

Hai Duong's

Curriculum Vitae

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1 Education

- **PhD**, Computer Science, George Mason University, Fairfax, VA 2022–present
Advisor: ThanhVu Nguyen
- **MS**, Electrical Engineering, Hanoi University of Science and Technology, Hanoi, VN 2019–2021
Advisor: Quoc-Cuong Nguyen
- **BS**, Electrical Engineering, Hanoi University of Science and Technology, Hanoi, VN 2014–2019

2 Experience

- **Research Assistant**, ROARS Lab, George Mason University 2022–present
 - Developed a verification tool, NeuralSAT, ranked 4th in VNN-COMP'23, 2nd in '24 and '25.
 - Developed a proof generation tool, APTP, outperforms prior work on 400 DNNV problems.
 - Developed optimization techniques for NeuralSAT, e.g., stabilization for reducing search space that verifies 12x problems, compositional techniques that verifies 6.5x problems than SoTA verifiers.
 - Developed structural perturbation framework that allows verifying 78% problems (total 5508 problems) that SoTA verifiers cannot verify before.
 - Developed a DRL-guided smart branching technique for Branch-and-Bound verifiers that outperforms the SoTA branching heuristic by 15%.
 - Developed a Brand-and-Bound framework for verifying correctness of LLMs that yeilds sound lower and upper bounds of probability that LLM can correctly solve input queries with arbitrary appended suffix.
 - Published papers at ISSTA, SAIIV, FSE, CAV, NeurIPS, and CVPR.
- **Research Assistant**, BachLe's Lab, University of Melbourne 2021–2022
 - Worked on a graph-based source code modeling and explanation technique (published at ICSME'22).
- **Research Assistant**, Sensor Lab, Hanoi University of Science and Technology 2019–2021
 - Developed a speech enhancement system using graph-based neural beamforming.
 - Developed a small-footprint keyword spotting system using deformable convolution.

3 Awards and Honors

- Scholar Award, NeurIPS 2025
- Spotlight Paper Award [P3], NeurIPS 2025
- NeuralSAT ranked 2nd, VNN-COMP 2024–2025
- NeuralSAT ranked 4th and received New Participant Award, VNN-COMP 2023
- Graduate Scholarship (Full Tuition), HUST 2019–2021
- Outstanding Undergraduate Award, HUST 2015–2018

4 Publications

4.1 Refereed Conference/Journal Papers (in print)

- P1 Hai Duong, Lam Nguyen, Thanh Le, and ThanhVu Nguyen. “Verifying Neural Network Robustness with Dual Perturbations”. In: *Computer Vision and Pattern Recognition (CVPR)*. 2026, to appear
- P2 Hai Duong, Thanh Le, Lam Nguyen, and ThanhVu Nguyen. “Verifying Structural Robustness of Deep Neural Network”. In: *Proceedings of the ACM on Software Engineering 3.Foundations of Software Engineering (FSE)* (2026), to appear
- P3 Hai Duong, David Shriver, ThanhVu Nguyen, and Matthew Dwyer. “Compositional Neural Network Verification via Assume-Guarantee Reasoning”. In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2025, to appear

Spotlight Paper

- P4 Hai Duong, ThanhVu Nguyen, and Matthew Dwyer. “Generating and Checking DNN Verification Proofs”. In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2025, to appear
- P5 Hai Duong, ThanhVu Nguyen, and Matthew Dwyer. “NeuralSAT: A High-Performance Verification Tool for Deep Neural Networks”. In: *Computer Aided Verification (CAV)*. 2025, pages 409–423
- P6 Hai Duong and ThanhVu Nguyen. “NeuralSAT: Scaling Constraint Solving for DNN Verification (Competition Contribution)”. In: *International Symposium on AI Verification (SAIV)*. Springer. 2025, pages 253–259
- P7 Hai Duong, Dong Xu, ThanhVu Nguyen, and Matthew Dwyer. “Harnessing Neuron Stability to Improve DNN Verification”. In: *Proceedings of the ACM on Software Engineering 1.Foundations of Software Engineering (FSE)* (2024), pages 859–881
- P8 Dong Xu, Nusrat Jahan Mozumder, Hai Duong, and Matthew B Dwyer. “Training for Verification: Increasing Neuron Stability to Scale DNN Verification”. In: *International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*. Springer. 2024, pages 24–44
- P9 ThanhVu Nguyen, KimHao Nguyen, and Hai Duong. “SymInfer: Inferring Numerical Invariants using Symbolic States”. In: *International Conference on Software Engineering (ICSE)*. IEEE, 2022, pages 197–201
- P10 Thanh-Dat Nguyen, Thanh Le-Cong, Duc-Minh Luong, Hai Duong, Xuan-Bach D Le, David Lo, and Quyet-Thang Huynh. “Ffl: Fine-grained fault localization for student programs via syntactic and semantic reasoning”. In: *2022 IEEE International Conference on Software Maintenance and Evolution (ICSME)*. IEEE. 2022, pages 151–162
- P11 Huu Binh Nguyen, Hai Duong, Anh Xuan Tran Thi, and Quoc Cuong Nguyen. “Efficient keyword spotting system using deformable convolutional network”. In: *IETE Journal of Research* 69.7 (2023), pages 4196–4204
- P12 Huu Binh Nguyen, Hai Duong, Tien Dat Bui, Hoang Ngoc Chau, and Quoc Cuong Nguyen. “Multi-channel speech enhancement using a minimum variance distortionless response beamformer based on graph convolutional network”. In: *International Journal of Advanced Computer Science and Applications* 13.10 (2022)

4.2 Unpublished

- U1 Hai Duong, Thanh Le, Lam Nguyen, and ThanhVu Nguyen. “DRL-Guided Smart Branching for Neural Network Verification”. In: *Submitted*. 2026
- U2 Junyu Yin, Lingda Li, Hai Duong, Adolfy Hoisie, and Keren Zhou. “Trace-Driven DL-based Framework for GPU Performance Modeling”. In: *Submitted*. 2025
- U3 Thanh Le, Hai Duong, ThanhVu Nguyen, and Takeshi Matsumura. “Formal Verification of DNN-based Semantic Communication to Adversarial Noise”. In: *Submitted*. 2025
- U4 Thanh Le, Hai Duong, Yusheng Ji, ThanhVu Nguyen, and John C.S. Lui. “FGGM: Formal Grey-box Gradient Method for Attacking DRL-based MU-MIMO Scheduler”. In: *arXiv*. 2025
- U5 Hai Duong, ThanhVu Nguyen, and Matthew Dwyer. “A DPLL(T) Framework for Verifying Deep Neural Networks”. In: *arXiv*. 2024

5 Miscellaneous

- NeurIPS Scholar Award, 2025.
- Contributed to proposal:
 - NVIDIA Academic Grant Program: Trustworthy AI: Bringing Scalability and Assurance to DNN Verification. 2025, DGX Spark System. NVIDIA.
 - NSF CAREER: NeuralSAT: A Constraint-Solving Framework for Verifying Deep Neural Networks. NSF 2238133. 8/1/2023–7/31/2028, \$510,509. NSF.
 - Amazon Research Award (Automated Reasoning): Scalable and Precise DNN Constraint Solving with Abstraction and Conflict Clause Learning. 2023, \$50,000 unrestricted gift. Amazon.
- Helped review papers at ISSTA’23, PLDI’24, OOPSLA’24, ICLR’25, ECCV’26, ICML’26.