

*Formal methods for verifying deep neural networks and
certifying AI-enabled cyber-physical systems*

Research Interests

Formal methods for neural network verification: abstract domains, branching, and scalability

Verification of AI-enabled cyber-physical systems, *e.g.*, verifying the robustness of DNN-based wireless communication

Machine-checked proofs in Lean of DNN verification algorithms and fundamental asymptotic formulation of wireless communication

Education

3/2025 **Ph.D., Informatics**, SOKENDAI (*The Graduate University for Advanced Studies*), National Institute of Informatics (NII), Tokyo, Japan

Advisor: Prof. Yusheng Ji. Dissertation: Distributed Learning Techniques for Dynamic Access Control in massive Machine-Type Communication (mMTC). Conducted jointly with NII, in close collaboration with Prof. John C. S. Lui of The Chinese University of Hong Kong.

5/2021 **M.S., Information and Communication Technology**, School of Information and Communication Technology (SoICT), Hanoi University of Science and Technology (HUST), Hanoi, Vietnam

Advisor: Prof. Huynh Thi Thanh Binh (Vice Dean, SoICT, HUST). Thesis: Adaptive Many-Task Evolutionary Algorithm

8/2019 **B.E., Information and Communication Technology**, School of Information and Communication Technology (SoICT), Hanoi University of Science and Technology (HUST), Hanoi, Vietnam

Advisor: Prof. Huynh Thi Thanh Binh. Graduated with five-year English-taught curriculum.

Research Experience

5/2025 – present **Researcher**, Wireless Systems Laboratory, Wireless Networks Research Center, National Institute of Information and Communications Technology (NICT), Yokosuka, Japan

Develop formal verification frameworks for learned wireless communications, including power control, traffic prediction, and joint source-channel coding. Validate certified robustness bounds through over-the-air experiments on software-defined radio testbeds. Demonstrated real-time zero-shot semantic communication on ADALM-PLUTO SDRs to the general public at the NICT Open House (June 2026).

10/2021 – **PhD Student / Research Assistant**, National Institute of Informatics (NII), Tokyo, Japan

3/2025 Addressed the limits of centralized control in massive machine-type communication (mMTC), where surging device numbers make central coordination unscalable. Developed multi-agent learning algorithms that achieve decentralized channel access and power allocation for 10,000 devices.

3/2020 – 9/2020 **Research Intern**, National Institute of Informatics (NII), Tokyo, Japan

Studied deep learning for mobile network traffic prediction and imputation under Prof. Yusheng Ji, leading to co-authored publications at IEEE ICC'21 and IFIP/IEEE IM'21.

9/2019 – 5/2021 **M.S. Student / Research Assistant**, School of Information and Communication Technology (SoICT), Hanoi University of Science and Technology (HUST), Hanoi, Vietnam

Researched adaptive many-task optimization and evolutionary algorithms under Prof. Huynh Thi Thanh Binh, leading to publications at IEEE CEC'21 and Applied Soft Computing (ASOC). Contributed to proposal writing and research papers on a U.S. Army Research Laboratory (CCDC Pacific) grant on multitasking evolutionary optimization.

Honors and Awards

Research

- 6/2026 **Highlight Paper** (co-author), *Computer Vision and Pattern Recognition (CVPR'26)*.
2026 **4th Place Overall**, *International Verification of Neural Networks Competition (VNN-COMP'26)*, with NeuralSAT.

Academia and Presentation

- 3/2025 **INOSE Student Encouragement Award**, *National Institute of Informatics (NII)*. Awarded for active research contributions and public presentations at the NII Open House 2024.
11/2024 **Excellence in Presentation Award**, *TKG Symposium*, for the poster “X-armed Bandits for Optimizing Information Freshness in Robots Communication”.

Publications

Summary 13 refereed publications: 2 Q1 journal articles (IEEE Transactions on Mobile Computing, Applied Soft Computing), 10 conference papers (NeurIPS, CVPR Highlight, FSE, IEEE VTC, IEEE ICC, IFIP/IEEE IM, etc.), and 1 workshop paper (IEEE ICC Workshops). Includes 2 co-first-author papers at NeurIPS'26 and FSE'26, and 1 Highlight paper at CVPR'26. 5 preprints or manuscripts under review. Contributor to NeuralSAT (ranked 4th overall in VNN-COMP'26).

* Equal contribution.

Refereed Journal Articles

- IEEE TMC (Q1) T. Le, Y. Ji, and J. C. S. Lui. MFTTS: A mean-field transfer Thompson sampling approach for distributed power allocation in unsourced multiple access. *IEEE Transactions on Mobile Computing*, 23(12):11312–11325, 2024
Applied Soft Computing (Q1) T. Le, B. T. Ta, V. C. Le, and H. T. T. Binh. Multitask augmented random search in deep reinforcement learning. *Applied Soft Computing*, 160:111605, 2024

Refereed Conference Publications

- NeurIPS'26 H. Duong*, T. Le*, and TV. Nguyen. Verifying neural networks with reinforcement learning. In *Neural Information Processing Systems (NeurIPS)*, 2026
VTC Fall'26 T. Le, T. Matsumura, Y. Ji, and J. C. S. Lui. Formal verification for deep learning-based power control in massive MIMO. In *IEEE Vehicular Technology Conference (VTC-Fall)*, 2026
WPMC'26 T. Le, A. Dataesatu, H. Murakami, and T. Matsumura. Implementation of zero-shot semantic communication on software defined radio. In *Wireless Personal Multimedia Communications (WPMC)*, 2026
FSE'26 H. Duong*, T. Le*, L. Nguyen, and TV. Nguyen. Verifying structural robustness of deep neural network. In *Foundations of Software Engineering (FSE)*, 2026
CVPR'26 Highlight H. Duong, L. Nguyen, T. Le, and TV. Nguyen. Verifying neural network robustness with dual perturbations. In *Computer Vision and Pattern Recognition (CVPR)*, 2026
ICAHC'26 T. Le and T. Matsumura. Formal verification for deep learning-based mobile network traffic prediction. In *International Conference on Artificial Intelligence in Information and Communication (ICAHC)*, 2026
VTC Fall'22 T. Le, Y. Ji, and J. C. S. Lui. TinyQMIX: Distributed access control for mMTC via multi-agent reinforcement learning. In *IEEE Vehicular Technology Conference (VTC-Fall)*, 2022
ICC'21 V. A. Le, T. Le, P. L. Nguyen, H. T. T. Binh, R. Akerkar, and Y. Ji. GCRINT: Network traffic imputation using graph convolutional recurrent neural network. In *IEEE International Conference on Communications (ICC)*, pages 1–6, 2021
IM'21 V. A. Le, T. Le, P. L. Nguyen, H. T. T. Binh, and Y. Ji. Multi-time-step segment routing based traffic engineering leveraging traffic prediction. In *IFIP/IEEE International Symposium on Integrated Network Management (IM)*, pages 125–133, 2021

- CEC'21 T. Le, V. C. Le, B. T. Ta, and H. T. T. Binh. Multi-armed bandits for many-task evolutionary optimization. In *IEEE Congress on Evolutionary Computation (CEC)*, pages 1664–1671, 2021

Refereed Workshop Publications

- ICC-W'24 L. Wei, T. Le, Y. Ji, M. Wang, Y. Liu, Y. Wang, and J. C. S. Lui. Towards efficient traffic engineering via distributed optimization in large-scale LEO constellation. In *IEEE International Conference on Communications Workshops (ICC Workshops)*, pages 353–358, 2024

Preprints and Papers under Review

- TMLCN T. Le, H. Duong, T. Matsumura, and TV. Nguyen. Neural network verification for deep joint source-channel coding. Submitted to *IEEE Transactions on Machine Learning in Communications and Networking (TMLCN)*
- arXiv T. Le, H. Duong, Y. Ji, TV. Nguyen, and J. C. S. Lui. FGGM: Formal grey-box gradient method for attacking DRL-based MU-MIMO scheduler. arXiv:2510.26075
- arXiv H. Duong, T. Le, N. Ho, and TV. Nguyen. Towards verifying neural networks against multi-parameter bit-flip perturbations. arXiv:2610.08876
- arXiv H. Duong, T. Le, and TV. Nguyen. CLAD: Constrained abstract domain for neural network verification. arXiv:2609.34628
- arXiv H. Duong, T. Le, and TV. Nguyen. ZonoGPT: Towards an abstract domain for verifying large GPT models. arXiv:2609.34457

Dissertation and Thesis

- Ph.D. T. Le. Distributed Learning Techniques for Dynamic Access Control in massive Machine-Type Communication. SOKENDAI, March 2025
- M.S. T. Le. Adaptive Many-Task Evolutionary Algorithm. Hanoi University of Science and Technology, 2021

Software and Open-Source Systems

- NeuralSAT Deep neural network verifier, core contributor; ranked 4th overall in VNN-COMP'26. neural-sat.roars.dev
- Explainer Abstract Domain Explainer, an interactive tutorial on deep neural network verification, developed with H. Duong. hocdot.github.io/abstract-domain-explainer
- Community VietProfs, a directory of Vietnamese professors worldwide (vietprofs.roars.dev), and CS Picks, tools for computer science PhD applicants (cspicks.roars.dev)
- Vietnam at the Top AI Conferences, a CSRankings-style ranking of Vietnamese faculty and institutions tracking publications at top AI venues, with over 1,000 distinct visitors in its first month. thanhlexyz.github.io/vn-at-top-ai-conference

Research Mentoring and Teaching

- Mentoring Guided the research of five undergraduate students at Hanoi University of Science and Technology (co-mentored with Prof. Huynh Thi Thanh Binh, 2020 – 2021).
- Mentored master's student Roger Garcia Nevado (Universitat Politècnica de Catalunya / NII, 2023; advisors: Prof. José María Barceló Ordinas and Prof. Yusheng Ji), whose thesis developed multi-agent reinforcement learning for cooperative vehicular offloading.
- Teaching Prepared to teach undergraduate and graduate core curricula: Introduction to Machine Learning (CS 429/529), Computer Networks (CS 585), Introduction to Cybersecurity (CS 544), and Algorithms and Data Structures.
- Designing an advanced graduate seminar on Neural Network Verification.

Professional Service

TPC Member	Technical Program Committee, INFOCOM'26 Workshop on Fusion Data Operation Information.
Reviewer	IEEE Transactions on Cognitive Communications and Networking (TCCN), Computer Communications (ComCom). IEEE ICC (2022, 2023, 2025), IEEE GLOBECOM (2024, 2025), WPMC'26 Workshop, ICLR'27.
Assisting Reviewer	NeurIPS'26, ICML'26, AAAI'27, POPL'27.
Presentations	Delivered poster presentation and live demonstration at the NICT Open House (June 2026): deployed zero-shot semantic communication on ADALM-PLUTO software-defined radios with Raspberry Pi NPU acceleration, visualizing how semantic features are transmitted via wireless channels, designed to be easy to understand for the general public, including elementary school students. Delivered public research presentation at the NII Open House (June 2024); poster presentation at TKG 2024 (Excellence in Presentation Award).
Community	Organized student sessions at the Technology symposium of mobility and network by Global Students (TKG 2024).

Language

English Fluent

References

- Prof. ThanhVu Nguyen Associate Professor of Computer Science, George Mason University
Web: tvn.roars.dev
Relationship: Research collaborator and co-author (NeurIPS, CVPR, FSE)
- Prof. Yusheng Ji Emeritus Professor, National Institute of Informatics (NII) and SOKENDAI
Web: klab-nii.github.io
Relationship: Ph.D. advisor at SOKENDAI and NII, and co-author
- Prof. Huynh Thi Thanh Binh Professor and Vice Dean, School of Information and Communication Technology (SoICT), Hanoi University of Science and Technology (HUST)
Web: users.soict.hust.edu.vn/binhht
Relationship: B.E. and M.S. advisor and grant PI
- Prof. John C. S. Lui Choh-Ming Li Chair Professor of Computer Science and Engineering, The Chinese University of Hong Kong (CUHK)
Web: cse.cuhk.edu.hk/~cslui
Relationship: Doctoral research collaborator and co-author