VIETNAM NATIONAL UNIVERSITY, HANOI
**VNU UNIVERSITY OF ENGINEERING AND TECHNOLOGY**

**SOCIALIST REPUBLIC OF VIETNAM**
**Independence – Freedom – Happiness**

# INFORMATION ON DOCTORAL THESIS

1. Full name : VO VAN HOANG ..... 2. Sex: male

3. Date of birth: 12/02/1986 ..... 4. Place of birth: Ha Tinh

5. Admission decision number: 1200/QĐ-CTSV, Dated 29/12/2020

6. Changes in academic process: Extension of study period for 2 years (24 months) according to Decision No. 1442/QĐ-ĐHQG dated December 29, 2023, issued by the Rector of the University of Engineering and Technology.

7. Official thesis title: *Enhancing intrusion detection performance by data augmentation, parallel ensemble inference, and flow sensing strategy*.

8. Major: Information Systems..... 9. Code: 9480104.01

10. Supervisors:

- Associate Professor, Doctor Nguyen Ngoc Hoa, VNU University of Engineering and Technology.
- Associate Professor, Doctor Nguyen Ngoc Tu, Kennesaw State University.

11. Summary of the **new findings** of the thesis:

- Proposed a machine learning pipeline combining data augmentation and feature optimization (WGAN-powered augmentation + SHAP-based feature optimization) to balance and enhance the quality of the training dataset, thereby improving the detection capability of attacks targeting minority classes;
- Proposed a mutual deep + boosting inference framework that enhances the accuracy and robustness of intrusion and malware detection systems;
- Proposed a solution to address data bottlenecks in large-scale network intrusion prevention by adopting a flow sensing strategy based on time intervals and frequencies, and parallelizing the inference process of combined deep + boosting mutual inference models;
- Integrated the proposed methods to deploy the real-time intrusion detection and prevention system NetIPS, capable of AI-based detection in user space, supporting real-time large-scale traffic processing suitable for enterprise or ISP networks.

12. Practical applicability, if any: The Intrusion Detection and Prevention System (NetIPS) can be deployed in large-scale networks, supports real-time detection, and integrates signature-based techniques, machine learning, and behavioral analysis.

13. Further research directions, if any: Extending NetIPS evaluation to large-scale real-world networks with diverse attack scenarios and hardware performance considerations and optimizing practical deployment.

14. Thesis-related publications:


+ **Hoang V. Vo** and P. Du and H. N. Nguyen, Apelid: Enhancing real-time intrusion detection with augmented wgan and parallel ensemble learning, Computers \& Security 136 (2024) 103567. doi:10.1016/j.cose.2023.103567;

+ **Hoang V. Vo** and H. P. Du and H. N. Nguyen, Ai-powered intrusion detection in large-scale traffic networks based on flow sensing strategy and parallel deep analysis, Journal of Network and Computer Applications 220 (2023) 103735. doi:10.1016/j.jnca.2023.103735;

**+ Hoang V. Vo** and H. P. Du and H. N. Nguyen, MDOB: Enhancing Resilient and Explainable AI-Powered Malware Detection Using Feature Set Optimization and Mutual Deep+Boosting Ensemble Inference. Journal of Information Security and Applications 93 (2025) 104175. doi.org/10.1016/j.jisa.2025.104175;

**+ Hoang V. Vo** , H. N. Nguyen, T. N. Nguyen, H. P. Du, Sdaid:Towards a hybrid signature and deep analysis-based intrusion detection method, in: GLOBECOM 2022 - 2022 IEEE Global Communications Conference, 2022, pp. 2615–2620. doi:10.1109/GLOBECOM 48099.2022.10001582;

**+ Hoang V. Vo**, D. H. Nguyen, T. T. Nguyen, H. N. Nguyen, D. V. Nguyen, Leveraging ai-driven realtime intrusion detection by using wgan and xgboost, in: Proceedings of the 11th International Symposium on Information and Communication Technology, Association for Computing Machinery, New York, NY, USA, 2022, p. 208–215. doi:10.1145/3568562.3568660;

**+ Hoang V. Vo**, P. H. Nguyen, H. T. Nguyen, D. B. Vu, H. N. Nguyen, Enhancing ai - powered malware detection by parallel ensemble learning, in: 2023 RIVF International Conference on Computing and Communication Technologies (RIVF), 2023, pp. 503–508. doi:10.1109/RIVF60135.2023.10471855;

**+ Hoang V. Vo**, H. P. Du and H. N. Nguyen, "AWDLID: Augmented WGAN and Deep Learning for Improved Intrusion Detection," 2024 1st International Conference On Cryptography And Information Security (VCRIS), Hanoi, Vietnam, 2024, pp. 1-6, doi: 10.1109/VCRIS63677.2024.10813392.