Prasanna Date, *Ph.D.*

Research Scientist

Computer Science & Mathematics
Oak Ridge National Laboratory
Oak Ridge, Tennessee, USA

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+1-865-341-0344
ORNL Webpage
Personal Webpage

Profiles

LinkedIn
Twitter
ResearchGate
ORCID
Google Scholar
GitHub

Interests

- Artificial Intelligence
- Machine Learning
- Deep Learning
- Quantum Computing
- Neuromorphic Computing
- High Performance Computing
- Applied Operations Research

Biography

Dr. Prasanna Date is a Research Scientist at the Oak Ridge National Laboratory (ORNL). He explores AI and machine learning techniques on non-conventional computing platforms like quantum computing and neuromorphic computing. He obtained his Ph.D. in Computer Science at Rensselaer Polytechnic Institute in 2019. He is a member of AAAI, ACM, APS, IEEE, INFORMS and SIAM.

Experience

Sep 2019–Present — **Research Scientist** — **Oak Ridge National Laboratory, Oak Ridge, TN**

- Part of the Computer Science and Mathematics Division (CSMD).
- Pursued research in quantum computing, neuromorphic computing, artificial intelligence, machine learning and autonomous vehicles; organized conferences and workshops; secured research funding at internal ORNL avenues etc.
- Highlights (till date): 1 workshop paper, 5 conference papers, 3 journal papers (in review), 2 research grants.

May 2019–Sep 2019, Aug 2018–Dec 2018, May 2015–Dec 2017 — **Research Assistant** — **Rensselaer Polytechnic Institute, Troy, NY**

- Worked in the research group of Prof. Christopher D. Carothers.
- Pursued research in neuromorphic computing and deep learning: CoNNTrA training algorithm for neuromorphic spiking neural networks; predicting supercomputer failures using neuromorphic computing; and design index for deep neural networks.
- Highlights: 1 doctoral dissertation, 3 conference papers (1 in review).

Jan 2018–Aug 2018 — **Research Intern** — **Oak Ridge National Laboratory, Oak Ridge, TN**

- Part of the Computational Data Analytics (CDA) Group, mentored by Dr. Robert M. Patton.
- Pursued research in quantum computing and machine learning.
- Highlights: 1 journal paper, 1 conference paper.

Education

2014–2019 — **Ph.D. Computer Science** — **Rensselaer Polytechnic Institute, Troy, NY**
Dissertation: *Combinatorial Neural Network Training Algorithm for Neuromorphic Computing*
Advisor: Prof. Christopher D. Carothers
GPA: 3.9 / 4.0
Neuromorphic Computing | Deep Learning | HPC

2014–2019 — **M.S. Computer Science** — **Rensselaer Polytechnic Institute, Troy, NY**
GPA: 3.9 / 4.0
Machine Learning | Data Mining | Randomized Algorithms

2014–2019 — **M.Eng. Industrial Engineering** — **Rensselaer Polytechnic Institute, Troy, NY**
GPA: 3.8 / 4.0
Operations Research | Combinatorial Optimization

2010–2014 — **B.E. (Honors) Manufacturing Engineering** — **BITS Pilani, India**
Thesis: *Development of Fuzzy PROMETHEE Algorithm for Evaluation of Indian World Class Manufacturing Organizations*
Supervisor: Prof. Abhijeet K. Digalwar
CGPA: 8.0 / 10.0
Algorithm Design | Fuzzy Logic | Supply Chain Management

Skills

Programming & Machine Learning:

- Python, C, C++
- TensorFlow
- Scikit-learn
- MATLAB, R

Quantum Computing:

- Google, IBM, D-Wave
- Rigetti, Xanadu

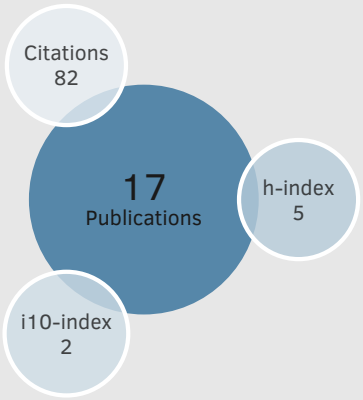
Neuromorphic Computing:

- Intel Loihi
- IBM TrueNorth

Web Development:

- HTML, CSS, JavaScript

Metrics



Memberships

AAAI: Association for the Advancement of Artificial Intelligence

ACM: Association for Computing Machinery

APS: American Physical Society

IEEE: Institute of Electrical and Electronics Engineers

INFORMS: Institute for Operations Research and the Management Sciences

SIAM: Society for Industrial and Applied Mathematics

Languages

English (Fluent)

Hindi (Fluent)

Marathi (Mother Tongue)

Research Projects

Oct 2020–Sep 2021 — **Autonomous Vehicles** — **ORNL**

- *Description*: Leverage reinforcement learning to drive simulated and small-sized autonomous vehicles. Deep neural networks running on GPUs and spiking neural networks running on Intel Loihi used.
- *Computing Resources*: Summit supercomputer, GPU clusters, Intel Loihi neuromorphic system, Python

Oct 2020–Jun 2021 — **Neuromorphic Algorithm Design** — **ORNL**

- *Description*: Design, implement and validate neuromorphic graph algorithms. Develop theoretical models of neuromorphic computational complexity.
- *Resources & Languages*: Intel Loihi neuromorphic system, NEST neuromorphic simulator, Python

Jul2020– Sep 2021 — **Quantum Machine Learning** — **ORNL**

- *Description*: Demonstrate the efficacy of quantum computers to train machine learning models faster than classical computers.
- *Resources & Languages*: IBM, Rigetti and Xanadu quantum computers, Google Cirq, IBM Qiskit, Rigetti Forest, Xanadu PennyLane

Apr 2020–Sep 2020 — **Epidemiological Modeling using Neuromorphic Computing** — **ORNL**

- *Description*: Develop spike-based neuromorphic models for epidemiological simulations of global pandemics such as COVID-19.
- *Resources & Languages*: NEST neuromorphic simulator, Python

Sep 2019–Jun 2020 — **Quantum Artificial Intelligence** — **ORNL**

- *Description*: Leverage quantum computing to design efficient algorithms that can train machine learning models. Leverage quantum computers to address NP-complete problems.
- *Resources & Languages*: D-Wave 2000Q quantum computer, Python

Awards & Grants

Mar 2021–Sep 2021 — **Award Recipient** — **ORNL**

- *Award*: Access to IBM, Rigetti and Xanadu quantum computers—world's most advanced quantum computers for 6 months
- *Title*: Machine Learning Acceleration using Quantum Computing (MAQ)
- *Program*: ORNL Oak Ridge Leadership Computing Facility (OLCF) Quantum Program

Mar 2021–Mar 2022 — **Award Recipient** — **ORNL**

- *Award*: Access to Summit supercomputer—world's second largest supercomputer for 1 year
- *Title*: Training deep neural networks (SNNs) to drive autonomous vehicles
- *Program*: ORNL Oak Ridge Leadership Computing Facility (OLCF) Supercomputing Program

Jul 2020–Sep 2021 — **Principal Investigator** — **ORNL**

- *Title*: Machine Learning Acceleration using Quantum Computing (MAQ)
- *Program*: ORNL Laboratory Directed Research and Development (LDRD) Seed Program
- *Amount:* **USD 190,000**

Apr 2020–Sep 2020 — **Co-Principal Investigator** — **ORNL**

- *Title*: Tracking COVID-19 in the Absense of Testing
- *Program*: ORNL Laboratory Directed Research and Development (LDRD) Seed Program
- *Amount*: **USD 190,000**

Leadership Experience

Jul 2021 — **Organizing Committee Member** — **ICONS 2021 Conference**
- *Conference*: International Conference on Neuromorphic Systems (ICONS) 2021
- *Venue*: Virtual

Oct 2020 — **Workshop Chair** — **IEEE AQAI 2020 Workshop**
- *Workshop*: Applied Quantum Artificial Intelligence (AQAI) Workshop, held as part of the IEEE Quantum Week: IEEE International Conference on Quantum Computing and Engineering (QCE) 2020
- *Venue*: Denver, Colorado / Virtual

Sep 2020 — **Breakout Session Facilitator** — **NITRD Extreme Heterogeneity Software**
- *Workshop*: Software in the Era of Extreme Heterogeneity
- *Venue*: Virtual

Jul 2020 — **Organizing Committee Member** — **ICONS 2020 Conference**
- *Conference*: International Conference on Neuromorphic Systems (ICONS) 2020
- *Venue*: Chicago, Illinois / Virtual

Jul 2020 — **Conference Session Chair** — **ICONS 2020 Conference**
- *Conference*: International Conference on Neuromorphic Systems (ICONS) 2020
- *Session*: Poster Session
- *Venue*: Chicago, Illinois / Virtual

Mar 2020 — **Workshop Track Co-Chair** — **DOE 5GEEIW Workshop**
- *Workshop*: U.S. Department of Energy 5G Enabled Energy Innovation Workshop (5GEEIW)
- *Track*: Software Architectures
- *Venue*: Chicago, Illinois

Nov 2018 — **Conference Session Chair** — **IEEE SSCI 2018 Conference**
- *Conference*: IEEE Symposium Series on Computational Intelligence (SSCI) 2018
- *Session*: Symposium on Neuromorphic Cognitive Computing
- *Venue*: Bangalore, India

Aug 2018– Jul 2019 — **Graduate Curriculum Committee (GCC) Member** — **RPI CS Department**
- Elected into GCC by about 100 graduate students in the Computer Science (CS) department at Rensselaer Polytechnic Institute (RPI).
- Improved curriculum, degree requirements and policies for masters and doctoral programs in Computer Science.
- Assisted graduate students with curriculum-related and degree requirements issues.

Teaching Experience

Jul 2021 — **Guest Lecturer** — **Rensselaer Polytechnic Institute, Troy, NY**
- *Topic*: Introduction to Quantum Computing
- *Platform*: Summer School on 'Advanced Cyberinfrastructure Training for Modeling Physical Systems 2021'
- *Host*: Prof. Joel Giedt

Jul 2021 — **Guest Lecturer** — **Rensselaer Polytechnic Institute, Troy, NY**
- *Topic*: Introduction to Neuromorphic Computing
- *Platform*: Summer School on 'Advanced Cyberinfrastructure Training for Modeling Physical Systems 2021'
- *Host*: Prof. Joel Giedt

Jun 2020 — **Guest Lecturer** — **Rensselaer Polytechnic Institute, Troy, NY**
- *Topic*: Quantum Artificial Intelligence
- *Platform*: Summer School on 'Advanced Cyberinfrastructure Training for Modeling Physical Systems 2020'
- *Host*: Prof. Joel Giedt

Jan 2019–May 2019, Aug 2014–May 2015 — **Teaching Assistant** — **Rensselaer Polytechnic Institute, Troy, NY**
- *Courses*: Parallel Computing, Big Data Analytics, Optimization Algorithms and Applications, Decision Focussed Systems Engineering
- *Duties*: Graded assignments, conducted office hours, mentored graduate and undergraduate students

Mentoring Experience

Jun 2020–Aug 2020 — **Research Mentor** — **Oak Ridge National Laboratory, Oak Ridge, TN**
- *Student*: David Quiroga, Universidad de Antioquia, Columbia
- *Project*: Clustering quantum states for efficient quantum signal propagation
- *Program*: U.S. Department of Energy Science Undergraduate Laboratory Internship (SULI)

Jun 2020–Aug 2020 — **Research Mentor** — **Oak Ridge National Laboratory, Oak Ridge, TN**
- *Student*: Benjamin Hansen, Brigham Young University, Idaho
- *Project*: Financial portfolio optimization using quantum computing
- *Program*: U.S. Department of Energy Science Undergraduate Laboratory Internship (SULI)

Jun 2020–Aug 2020 — **Research Mentor** — **Oak Ridge National Laboratory, Oak Ridge, TN**
- *Student*: Davis Arthur, Auburn University, Alabama
- *Project*: Balanced k-Means Clustering on an Adiabatic Quantum Computer
- *Program*: U.S. Department of Energy Science Undergraduate Laboratory Internship (SULI)

Jun 2020–Aug 2020 — **Research Mentor** — **Oak Ridge National Laboratory, Oak Ridge, TN**
- *Student*: Lauren Pusey-Nazzaro, Washington University in St. Louis, Missouri
- *Project*: Adiabatic Quantum Optimization Fails to Solve the Knapsack Problem
- *Program*: U.S. Department of Energy Science Undergraduate Laboratory Internship (SULI)

Volunteering Activities

March 2021 — **Back-Up Moderator** — **Tennessee Science Bowl (TSB)**
- Virtually led the Movie/TV/Streaming Community Group, comprising of 20 people at ORNL during COVID-19.
- Conducted discussion sessions about movies, TV and streaming, organized weekly meetings, supervised fun activities such as movie-related quizzes.

Oct 2020–Dec 2020 — **Co-Leader, Movie/TV/Streaming Community Group** — **Oak Ridge National Laboratory, Oak Ridge, TN**
- Virtually led the Movie/TV/Streaming Community Group, comprising of 20 people at ORNL during COVID-19.
- Conducted discussion sessions about movies, TV and streaming, organized weekly meetings, supervised fun activities such as movie-related quizzes.

Miscellaneous Experience

May 2017–Dec 2017 — **President, Cricket Club** — **Rensselaer Polytechnic Institute, Troy, NY**
- Led the Cricket Club, comprising of 50 people at Rensselaer Polytechnic Institute.
- Scheduled practices, managed budget, procured equipment, organized club outing events and represented the club in RPI student union.

Jun 2013–Aug 2013 — **Summer Intern** — **Larsen & Toubro Limited, Mumbai, India**
- Designed an automation system comprising of a robotic arm for TIG welding.
- Resulted in 15% improvement in productivity. Received a job offer based on that.

Aug 2012–Dec 2012 — **President, Department of Music** — **BITS Pilani, India**
- Led the department of 50 people in conducting music workshops, organizing music performances and participating in music competitions.
- Generated revenue, managed finances, procured equipment and organized music events.

Jun 2012–Aug 2012 — **Summer Intern** — **Thermax Limited, Pune, India**
- Created Standard Operating Procedures (SOP) for drum shop and panel shop, which were used in manufacturing bi-drum boilers.

Quantum Artificial Intelligence

Quantum Machine Learning

Neuromorphic Algorithms

Autonomous Vehicles

Epidemiological Modeling & Simulation

Peer Review

Journals

1. *Reviewer*: **IEEE Transactions on Neural Networks and Learning Systems (TNNLS)** | Impact Factor: 11.68
2. *Reviewer*: **IEEE Transactions on Computers** | Impact Factor: 3.13
3. *Reviewer*: **Public Library of Science (PLOS) One** | Impact Factor: 2.74
4. *Reviewer*: **Springer Quantum Information Processing (QIP)** | Impact Factor: 2.4
5. *Reviewer*: **World Scientific International Journal of Quantum Information (IJQI)** | Impact Factor: 1.18

Conferences

1. *Program Committee Member*: **International Conference on Neuromorphic Systems (ICONS) 2021**
2. *Program Committee Member*: **International Conference on Neuromorphic Systems (ICONS) 2020**
3. *Program Committee Member*: **International Conference on Neuromorphic Systems (ICONS) 2018**
4. *Reviewer*: **IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS) 2021**

Workshops

1. *Program Committee Chair*: **IEEE Applied Quantum Artificial Intelligence (AQAI) Workshop 2020**

Publications

Journal Publications

1. Arthur, Davis and **Prasanna Date** "Balanced k-Means Clustering on an Adiabatic Quantum Computer." *arXiv preprint arXiv:2008.04419* (2020). Submitted to *Springer Quantum Information Processing* journal.
2. **Date, Prasanna**, Davis Arthur, and Lauren Pusey-Nazzaro. "QUBO Formulations for Training Machine Learning Models." *arXiv preprint arXiv:2008.02369* (2020). Submitted to *Nature Scientific Reports* journal.
3. **Date, Prasanna**, Thomas Potok. "Adiabatic Quantum Linear Regression." *arXiv preprint arXiv:2008.02355* (2020). Submitted to *Nature Quantum Information* journal.
4. **Date, Prasanna**, Robert Patton, Catherine Schuman, and Thomas Potok. "Efficiently embedding QUBO problems on adiabatic quantum computers." *Quantum Information Processing* 18, no. 4 (2019): 117.
5. Digalwar, Abhijeet K., and **Prasanna A. Date**. "Development of fuzzy PROMETHEE algorithm for the evaluation of Indian world-class manufacturing organisations." *International Journal of Services and Operations Management* 24, no. 3 (2016): 308-330.

Conference Publications

1. **Date, Prasanna**. "Quantum Discriminator for Binary Classification." arXiv preprint arXiv:2009.01235 (2020).
2. **Date, Prasanna**, Christopher D. Carothers, John E. Mitchell, James A. Hendler, and Malik Magdon-Ismail. "Training Deep Neural Networks with Constrained Learning Parameters." In IEEE International Conference on Rebooting Computing (ICRC) 2020.
3. Pusey-Nazzaro, Lauren and **Prasanna Date**. "Adiabatic Quantum Optimization Fails to Solve the Knapsack Problem." *arXiv preprint arXiv:2008.07456* (2020).
4. Hamilton, Kathleen, Tiffany Mintz, **Prasanna Date**, and Catherine D. Schuman. "Spike-based graph centrality measures." In International Conference on Neuromorphic Systems 2020, pp. 1-8. 2020.
5. Hamilton, Kathleen, **Prasanna Date**, Bill Kay, and Catherine Schuman D. "Modeling epidemic spread with spike-based models." In International Conference on Neuromorphic Systems 2020, pp. 1-5. 2020.
6. Schuman, Catherine D., J. Parker Mitchell, J. Travis Johnston, Maryam Parsa, Bill Kay, **Prasanna Date**, and Robert M. Patton. "Resilience and Robustness of Spiking Neural Networks for Neuromorphic Systems."
7. Parsa, Maryam, Catherine D. Schuman, **Prasanna Date**, Derek C. Rose, Bill Kay, J. Parker Mitchell, Steven R. Young, Ryan Dellana, William Severa, Thomas E. Potok, and Kaushik Roy. "Hyperparameter Optimization in Binary Communication Networks for Neuromorphic Deployment." *arXiv preprint arXiv:2005.04171* (2020).
8. **Date, Prasanna**, Catherine Schuman, Robert Patton, and Thomas Potok. "A classical-quantum hybrid approach for unsupervised probabilistic machine learning." In *Future of Information and Communication Conference*, pp. 98-117. Springer, Cham, 2019.
9. **Date, Prasanna**, Christopher D. Carothers, James A. Hendler, and Malik Magdon-Ismail. "Efficient classification of supercomputer failures using neuromorphic computing." In *2018 IEEE Symposium Series on Computational Intelligence (SSCI)*, pp. 242-249. IEEE, 2018.
10. **Date, Prasanna**, James A. Hendler, and Christopher D. Carothers. "Design index for deep neural networks." *Procedia Computer Science* 88 (2016): 131-138.

NP-Complete Problems

Deep Neural Networks

Spiking Neural Networks

Support Vector Machines

k-Nearest Neighbors

k-Means Clustering

Workshop Publications

1. Kay, Bill, **Prasanna Date**, and Catherine Schuman. "Neuromorphic Graph Algorithms: Extracting Longest Shortest Paths and Minimum Spanning Trees." In Proceedings of the *Neuro-inspired Computational Elements Workshop*, pp. 1-6. 2020.

Thesis

1. **Date, Prasanna**. "Combinatorial Neural Network Training Algorithm for Neuromorphic Computing." PhD diss., Rensselaer Polytechnic Institute, 2019.