

Prasanna Date

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EDUCATION

Rensselaer Polytechnic Institute, Troy, NY May 2019 (expected)
Doctor of Philosophy, Computer Science (Advisor: Prof. Christopher D. Carothers) GPA: 3.87/4
Master of Science, Computer Science GPA: 3.87/4
Master of Engineering, Industrial & Management Engineering GPA: 3.87/4

Birla Institute of Technology and Science Pilani, India May 2014
Bachelors of Engineering (Honors), Manufacturing Engineering GPA: 8/10

EXPERIENCE

Research Intern **Oak Ridge National Laboratory (ORNL)**
January 2018 – August 2018 Oak Ridge, TN

- Part of the Computational Data Analytics (CDA) Group, mentored by Dr. Robert M. Patton.
- Pursued research in the field of Quantum Computing and Machine Learning.
- Output: 1 Patent (provisional), 1 Copyright (pending), 1 Journal Paper (published), 1 Conference Paper (published).

Research Assistant **Rensselaer Polytechnic Institute (RPI)**
August 2018 – December 2018, May 2015 – December 2017 Troy, NY

- Worked in the research group of Prof. Christopher D. Carothers.
- Pursued research in the field of Neuromorphic Computing and Deep Learning.
- Output (till date): 2 Conference Papers (published).

RESEARCH PROJECTS

- Efficient Embedding Algorithm for Adiabatic Quantum Computers (AQC)**
 - **Aim:** To develop an efficient algorithm that can embed Quadratic Unconstrained Binary Optimization (QUBO) problems on D-Wave's Adiabatic Quantum Computers (AQC).
 - **Approach:** Used Python to develop an embedding algorithm that ran in quadratic time and had a quadratic qubit footprint. Compared this algorithm to D-Wave's embedding algorithm, which was considered to be state of the art.
 - **Results:** My algorithm ran an *order of magnitude faster*, used *upto 30% less qubits*, and was *more accurate* than D-Wave's algorithm. Paper published in [Springer Quantum Information Processing Journal](#).
- Classical-Quantum Hybrid Approach for Machine Learning**
 - **Aim:** To develop a classical-quantum hybrid approach for unsupervised probabilistic machine learning.
 - **Approach:** Hybrid approach used GPUs for matrix computations and D-Wave quantum sampling library for generating samples during training. Compared the hybrid approach to classical and quantum approaches. Used Python, TensorFlow and D-Wave libraries.
 - **Results:** Hybrid approach outperformed quantum approach, performed comparably to GPU approach, and was outperformed by CPU approach. Paper published in proceedings of [FICC 2019](#).
- Efficiently Classifying Supercomputer Failures using Neuromorphic Computing**
 - **Aim:** Use Neuromorphic Computing to classify supercomputer failure data and compare its performance to Machine Learning (ML) and Deep Learning (DL) approaches.
 - **Approach:** Used Python (Pandas) for pre-processing 1-year worth of error logs from IBM Blue Gene/L supercomputer. Using the IBM TrueNorth Neurosynaptic System, trained a Spiking Neural Network (SNN) to classify these error logs. Compared SNN performance to 5 other ML/DL techniques: Logistic Regression, Support Vector Machines, K-Nearest Neighbors, Deep Neural Networks, and Recurrent Neural Networks.
 - **Results:** SNN outperformed other approaches on the IBM Blue Gene/L dataset. Paper published in proceedings of [IEEE SSCI 2018](#) conference.

4. Design Index for Deep Neural Networks (DNN)

- **Aim:** Propose 'Design Index' – a metric to measure accuracy and overfitting of trained DNN models.
- **Approach:** Used a design of experiments approach to study influence of model-specific and data-specific parameters on certain performance metrics of DNNs by analyzing synthetic data generated in Python (LMDB) using Caffe. Through this study, came up with the idea of the Design Index, which is a tool to aid a DNN designer during designing process of DNNs.
- **Results:** Successfully demonstrated the concept of DNN Design Index. Paper published in BICA 2016.

5. CoNNTrA: Combinatorial Neural Network Training Algorithm

- **Aim:** To develop an evolutionary algorithm (CoNNTrA) for on-chip training of Spiking Neural Networks (SNN) on digital neuromorphic systems like IBM TrueNorth Neurosynaptic System.
- **Approach:** First showed that CoNNTrA works for linearly separable and linearly inseparable data as proof of concept. Next, performed algorithmic analysis to demonstrate theoretical soundness of the algorithm. Finally, validated the algorithm by using it to train benchmark deep learning problems.
- **Results:** *Awaiting results as of Spring 2019.*

PUBLICATIONS

1. **Date**, Patton, Schuman and Potok, "*Efficiently Embedding QUBO Problems on Adiabatic Quantum Computers*," **published** in Springer Quantum Information Processing Journal.
2. **Date**, Schuman, Patton and Potok, "*A Classical-Quantum Hybrid Approach for Unsupervised Probabilistic Machine Learning*," **published** in the proceedings of Future of Information and Communications Conference (FICC) 2019 (March 14-15, 2019 in San Francisco, CA).
3. **Date**, Carothers, Magdon-Ismail and Hendler, "*Efficient Classification of Supercomputer Failures using Neuromorphic Computing*," **published** in the proceedings of IEEE Symposium Series on Computational Intelligence (SSCI) 2018 (November 18-21, 2018 in Bengaluru, India).
4. **Date**, Hendler and Carothers, "*Design Index for Deep Neural Networks*," **published** in the proceedings of Biologically Inspired Cognitive Architectures (BICA) 2016 (July 16-18, 2016 in New York City, NY), DOI: <http://dx.doi.org/10.1016/j.procs.2016.07.416>.
5. **Date** and Digalwar, "*Development of Fuzzy PROMETHEE Algorithm for the Evaluation of Indian World-Class Manufacturing Organizations*," **published** in International Journal of Services and Operations Management (IJSOM), DOI: <http://dx.doi.org/10.1504/IJSOM.2016.076903>.

INTELLECTUAL PROPERTY

1. **Provisional Patent** on "*A Method for Embedding Quadratic Unconstrained Binary Optimization (QUBO) Problems on Adiabatic Quantum Computers*," Serial Number: 62/717,032.
2. **Copyright (Pending)** on "*EQEL: Efficient Quantum Embedding Library*."

COMPUTER SKILLS

Go To Programming Languages: Python, C

Deep Learning Frameworks: TensorFlow, Matlab (EEDN & MatConvNet), Caffe

Comfortable With: MPI, C++, R, Matlab

RESEARCH INTERESTS

Quantum Computing, Neuromorphic Computing, Deep Learning, Machine Learning, Applied Operations Research

LEADERSHIP PORTFOLIO

Graduate Curriculum Committee (GCC) Member **Department of Computer Science, RPI**
August 2018 – Present Troy, NY

- Elected into the GCC by about 100 graduate students (MS and PhD).
- Improved curriculum, degree requirements and policies for masters and doctoral programs in Computer Science.
- Assisted graduate students with any curriculum and degree requirements related issues.

President **Cricket Club, RPI**
May 2017 – December 2017 Troy, NY

- Led RPI Cricket team to the semifinal stage in the CDCA Cricket Tournament (upstate NY) – this was unprecedented for the team.
- Scheduled practices, managed budget, procured equipment, organized club outing events and represented the club in RPI student union.

President **Department of Music, BITS Pilani**
August 2012 – December 2012 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.

OTHER EXPERIENCE

Program Committee Member & Volunteer **ICONS 2018 Conference**
Reviewed papers and assisted in organizing the International Conference on Neuromorphic Systems (ICONS) 2018, held at Knoxville, TN from July 23-26, 2018.

Teaching Assistant **Rensselaer Polytechnic Institute (RPI)**
January 2019 – Present, August 2014 – May 2015 Troy, NY
Conducted weekly office hours and graded homeworks, assignments and exams for following four courses: Parallel Programming and Computing, Optimization Algorithms and Applications, Decision Focused Systems Engineering, and Big Data Analytics.

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

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