processes
Information Theory
Communication Theory

Programming Languages

C/C++, Java, MATLAB, R

Scripting Languages

Python, Bash, Julia

Distributed Computing

MPI, Hadoop MapReduce, Lustre

Analytical Software

Keras, TensorFlow, Mathematica

Utility Software

Git, GitHub/Bitbucket

L^AT_EX, B_IB_TE_X

Operating Systems

Apple OS X

Linux, RedHat, and other UNIX variants

Interpersonal

Teamwork and communication

Leadership and mentoring

Public and technical speaking

**PEER-REVIEWED
CONFERENCE
PUBLICATIONS**

- [1] 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.
- [2] 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.
- [3] **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.
- [4] 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.
- [5] **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.
- [6] 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*, SECRIPT. **Best Paper Award**. 2018.
- [7] **Ben W. Priest**, Era Vuksani, Neal Wagner, Brady Tello, Kevin M. Carter, and William W. Streilein. Agent-based simulation in support of moving target cyber defense technology development and evaluation. In *Proceedings of the 18th Symposium on Communications & Networking, 2015 ACM Spring Simulation Multi-Conference*, CNS/SpringSim. 2015.

- [8] Kevin M. Carter, Ramona S. Caceres and **Ben Priest**. Characterization of latent social networks discovered through computer network logs. In *Networks in the Social and Information Sciences workshop of the 29th Annual Conference on Neural Information Processing Systems*, NIPS. 2015.
- [9] **Ben Priest** and Kevin M. Carter. Characterizing latent user interests on enterprise networks. In *Proceedings of the Twenty-Seventh International Florida Artificial Intelligence Research Society Conference*, FLAIRS. 2014.
- [10] Kevin M. Carter, Rajmonda S. Caceres, and **Ben Priest**. Latent community discovery through enterprise user search query modeling. In *Proceedings of the 37th International ACM SIGIR Conference on Research & Development in Information Retrieval*, SIGIR. 2014.
- [11] Kevin Gold, Zachary J. Weber, **Ben Priest**, Josh Ziegler, Karen Sittig, William W. Streilein, and Mark Mazumder. Modeling how thinking about the past and future impacts network traffic with the GOSMR architecture. In *International conference on Autonomous Agents and Multi-Agent Systems*, AAMAS. 2013.
- [12] **Ben Priest** and Kevin Gold. Utility discounting explains informational website traffic patterns before a hurricane. In *Proceedings of the 22nd International World Wide Web Conference*, WWW. 2013.
- [13] Kevin Gold, **Ben Priest**, and Kevin M. Carter An expectation maximization approach to detecting compromised remote access accounts. In *Proceedings of the Twenty-Sixth International Florida Artificial Intelligence Research Society Conference*, FLAIRS. 2013.
- WORKING PAPERS [14] **Benjamin W. Priest**. DegreeSketch: Distributed Cardinality Sketches on Massive Graphs with Applications. 2020. arXiv:2004.04289.
- [15] 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]
- [16] 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]
- [17] **Benjamin W. Priest**. Track Linking via Locality Sensitive Hashing. [In Preparation for Advanced Maui Optical and Space Surveillance Technologies Conference 2020].
- [18] Imene Goumiri, **Benjamin W. Priest**, and Michael Schneider. Star-Galaxy Separation via Gaussian Processes with Neural Network Dual Kernels. [In Preparation for Advanced Maui Optical and Space Surveillance Technologies Conference 2020].
- OTHER CONFERENCE PUBLICATIONS [19] **Benjamin W. Priest** and George Cybenko. Approximating centrality in evolving graphs: toward sublinearity. In *Proceedings of the 2017 SPIE Defense + Security Conference*, SPIE D+S. 2017.
- [20] **Benjamin W. Priest** and George Cybenko. Efficient inference of hidden Markov models from large observation sequences. In *Proceedings of the 2016 SPIE Defense + Security Conference*, SPIE D+S. 2016.
- BOOK CHAPTERS [21] Geoffrey Sanders, Roger Pearce, **Benjamin W. Priest**, and Trevor Steil. Massive-Scale Distributed Triangle Enumeration and Applications. In: David Bader (Ed.), *Processing Very Large Graphs*, [In Preparation]

	[22] Benjamin W. Priest , George Cybenko, Satinder Singh, Massimiliano Albanese and Peng Liu. Online and Scalable Adaptive Cyber Defense. In: Michael Wellman (Ed.), <i>Adversarial and Uncertain Reasoning for Adaptive Cyber Defense</i> , ch. 11, pp. 232-261. 2019. Springer.
CONFERENCE TALKS	<p>[23] Benjamin W. Priest and George Cybenko Approximating centrality in evolving graphs: toward sublinearity. At: <i>2017 SPIE Defense + Security Conference</i>, SPIE D+S. Anaheim, CA, USA, 9–13 April 2017.</p> <p>[24] Benjamin W. Priest and George Efficient Inference of hidden Markov models from large observations sequences. At: <i>2016 SPIE Defense + Security Conference</i>, SPIE D+S. Anaheim, CA, USA, 17–21 April 2016.</p> <p>[25] Benjamin W. Priest, Era Vuksani and Neal Wagner. Agent-based simulation in support of moving target cyber defense technology development and evaluation. At: <i>18th Symposium on Communications & Networking, 2015 ACM Spring Simulation Multi-Conference</i>, CNS/SpringSim. Alexandria, VA, USA, 12–15 April 2015.</p> <p>[26] Benjamin W. Priest and Kevin M. Carter. Characterizing latent user interests on enterprise networks. At: <i>2014 International Florida Artificial Intelligence Research Society Conference</i>, FLAIRS. Pensacola Beach, FL, USA, 21–23 May 2014.</p>
INVITED TALKS	[27] Benjamin W. Priest . High-fidelity enterprise network emulation using the GOSMR architecture. In: <i>2014 MIT Lincoln Laboratory Cyber and Net-Centric Workshop</i> , CNW. June, 2014.
POSTER PRESENTATIONS	<p>[28] Benjamin W. Priest, Roger Pearce, and Geoffrey Sanders. Estimating edge-local triangle count heavy hitters in edge-linear time and almost-vertex-linear space. At: <i>GraphChallenge Workshop at the IEEE High Performance Extreme Computing Conference</i>, HPEC. 25–27 September 2018.</p> <p>[29] Benjamin W. Priest, Roger Pearce, and Geoffrey Sanders. Efficient Sublinear Estimation of Local Triangle Count Heavy Hitters. At: <i>2018 Summer Student Poster Symposium at Lawrence Livermore National Laboratory</i>. 9 August 2018.</p> <p>[30] Kevin M. Carter, Rajmonda Caceres and Ben Priest Characterization of latent social networks discovered through computer network logs. At: <i>Networks in the Social and Information Sciences workshop of the 29th Annual Conference on Neural Information Processing Systems</i>, NIPS. Montreal, Canada, 12 December 2015.</p> <p>[31] Ben Priest and Kevin Gold Utility discounting explains informational website traffic patterns before a hurricane. At: <i>22nd International World Wide Web Conference</i>, WWW. 2013. Rio de Janeiro, Brazil, 13–17 May 2013.</p>
GRANTS	<p>Awaiting Decision</p> <p>[1] Co-I, “Scalable Approximate Graph Clustering”, LLNL LDRD Er, \$1,500,000, October 1, 2020 to September 30, 2022.</p> <p>Awarded</p> <p>[2] Co-PI, “Scalable Approximate Graph Clustering”, LLNL LDRD 20-FS-037, \$150,000, February 1, 2020 to September 30, 2020.</p>
PROFESSIONAL SERVICE	<p>Conference Service</p> <p>- Program Committee: 28th International AAAI Florida Artificial Intelligence Research Symposium Conference, FLAIRS-28. Hollywood, Florida, USA. May 18-20, 2015.</p>

TEACHING
EXPERIENCE

Thayer School of Engineering at Dartmouth College, Hanover, VT, USA

Teaching Assistant

Instructor for ENGS/QBS 108: Applied Machine Learning

Autumn 2017

- Collaborated with instructors to develop course curriculum aimed at graduate engineering and computer science students
- Designed and taught approximately twenty-five percent of the course lecture content, including all practical implementation content
- Led team of 4 teaching assistants
- Provided one-on-one assistance to students covering lecture topics
- Planned, wrote, and graded all student assignments

Instructor for ENGS 177: Decision Making Under Risk and Uncertainty **Winter 2017**

- Planned and taught a weekly recitation covering practical machine learning topics
- Provided ground and one-on-one assistance to students covering lecture topics
- Wrote student assignments with the assistance of the instructor and provided grading

The Ohio State University, Columbus, OH, USA

Teaching Assistant

Instructor for CSE 625: Automata and Formal Languages

Summer & Autumn 2010

- Planned and taught a weekly recitation covering details and proofs of lecture topics
- Graded student assignments

Grader for CSE 560: System Software Design and Development

Summer 2010

- Graded student assignments and held office hours

AWARDS

HPEC Graph Challenge

Graph Challenge Champion, 2019.

The Ohio State University

SECRYPT

Best Paper Award, 2018.

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

MIT Lincoln Laboratory

Lincoln Scholar Program recipient, 2015
- (declined)

CITIZENSHIP

USA