AMANDEEP SINGH BHATIA

Postdoctoral Researcher, Elmore Family School of Electrical and Computer Engineering, Purdue University, IN, US.

CONTACT

2606 Bristlecone Dr, Redpoint Apartments, West Lafayette (47906), IN, USA

+1-7653895686

drasinghbhatia@gmail.com

www.linkedin.com/in /amandeep-singh-bhatia-phd-07b83822/

https://drasbhatia.netlify.app

SKILLS

- C, C++
- PYTHON
- CIRQ
- QISKIT
- LINUX
- LATEX

PROFILE

I earned my Ph.D. in quantum computation and quantum information at the Department of Computer Science, Thapar Institute of Engineering & Technology, Patiala, India in 2020. After my Ph.D., during the pandemic, I worked as a Postdoctoral fellow in Prof Daniel Braun Group at the University of Tubingen, Germany. I'm currently working as Postdoctoral Research Associate in School of Electrical and Computer Engineering at Purdue University under Prof. Alam's group and the Department of Chemistry under Prof. Kais group.

I have a great interest in quantum technologies, education, and public outreach activities. I previously worked on quantum computational models and their applications in Biology, Chemistry, and tensor network theory. Now I'm focused on quantum optimization using resilient algorithms in the financial sector. I am currently working on near-term quantum computing techniques, in particular variational quantum algorithms, quantum/classical machine learning and trustworthy federated learning algorithms with applications in engineering disciplines and more recently, in the Photovoltaic (PV) power systems, Chemistry and healthcare sector.

My research interests lie in the fields of Quantum Computation, Quantum Algorithms, Quantum/classical Machine Learning, Federated learning, Tensor network theory, Theory of Computation, and Formal Languages. Skilled in programming languages with experience using quantum computing frameworks such as Qiskit, Cirq, and Pennylane.

EXPERIENCE

Postdoctoral Research Associate — 2022-
Purdue University, US

Postdoctoral Researcher — 2021 - 2022
University of Tubingen, Germany

Assistant Professor-Research — 2019 - 2022
Chitkara University, India

Teaching Associate — 2016 - 2017
Thapar University, India

Assistant Professor — 2014 - 2015
Maharaja Agrasen University

Assistant Professor — 2013 - 2014
IEC University

Computer Programmer — 2010 - 2011
Sportking Industries Ltd

EDUCATION

2015 - 2020

Doctor of Philosophy: Computer Science & Engineering
On Some Aspects of Quantum Computational Models
Thapar Institute of Engineering & Technology

I earned my PhD in quantum computation and information under the supervision of Dr. Ajay Kumar. It is devoted to design and development of variants of classical and quantum computational models to represent various formal languages. The proposed models are useful for determining the expressive power and boundaries of various computational features. In many cases, quantum models are more superior to classical models in terms of language recognition. Furthermore, the assets of quantum computing are applied in various areas such as biology, chemistry, tensor network theory, neural computation, cryptography and machine learning.

2011 - 2013

M.Tech
Majoring in Computer Science & Engineering (CGPA 8.32)
Lovely Professional University

Power Consumption and Conservation of Dynamic Source Routing Protocol (DSR) in Mobile ad-hoc network (MANET). It is focused on the performance analysis of MANET routing protocols on the basis of mobility using Random Way point and conserved the power of highest mobility routing protocol DSR using Network Simulator.

2006 - 2010

B.Tech
Majoring in Computer Science & Engineering (81%)
DAV Institute of Engineering & Technology

Developed few modules of a project Punjab Police MIS, e.g. missing people, most wanted people of Punjab police MIS project under Punjab government using C#.net, SQL server at CDAC Mohali.

RESEARCH PUBLICATIONS

2023

- **A. S. Bhatia**, S. Kais, M. Alam, Federated Quanvolutional Neural Network: A new paradigm for collaborative quantum learning, Quantum Science and Technology, 10.1088/2058-9565/acfc61, 2023, [I.F-6.8]
- **A. S. Bhatia**, M. K. Saggi, S. Kais, Quantum machine learning predicting ADME-Tox properties in drug discovery, Journal of Chemical Information & Modeling, 10.1021/acs.jcim.3c0107, 2023. [I.F-5.6]
- **A. S. Bhatia**, S. Kais, M. Alam, Handling privacy-sensitive clinical data with federated quantum machine learning, Bulletin of the American Physical Society, APS, Mar 9, 2023.
- J. B. Jahangir, **A. S. Bhatia**, M. Alam, Can hierarchical physics-based machine learning de-anonymize solar farm locations?, IEEE Photovoltaic Specialists Conference, 2023.
- S. Brandhofer, D. Braun, V. Dehn, G. Hellstern, M. Hüls, Y. Ji, I. Polian, **A. S. Bhatia**, T. Wellens, Benchmarking the performance of portfolio optimization with QAOA. Quantum Information Processing, 22(1), 2023 1-27. [I.F-2.3].

2022

- P. Sen, **A. S. Bhatia**, K. S. Bhangu, A. Elbeltagi, Variational quantum classifiers through the lens of the Hessian. Plos one, 17(1), e0262346, 2022, [I.F-3.7].
- M. K. Saggi, S. Jain, **A. S. Bhatia**, R. Sharda, Proposition of new ensemble data-intelligence model for evapotranspiration process simulation. Journal of Ambient Intelligence and Humanized Computing, 1-17, 2022, [I.F-6.1].
- S. Heddam, Z. M. Yaseen, Z. M., M. W. Falah, L. Goliatt, M. L. Tan, Z. Sa'adi, I. Ahmadianfar, M. Saggi, **A. S. Bhatia**, P. Samui. Cyanobacteria blue-green algae prediction enhancement using hybrid machine learning–based gamma test variable selection and empirical wavelet transform. Environmental Science and Pollution Research, 2022 1-31. [I.F-5.1]

2020

- **A. S. Bhatia**, M. K. Saggi, S. Zheng, QPSO-CD: Quantum behaved particle swarm optimization algorithm with Cauchy distribution, Quantum Information Processing, 19(10), 2020, [I.F-2.3].
- **A. S. Bhatia** and S. Zheng, A quantum finite automata approach to modeling chemical reactions, Frontiers in Physics, doi: 10.3389/fphy. 2020.547370, 2020, [I.F-3.7].
- M. A. Ghorbani, F. Salmasi, M. K. Saggi, **A. S. Bhatia**, E. Kahya, R. Norouzi, Deep Learning under H2O framework: A novel approach for quantitative analysis of discharge coefficient in sluice gates, Journal of Hydroinformatics, 22(6), 1603-1619, 2020, [I.F-3.0].
- A. Elbeltagi, M. R. Aslam, A. Malik, B. Mehdinejadiani, A. Srivastava, **A.S. Bhatia**, J. Denga, The impact of climate changes on the water footprint of wheat and maize production in the Nile Delta, Egypt, Science of the Total Environment, 743, 2020. [I.F-10.7].

2019

- **A. S. Bhatia**, M. K. Saggi, A. Kumar, S. Jain, Matrix product state based quantum classifier, IEEE- Neural Computation, 7(31), 2019. [I.F-3.2].
- **A. S. Bhatia** and A. Kumar, On the relation between linear temporal logic and quantum finite automata, Journal of Logic, Language & Information, 29, 109-120, 2019. [I.F-0.56].

2004 - 2006

High School
Specializing in Physics, Chemistry & Mathematics (77%)
Sahibzada Ajit Singh Academy, CBSE

CERTIFICATIONS

Qiskit Advocate - Aug 2021

Certificate issued by IBM Quantum for actively contributing to the Qiskit community.

Quantum Associate Certified Developer -July 2021

Digital badge issued by IBM Quantum for demonstrating fundamental knowledge of quantum computing concepts and expressing them using the Qiskit.

IBM Quantum Challenge - June 2021

Advanced Digital badge issued by IBM for completing all exercises in IBM Quantum challenge.

IBM Quantum Practitioner

Digital badge issued by IBM Quantum for demonstrating proficiency and understanding of Quantum technical topics.

IBM Quantum Challenge - Dec 2020

Advanced Digital badge issued by IBM for completing all exercises in IBM Quantum challenge.

IBM Quantum Challenge - Oct 2020

Received a certificate of proficiency on qualifying Qiskit India two-week challenge from IBM Quantum.

Quantum Talks - Oct 2020

- **A. S. Bhatia** and A. Kumar, On the power of two-way multihead quantum finite automata, RAIRO-Theoretical Informatics and Applications, Vol. 23, 1-2, 2019. [I.F-0.365].
- **A. S. Bhatia** and A. Kumar, Quantum omega-automata over Infinite Words and their Relationships, International Journal of Theoretical Physics, 58(3), 1-12, 2019 [I.F-0.968].

2018

- **A. S. Bhatia** and A. Kumar, Modeling of RNA secondary structures using two-way quantum finite automata, Chaos, Solitons & Fractals, 116, 332-339, 2018. [I.F-9.9].
- **A. S. Bhatia** and A. Kumar, Neurocomputing approach to matrix product state using quantum dynamics, Quantum Information Processing, Springer, 17(10), 2018. [I.F-2.3].
- **A. S. Bhatia** and A. Kumar, Quantifying matrix product state, Quantum Information Processing, Springer, 17(3), 2018. [I.F-2.3].

Book Chapters

- **A. S. Bhatia** and R. Wong, Recent Progress in Quantum Machine Learning, In: Limitations and Future Applications of Quantum Cryptography, IGI Global, 2021.
- R. Wong and **A. S. Bhatia**, Quantum Algorithms: Application Perspective, In: Limitations and Future Applications of Quantum Cryptography, IGI Global, 2021.
- **A. S. Bhatia**, M. K. Saggi, A. Sundas, J. Ashta, Reinforcement learning, In: Machine Learning and Big Data: Concepts, Algorithms, Tools and Applications, John Wiley & Sons, 2020.
- **A. S. Bhatia** and S. Zheng, Post-Quantum Cryptography and Quantum Cloning, In: Research Anthology on Advancements in Quantum Technology, IGI Global, 2021.
- **A. S. Bhatia** and A. Kumar, Post Quantum Cryptography, In: Emerging Security Algorithms and Techniques, CRC Press (Taylor & Francis), First edition, 2019.

Preprints

- **A. S. Bhatia** and S. Zheng, RNA-2QCFA: Evolving two-way quantum finite automata with classical states for RNA secondary structures. arXiv preprint: arXiv:2007.06273, 2020.
- **A. S. Bhatia** and A. Kumar, Quantized quadratic sieve algorithm & its simulation. arXiv preprint: 2005.11668, 2020.
- **A. S. Bhatia** and A. Kumar, Quantum finite automata: survey, status and research directions. arXiv preprint: 1901.07992, 2019.
- **A. S. Bhatia** and A. Kumar, McEliece cryptosystem based on extended Golay code. arXiv preprint: 1811.06246, 2018.
- **A. S. Bhatia** and A. Kumar, On the power of quantum queue automata in real-time. arXiv preprint: 1810.12095, 2018.

Talks/Poster Presentations

- **A. S. Bhatia**, M. K. Saggi, S. Kais, M. Alam, Federated Quanvolutional Neural Network: A new paradigm for collaborative quantum learning, Center for Quantum Technologies Meeting, Indiana University, IN, USA, Oct 10, 2023.
- A talk delivered on "Federated Quantum Machine Learning", in School & Conference on Quantum Technologies: Introduction, Materials and Devices, IISER, Pune, India, July 14, 2023.

Received a certificate for successfully completing the Online Symposium on Quantum Information and Computation (Quantum talks), organized by IIIT Hyderabad

Junior Research Fellowship (JRF), 2017-2019

Awarded Junior Research Fellowship (JRF) Under Maulana Azad National Fellowship (MANF) by Ministry of Minority Affairs, Government of India.

First Position - July 2007

Bagged a first position in B.Tech second semester of university examinations.

First Position - Dec 2006

Bagged a first position in B.Tech first semester of university examinations.

OTHER DETAILS

- **Date of Birth**: 08 October, 1988
- **Place of Birth**: Nalagarh, HP, India
- **Gender**: Male
- **Marital Status**: Married
- **Nationality**: Indian
- **Passport No.**: Z4663836
- **Language Proficiency**: English, Hindi, Punjabi

- P. Sen, A. Maldonado, **A. S. Bhatia**, Hierarchical Extreme Quantum Machine Learning with Neural Tensor Networks in the NISQ Era, In: 16th Conference on the Theory of Quantum Computation, Communication and Cryptography, Latvia, 2021.
- **A. S. Bhatia**, M. K. Saggi, S. Zheng, Reconstructing matrix product states with quantum autoencoder, In: 23rd annual conference on Quantum information processing (QIP), Shenzhen, China, 2020.
- **A. S. Bhatia**, M. K. Saggi, S. Jain, Tensor train quantum classifier, In: Quantum techniques in machine learning (QTML), Korea Advanced Institute of Science & Technology (KAIST), South Korea, 2019.
- **A. S. Bhatia**, M. K. Saggi, A. Kumar, S. Jain, Matrix product state based quantum classifier, In: 19th Asian Quantum Information Science Conference (AQIS), Korea Institute for Advanced Study, Seoul Korea, 2019.
- **A. S. Bhatia**, Towards quantum computing with matrix product states, In: Young Scientist Forum, Peng Cheng Laboratory (PCL), Shenzhen, China. [Apr 3, 2019].

REFERENCES

- **Dr. Muhammad Ashraful Alam**
  Jai N. Gupta Professor,
  Electrical and Computer Engineering,
  Purdue University, IN, US
  Mail: alam@purdue.edu

- **Dr. Sabre Kais**
  Distinguished Professor,
  Physical/Theoretical and Computer Science,
  Purdue University, IN, US
  Mail: kais@purdue.edu

- **Dr. Mohit Kapoor**
  Scientist
  Charnwood Molecular Ltd, United Kingdom
  Mail: m.kapoor@charnwood-molecular.com

- **Dr. Sushma Jain**
  Associate Professor, CSED
  Thapar Institute of Engineering & Technology, Patiala
  Mail: sjain@thapar.edu