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 4^{th} in VNN-COMP'23, 2^{nd} 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, SAIV, 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 2^{nd}, VNN-COMP 2024–2025
- NeuralSAT ranked 4^{th} 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

- Reviewer at ECCV'26 and ICML'26.
- 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.