

Tan Minh Nguyen

CONTACT INFORMATION

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ACADEMIC APPOINTMENTS

National University of Singapore, Singapore 2023–present
• Assistant Professor (Presidential Young Professor, tenure-track), Department of Mathematics

University of California, Los Angeles, CA, USA 2020–present
• Post-doctoral Scholar in Mathematics
• Mentor: Professor Stanley J. Osher

EDUCATION

Rice University, Houston, Texas, USA

Ph.D. in Electrical and Computer Engineering, 2014–2020
• Advisor: Professor Richard G. Baraniuk
• Thesis: Momentum-based Methods for Training and Designing Deep Neural Networks

M.S. in Electrical and Computer Engineering, 2014–2016
• Advisor: Professor Richard G. Baraniuk
• Thesis: Bridging Theory and Practice in Deep Learning with the Deep Rendering Model

B.S. in Electrical and Computer Engineering, 2011–2014

RESEARCH INTERESTS

My research focuses on the interplay of the interpretability, robustness, and efficiency of machine learning models from three principled approaches:

- Optimization (primal-dual frameworks for deep learning models, momentum-based neural networks, fast multipole transformers)
- Differential equation (Nesterov neural ordinary differential equations, graph neural diffusion)
- Statistical modeling (mixture and nonparametric kernel regression frameworks for transformers, deep generative models)

JOURNAL PUBLICATIONS

Tan M. Nguyen*, Nhat Ho*, Ankit B. Patel, Anima Anandkumar, Michael I. Jordan, Richard G. Baraniuk. “A Bayesian Perspective of Convolutional Neural Networks through a Deconvolutional Generative Model”. *Journal of Machine Learning Research*, 2023.

Bao Wang*, **Tan M. Nguyen***, Andrea L. Bertozzi, Richard G. Baraniuk, Stanley J. Osher. “Scheduled Restart Momentum for Accelerated Stochastic Gradient Descent”. *SIAM Journal on Imaging Sciences*, 2022.

Bao Wang, Hedi Xia, **Tan M. Nguyen**, Stanley J. Osher. “How Does Momentum Benefit Deep Neural Networks Architecture Design? A Few Case Studies”. *Research in the Mathematical Sciences*, 2022.

Yue Wang, Jianghao Shen, Ting-Kuei Hu, Pengfei Xu, **Tan M. Nguyen**, Richard Baraniuk, Zhangyang Wang, Yingyan Lin. “Dual Dynamic Inference: Enabling More Efficient, Adaptive, and Controllable Deep Inference”. *IEEE Journal of Selected Topics in Signal Processing*, 2020.

*: co-first authors, **: co-last authors

Rachel S.Y. Teo, **Tan M. Nguyen**. “MomentumSMoE: Integrating Momentum into Sparse Mixture of Experts”. *Conference on Neural Information Processing Systems (NeurIPS), 2024 (journal-quality, acceptance rate: 25.8%)*.

Rachel S.Y. Teo, **Tan M. Nguyen**. “Unveiling the Hidden Structure of Self-Attention via Kernel Principal Component Analysis”. *Conference on Neural Information Processing Systems (NeurIPS), 2024 (journal-quality, acceptance rate: 25.8%)*.

Stefan Nielsen*, Laziz Abdullaev*, Rachel S.Y. Teo, **Tan M. Nguyen**. “Elliptical Attention”. *Conference on Neural Information Processing Systems (NeurIPS), 2024 (journal-quality, acceptance rate: 25.8%)*.

Hoang V. Tran*, Thieu Vo*, Tho Tran Huu, An Nguyen The, **Tan M. Nguyen**. “Monomial Matrix Group Equivariant Neural Functional Networks”. *Conference on Neural Information Processing Systems (NeurIPS), 2024 (journal-quality, acceptance rate: 25.8%)*.

Tam Nguyen, Cesar A. Uribe, **Tan M. Nguyen****, Richard Baraniuk**. “PIDformer: Transformer Meets Control Theory”. *International Conference on Machine Learning (ICML), 2024 (journal-quality, acceptance rate: 27.5%)*.

Hien Dang, Tho Tran Huu, **Tan M. Nguyen****, Nhat Ho**. “Neural Collapse for Cross-entropy Class-Imbalanced Learning with Unconstrained ReLU Features Model”. *International Conference on Machine Learning (ICML), 2024 (journal-quality, acceptance rate: 27.5%)*.

Long Minh Bui, Tho Tran Huu, Duy Dinh, **Tan M. Nguyen****, Trong Nghia Hoang**. “Revisiting Kernel Attention with Correlated Gaussian Process Representation”. *Conference on Uncertainty in Artificial Intelligence (UAI), 2024 (journal-quality, acceptance rate: 27.0%)*.

Hien Dang, Tho Tran Huu, **Tan M. Nguyen****, Nhat Ho**. “Beyond Vanilla Variational Autoencoders: Detecting Posterior Collapse in Conditional and Hierarchical Variational Autoencoders”. *International Conference on Learning Representations (ICLR), 2024 (journal-quality, acceptance rate: 30.8%)*.

Tuan Nguyen, Hirotada Honda, Takashi Sano, Vinh Nguyen**, Shugo Nakamura**, **Tan M. Nguyen****. “From Coupled Oscillators to Graph Neural Networks: Reducing Over-smoothing via a Kuramoto Model-based Approach”. *International Conference on Artificial Intelligence and Statistics (AISTATS), 2024 (journal-quality, acceptance rate: 27.6%)*.

Tam Nguyen, **Tan M. Nguyen**, Richard G. Baraniuk. “Mitigating Over-smoothing in Transformers via Regularized Nonlocal Functionals”. *Conference on Neural Information Processing Systems (NeurIPS), 2023 (journal-quality, acceptance rate: 26.1%)*.

Xing Han*, Tongzheng Ren*, **Tan M. Nguyen***, Khai Nguyen, Joydeep Ghosh, Nhat Ho. “Designing Robust Transformers using Robust Kernel Density Estimation”. *Conference on Neural Information Processing Systems (NeurIPS), 2023 (journal-quality, acceptance rate: 26.1%)*.

Khang Nguyen, Hieu Nong, Vinh Nguyen, Nhat Ho, Stanley J. Osher, **Tan M. Nguyen**. “Revisiting Over-smoothing and Over-squashing using Ollivier-Ricci Curvature”. *International Conference on Machine Learning (ICML), 2023 (journal-quality, acceptance rate: 27.9%)*.

Hien Dang, Tho Tran Huu, Stanley Osher, Hung Tran-The, Nhat Ho, **Tan M. Nguyen**. “Neural Collapse in Deep Linear Networks: From Balanced to Imbalanced Data”. *International Conference on Machine Learning (ICML), 2023 (journal-quality, acceptance rate: 27.9%)*.

Tan M. Nguyen*, Tam Nguyen*, Nhat Ho, Andrea Bertozzi, Richard G. Baraniuk, Stanley J. Osher. “A Primal-Dual Framework for Transformers and Neural Networks”. *International Conference on Learning Representations (ICLR), 2023 (journal-quality, acceptance rate: 32.0%, notable-top-25%)*.

Khai Nguyen, Tongzheng Ren, Huy Nguyen, Litu Rout, **Tan M. Nguyen**, Nhat Ho. “Hierarchical Sliced Wasserstein Distance”. *International Conference on Learning Representations (ICLR), 2023 (journal-quality, acceptance rate: 32.0%)*.

Khang Nguyen, Hieu Nong, Khuong Nguyen, **Tan M. Nguyen****, Vinh Nguyen**. “DeepGRAND: Deep Graph Neural Diffusion”. *Asilomar Conference, 2023*.

Tan M. Nguyen*, Tam Nguyen*, Long Bui, Hai Do, Dung Le, Hung Tran-The, Khuong Nguyen, Richard G. Baraniuk, Nhat Ho, Stanley J. Osher. “A Probabilistic Framework for Pruning Transformers via a Finite Admixture of Keys”. *International Conference on Acoustics, Speech, and Signal Processing (ICASSP, notable-top-3%), 2023*.

Tan M. Nguyen*, Minh Pham*, Tam Nguyen, Khai Nguyen, Stanley J. Osher, Nhat Ho. “FourierFormer: Transformer Meets Generalized Fourier Integral Theorem”. *Conference on Neural Information Processing Systems (NeurIPS), 2022 (journal-quality, acceptance rate: 25.6%)*.

Tan M. Nguyen*, Tam Nguyen*, Hai Do, Khai Nguyen, Vishwanath Saragadam, Minh Pham, Khuong Nguyen, Nhat Ho, Stanley J. Osher. “Improving Transformer with an Admixture of Attention Heads”. *Conference on Neural Information Processing Systems (NeurIPS), 2022 (journal-quality, acceptance rate: 25.6%)*.

Nghia Nguyen*, **Tan M. Nguyen***, Huyen Vo, Stanley J. Osher, Thieu Vo. “Improving Neural Ordinary Differential Equations with Nesterov’s Accelerated Gradient Method”. *Conference on Neural Information Processing Systems (NeurIPS), 2022 (journal-quality, acceptance rate: 25.6%)*.

Tam Nguyen*, **Tan M. Nguyen***, Dung Le, Khuong Nguyen, Anh Tran, Richard G. Baraniuk, Nhat Ho, Stanley J. Osher. “Improving Transformers with Probabilistic Attention Keys”. *International Conference on Machine Learning (ICML), 2022 (journal-quality, acceptance rate: 21.9%)*.

Matthew Thorpe*, **Tan M. Nguyen***, Hedi Xia*, Thomas Strohmer, Andrea Bertozzi, Stanley J. Osher, Bao Wang. “GRAND++: Graph Neural Diffusion with a Source Term”. *International Conference on Learning Representations (ICLR), 2022 (journal-quality, acceptance rate: 32.9%)*.

Tan M. Nguyen, Richard G. Baraniuk, Mike Kirby, Stanley J. Osher, Bao Wang. “Momentum Transformer: Closing the Performance Gap Between Self-attention and Its Linearization”. *Mathematical and Scientific Machine Learning (MSML), 2022*.

Tan M. Nguyen, Animesh Garg, Richard G Baraniuk, Anima Anandkumar. “InfoCNF: An Efficient Conditional Continuous Normalizing Flow with Adaptive Solvers”. *Asilomar Conference, 2022*.

Tan M. Nguyen, Vai Suliafu, Stanley J. Osher, Long Chen, Bao Wang. “FMMformer: Efficient and Flexible Transformer via Decomposed Near-field and Far-field Attention”. *Conference on Neural Information Processing Systems (NeurIPS), 2021 (journal-quality, acceptance rate: 25.7%)*.

Hedi Xia, Vai Suliafu, Hangjie Ji, **Tan M. Nguyen**, Andrea Bertozzi, Stanley J. Osher, Bao Wang. “Heavy Ball Neural Ordinary Differential Equations”. *Conference on Neural Information Processing Systems (NeurIPS), 2021 (journal-quality, acceptance rate: 25.7%)*.

Tan M. Nguyen, Richard G. Baraniuk, Andrea Bertozzi, Stanley J. Osher, Bao Wang. “MomentumRNN: Integrating Momentum into Recurrent Neural Networks”. *Conference on Neural Information Processing Systems (NeurIPS)*, 2020 (journal-quality, acceptance rate: 20.1%).

Yujia Huang, James Gornet, Sihui Dai, Zhiding Yu, **Tan M. Nguyen**, Doris Tsao, Anima Anandkumar. “Neural Networks with Recurrent Generative Feedback”. *Conference on Neural Information Processing Systems (NeurIPS)*, 2020 (journal-quality, acceptance rate: 20.1%).

Tan M. Nguyen*, Nhat Ho*, Ankit B. Patel, Anima Anandkumar, Michael I. Jordan, Richard G. Baraniuk. “Neural Rendering Model: Joint Generation and Prediction for Semi-Supervised Learning”. *Deep Math Conference (DeepMath)*, 2019. (Oral presentation)

Tan M. Nguyen, Wanjia Liu, Fabian Sinz, Richard G. Baraniuk, Andreas S. Tolias, Xaq Pitkow, Ankit B. Patel. “Towards a Cortically Inspired Deep Learning Model: Semi-Supervised Learning, Divisive Normalization, and Synaptic Pruning”. *Conference on Cognitive Computational Neuroscience (CCN)*, 2017.

Ankit B Patel, **Tan M. Nguyen**, Richard Baraniuk. “A Probabilistic Framework for Deep Learning”. *Conference on Neural Information Processing Systems (NeurIPS)*, 2016 (journal-quality, acceptance rate: 23.6%).

WORKSHOP PAPERS

Gavin D. Portwood, Peetak P. Mitra, Mateus Dias Ribeiro, **Tan M. Nguyen**, Balasubramanya T. Nadiga, Juan A. Saenz, Michael Chertkov, Animesh Garg, Anima Anandkumar, Andreas Dengel, Richard G. Baraniuk, David P. Schmidt. “Turbulence Forecasting via Neural ODE”. *NeurIPS Workshop on Machine Learning and the Physical Sciences*, 2019.

WORKSHOP ORGANIZATION

Integration of Deep Neural Models and Differential Equations at the International Conference on Learning Representations (ICLR), 2020.

Integration of Deep Learning Theories at the Conference on Neural Information Processing Systems (NeurIPS), 2018.

AWARDED GRANTS

PI, Toyota Research Institute Grant, *A Unified Framework for Building Large-Scale Language Models in Developing Countries: From Model and System to Data*, \$100,000, November, 2022 - November, 2023.

Co-PI, Singapore-Israel Scientific Research Program, *Mitigating Security and Privacy Risks of Large Language Models*, SGD 250,000, October, 2023 - March, 2025.

HONORS AND AWARDS

NUS Presidential Young Professorship, 2024-2027.

Computing Innovation Postdoctoral Fellowship (CIFellows), 2020–2023.

J. Tinsley Oden Visiting Fellowship, 2022

AWS Cloud Credits for Research, \$50,000, September, 2018.

NSF Graduate Research Fellowship, 2016–2020.

Ford Foundation Fellowship Honorable Mention, 2016.

Neuroengineering IGERT: From Cells to Systems Fellowship, 2015 – 2017.

Texas Instruments Fellowship, 2014–2016. (Awarded to top incoming graduate students in the ECE department at Rice University)

Louis J. Walsh Scholarship in Engineering, 2013–2014. (Awarded to top undergraduate students in the ECE department at Rice University)

Gold Scholar on Coca-Cola’s Community College Academic Team, 2011.

TEACHING

Spring 2024, DSA5202: Advanced Topics in Machine Learning, NUS.

Fall 2023, DSA5105: Principles of Machine Learning, NUS.

Spring 2023 and Summer 2022, Math156: Machine Learning, UCLA.

INVITED SEMINAR
PRESENTATIONS

A Statistical Treatment of the Attention Mechanism in Transformers. *Analytics Center of Excellence (ACOE), IQVIA, Italy, 2022.*

Principled Models for Machine Learning. *Math Machine Learning Seminar, the Max Planck Institute for Mathematics in the Sciences and UCLA, USA, 2022.*

Principled Models for Machine Learning. *Applied Math Colloquium at UCLA, USA, 2022.*

Momentum-based Methods for Training and Designing Deep Neural Networks. *VinAI Research, Vietnam, 2020.* (Invited talk)

Scheduled Restart Momentum for Accelerated Stochastic Gradient Descent. *Machine Learning Seminar, Rice University, USA, 2020.* (Invited talk)

Deep Generative Models for Geophysical Signal Disentanglement. *Geo-Mathematical Imaging Group (GMIG) Project Review Meeting, Rice University, USA, 2018.* (Invited talk)

CONFERENCE,
WORKSHOP
PRESENTATIONS

A Primal-Dual Framework for Transformers and Neural Networks. *Special Session on “Mathematics of Machine Learning”, Canadian Mathematical Society Winter Meeting, 2022.* (Invited talk)

Transformer with Fourier Integral Attentions. *Deep Learning for Sequence Modeling Minisymposium, the SIAM Conference on Computational Science and Engineering (CSE), 2023.* (Invited talk)

Transformer with a Mixture of Gaussian Keys. *Geometry of Machine Learning Minisymposium, the 4th Annual Meeting of the SIAM Texas-Louisiana Section, 2021.* (Invited talk)

Momentum-Based and Fast Multipole Methods for Designing Deep Learning Models. *Mathematical Foundation of Deep Learning with the Applications to PDE Minisymposium, the 4th Annual Meeting of the SIAM Texas-Louisiana Section, 2021.* (Invited talk)

Brain-inspired Robust Vision Using Convolutional Neural Networks with Feedback. *NeurIPS NeuroAI Workshop, 2019.* (Poster)

Conditional Continuous Normalizing Flows for Physics-Inspired Learning. *NVIDIA Onsite Research Event, 2019.* (Lightning Talk)

Neural Rendering Model: Rethinking Neural Networks from the Joint Generation and Prediction Perspective. *NeurIPS Workshop on Integration of Deep Learning Theories, 2018.* (Contributed talk)

EnergyNet: Energy-Efficient Dynamic Inference. *NeurIPS Workshop on Compact Deep Neural Network Representation with Industrial Applications, 2018*. (Poster)

Tremor Generative Adversarial Network (TremorGAN): Deep Generative Model Approach for Geophysical Signal Generation. *NeurIPS Workshop on Machine Learning for Geophysical and Geochemical Signals, 2018*. (Poster)

The Latent-Dependent Deep Rendering Model. *ICML Workshop on Theoretical Foundations and Applications of Deep Generative Models, 2018*. (Poster)

Mixed Reality Generative Adversarial Networks: Closing the Visual Gap between Synthetic and Real Images. *Amazon Graduate Research Symposium, 2017*. (Poster)

A Probabilistic Framework for Deep Learning. *Computational and System Neuroscience Conference (COSYNE), 2016*. (Poster)

MENTORING

Hedi Xia, Ph.D. student in the Mathematics Department at UCLA

Tam Nguyen, Resident at FPT Software AI. (Next: Ph.D. at Rice University)

Nghia Nguyen, Resident at FPT Software AI. (Next: Ph.D. at the University of Pennsylvania)

Yujia Huang, Ph.D. student in the Computing + Mathematical Sciences Department at Caltech

Wanjia Liu, Master student in the Computer Science Department at Rice University. (Next: Google)

Si Hui Dai, Undergraduate student in the Computing + Mathematical Sciences Department at Caltech. (Next: Ph.D. at Princeton)

Ethan Perez, Undergraduate student in the Computer Science Department at Rice University. (Next: Ph.D. at NYU)

PROFESSIONAL SERVICES

Journal reviewing

- Journal of Machine Learning Research
- Transactions on Pattern Analysis and Machine Intelligence
- Transactions on Machine Learning Research
- Machine Learning with Applications
- Information and Inference
- IEEE Journal on Selected Areas in Information Theory
- Statistical Applications in Genetics and Molecular Biology

Conference reviewing

- International Conference on Machine Learning (ICML)
- Conference on Neural Information Processing Systems (NeurIPS)
- International Conference on Learning Representations (ICLR)
- AAAI Conference on Artificial Intelligence (AAAI)
- Asilomar Conference on Signals, Systems, and Computers

Other service

- Summer Undergraduate Research Fellowship Program at Caltech, Pasadena, California, *Project Mentor*
- Machine Learning Lunch at Rice University, Houston, Texas, *Organizer*
- Deep Learning Meeting at Rice University, Houston, Texas, *Organizer*

MEMBERSHIP

Institute of Electrical and Electronics Engineers (IEEE)

REFERENCES

Professor Stanley J. Osher

Professor of Mathematics, Computer Science, Electrical Engineering, and Chemical and Biomolecular Engineering

Director of Special Projects, Institute for Pure and Applied Mathematics (IPAM)

University of California, Los Angeles

Email: sjo@math.ucla.edu

Professor Andrea L. Bertozzi

Distinguished Professor of Mathematics and Mechanical and Aerospace Engineering

Betsy Wood Knapp Chair for Innovation and Creativity

Director of Applied Mathematics

University of California, Los Angeles

Email: bertozzi@math.ucla.edu

Professor Richard G. Baraniuk

C. Sidney Burris Professor of Electrical and Computer Engineering

Founder & Director, OpenStax

Rice University, Houston, Texas

Email: richb@rice.edu

Professor Don Blasius

Professor of Mathematics

University of California, Los Angeles

Email: blasius@math.ucla.edu