Nam Nguyen

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EDUCATION

Oregon State University — Corvallis, OR, US
Doctor of Philosophy in Electrical and Computer Engineering — Expected Mar. 2027
Minor in Artificial Intelligence
Focus area: Information Theory, Machine Learning, Perceptual Lossy Compression

Oregon State University — Corvallis, OR, US
Master of Science in Electrical and Computer Engineering — Dec. 2024
Thesis: *On Minimizing Symbol Error Probability using Beamforming in MIMO Gaussian Wiretap Channels*

Posts and Telecommunications Institute of Technology — Hanoi, Vietnam
Bachelor of Engineering in Electronics and Communications Engineering — Mar. 2021
Graduated in top 10 of Telecommunications Engineering Department
Thesis: *Performance Enhancement of Satellite-based Free-Space Quantum Key Distribution Systems using Key Retransmission and Relaying Techniques*, Grade: 10/10

RESEARCH INTERESTS

Intersection of information theory and machine learning: Rate-distortion-perception-classification representation for lossy compression, neural data compression, representation learning.
Wireless communications and networks: Channel capacity, signal processing, optimization, and machine learning for advanced MIMO communication systems, physical layer security for MIMO, beamforming techniques, wireless networking and technology for 5G/6G.
Free-space quantum key distribution networks: Design, analysis, and optimization of link-layer retransmissions and relaying techniques.

RESEARCH EXPERIENCE

Research Assistant, Communications and Signal Processing Group — Dec. 2022 - Present
Oregon State University — Corvallis, OR, US
Advisor: Prof. Thinh Nguyen and Prof. Bella Bose
Topics: Representation learning, neural data compression, statistical signal processing and Bayesian inference, non-convex optimization, wireless communications, physical layer security.
Project: *Universal rate-distortion-classification representations for lossy compression*

- Develop a universal representation framework in lossy compression to handle multiple distortion-classification tradeoffs with a single encoder.
- Prove the approximate achievability of the universal rate-distortion-classification function using theoretical information-theoretic methods.
- Implement and evaluate novel deep learning algorithms for classification-enhanced neural image compression models (using Autoencoder + GAN + CNN Classifier) on MNIST/ SVHN datasets with PyTorch, showcasing minimal performance loss compared to designing separate encoders for each objective.
- **Outputs:** 1 conference paper submission & 1 journal paper manuscript [1], [2].

Project: *Design and Security Analysis of Symbol Error Probability-based Beamforming in MIMO Gaussian Wiretap Channels*

- Leading researcher and first author of **01** paper on low-complexity, high-performance symbol error probability minimization-based beamforming in Gaussian MIMO Wiretap Channels.
- Formulated a mathematical model and PHY signal design (binary antipodal signals and M-ary detection schemes) and proposed a novel low-complexity algorithm utilizing KKT conditions, generalized eigen-decomposition, and projected gradient descent.
- Conducted numerical experiments in MATLAB to evaluate the proposed beamforming scheme, analyzed results, and authored the paper.
- **Outputs:** 1 published conference paper & 1 journal paper submission [3], [4].

Research Assistant, Optical Communications Research Group — Mar. 2019 - Mar. 2023
Posts and Telecommunications Institute of Technology — Hanoi, Vietnam
Advisor: Prof. Vuong Mai and Prof. Ngoc Dang

Topics: Free-space quantum key distribution network, optical communication systems.
Project: *Design and Security Analysis of Satellite-based Free-Space Quantum Key Distribution Systems for Wireless and Vehicular Networks*
Sponsor: National Foundation for Science and Technology Development (NAFOSTED, Vietnam)

- Leading researcher and first author of **04** papers on satellite-based free-space quantum key distribution (QKD) systems for wireless networks.
- Innovated project ideas by expanding terrestrial binary phase shift keying (BPSK) modulation/direct-detection/QKD systems to satellite-based quadrature phase shift keying (QPSK) modulation/QKD systems.
- Designed and analyzed satellite-based QKD systems, including link-layer retransmissions, relaying techniques, and performance evaluations under atmospheric turbulence-induced phase fluctuations.
- Executed numerical experiments in MATLAB to assess system performance, analyzed results, and authored research papers.
- **Outputs:** 2 published conference papers & 2 published journal papers [5], [6], [7], [8].

PUBLICATIONS
Google Scholar

[1] **Nam Nguyen**, Thuan Nguyen, Thinh Nguyen, and Bella Bose, "A Theory of Universal Rate-Distortion-Classification Representations for Lossy Compression," 2025. [PDF]

[2] **Nam Nguyen**, Thuan Nguyen, Thinh Nguyen, and Bella Bose, "Universal Rate-Distortion-Classification Representations for Lossy Compression," *submitted to IEEE Information Theory Workshop*, 2025. [PDF]

[3] **Nam Nguyen**, An Vuong, Thuan Nguyen, and Thinh Nguyen, "On Symbol Error Probability-based Beamforming in MIMO Gaussian Wiretap Channels," *submitted to IEEE Transactions on Vehicular Technology*, 2024. [PDF]

[4] **Nam Nguyen**, An Vuong, Thuan Nguyen, and Thinh Nguyen, "On Minimizing Symbol Error Probability for Antipodal Beamforming in Gaussian MIMO Wiretap Channels," *2024 IEEE Vehicular Technology Conference*, Washington, DC, USA, 2024, pp. 1-5. [PDF]

[5] **Nam Nguyen**, Thang V. Nguyen, Ngoc T. Dang, and Vuong Mai, "Performance of Satellite Quantum Key Distribution under Atmospheric Turbulence-Induced Phase Fluctuations," *International Communications Satellite Systems Conference*, Bradford, UK, Oct. 2023. [PDF]

[6] **Nam D. Nguyen**, Hang T. T. Phan, Hien T. T. Pham, Vuong V. Mai, and Ngoc T. Dang, "Reliability Improvement of Satellite-based Quantum Key Distribution Systems using Retransmission Scheme," *Photonic Network Communications*, 42, 27–39, 2021. [PDF]

[7] **Nam D. Nguyen**, Hien T. T. Pham, Vuong V. Mai, and Ngoc T. Dang, "Comprehensive Performance Analysis of Satellite-to-Ground FSO/QKD Systems using Key Retransmission," *Optical Engineering*, Vol. 59, No. 12, pp. 126102-1-25, Dec. 2020. [PDF]

[8] **Nam D. Nguyen**, Hien T. T. Pham, Vuong V. Mai, and Ngoc T. Dang, "Performance Enhancement of Satellite FSO/QKD Systems using HAP-based Relaying and ARQ," *2020 International Conference on Advanced Technologies for Communications*, Nha Trang, Vietnam, pp. 12-17, 2020. [PDF]

INDUSTRY EXPERIENCE

Mobifone Telecommunications Corporation — Sept. 2020 - Dec. 2020
Networking and Communication Engineer Intern — Hanoi, Vietnam

- Conducted an in-depth study of technical documents to gain expertise in the 4G/LTE protocol and its applications in the telecommunications industry.
- Investigated and analyzed system and network operations, gaining valuable insights into network management and monitoring systems.

Viettel High Technology Industries Corporation — Jun. 2019 - Sept. 2019
Research and Development Intern — Hanoi, Vietnam

- Completed a competitive summer course on 4G/LTE Protocol Development, awarded a certificate for the top-performing project.

- Developed a multi-client TCP user client-server system to handle login, score retrieval, and logout requests over multi-threaded processes:
  - Designed a TCP server to authenticate clients and respond with scores, using unique threads for each client to handle simultaneous requests [Github Link].
  - Tools/Technologies: C, TCP/UDP Library, Linux, Functional Programming.

TEACHING EXPERIENCE

Teaching Assistant, Electrical Engineering and Computer Science Mar. 2022 - Present
Oregon State University Corvallis, OR, US

- **Courses:** ECE 353 - Introduction To Probability and Random Signals (3 quarters), ECE 351 - Signals and Systems I (2 quarters), ECE 352 - Signals and Systems II (3 quarters), CS 372 - Introduction to Computer Networks (1 quarter), ENGR 201 - Electrical Fundamentals I (4 quarters), ECE 271 - Digital Logic Design (1 quarter).
- **Responsibilities:** Grading assignments and exams, holding office hours and review sessions, and improving course materials.

TRAINING COURSES

AI 531 - Artificial Intelligence, AI 539 - Introduction to Online Learning, AI 534 - Machine Learning, AI 535 - Deep Learning, AI 539 - Information Theory, AI 586 - Applied Matrix Analysis, AI 539 - Convex Optimization, ECE 565 - Estimation, Filtering, and Detection, CS 527 - Error-Correcting Codes, ECE 563 - Wireless Communications Networks, ECE 669 - Communications System Design, ECE 564 - Digital Signal Processing, ECE 560 - Stochastic Signals and Systems, ECE 550 - Linear Systems.

TECHNICAL SKILLS

Quantitative Research: Mathematical Modeling, Optimization, Statistics and Probability Theory.
Programming Skills: Python, MATLAB, C/C++, LaTeX.
Software Tools: Pytorch, Tensorflow, MATLAB Toolboxes, CVX.
Research: Leading projects, teamwork, communication, problem-solving, programming, simulations, performance evaluation, presenting findings, and academic writing.

AWARDS & HONORS

NSF Student Travel Grant, AERPAW Spring Workshop – North Carolina State University 2025

Graduate School's Scholarly Presentation Award – Oregon State University 2024

SVTECH Scholarship – SV Technologies JSC 2021
Awarded to 5 outstanding students at the Posts and Telecommunications Institute of Technology

Participation Scholarship, 8th Vietnam School of Science – International Centre for Interdisciplinary Science and Education 2020

Second Prize, National Scientific Research Contest – Vietnam Ministry of Education and Training 2020

First Prize, Scientific Research Contest – Posts and Telecommunications Institute of Technology 2019

Second Prize in Physics – Provincial Excellent Student Competition, Vietnam 2012

First Prize in Physics – School-Level Excellent Student Competition, Vietnam 2011, 2012, 2013

REVIEWER SERVICE

2023 IEEE International Conference on Communications Workshops (1 paper), 2024 IEEE Wireless Communications Magazine (1 paper), 2024 IEEE Access (1 paper), 2025 IEEE International Symposium on Information Theory (4 papers).

REFERENCES

Prof. Thinh Nguyen
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Prof. Bella Bose
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Prof. Vuong Mai
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