NHAN H. PHAM

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RESEARCH INTERESTS

Stochastic methods for machine learning, deep learning, reinforcement learning, and federated learning.

EDUCATION

Ph.D. in Operations Research 2017–2021
Department of Statistics and Operations Research
University of North Carolina at Chapel Hill · Chapel Hill, NC, USA

Graduate Study in Computer Engineering 2015–2017
Department of Computer Science and Engineering
University of Nevada, Reno · Reno, NV, USA

Bachelor of Engineering (Honor Program) in Computer Engineering 2008–2013
Department of Computer Science and Engineering
Ho Chi Minh City University of Technology · Ho Chi Minh City, Vietnam

INDUSTRY EXPERIENCES

Research Scientist 2022–Present
IBM Research, Thomas J. Watson Research Center · Yorktown Heights, NY

Summer Machine Learning Intern *2021*
Blue River Technology Inc. · Sunnyvale, CA

Summer Research Intern *2020*
IBM Research, Thomas J. Watson Research Center · Yorktown Heights, NY

RESEARCH EXPERIENCES

Automation for Enterprise Data Management *Dec. 2023–Present*

- ◇ Build an end-to-end system for text-to-SQL using Large Language Models (LLMs).
- ◇ Conduct experiments using enterprise dataset as well as public Text2SQL dataset.

An Automated System for Tuning and Alignment of Foundation Models with Applications in Data Management
Mar. 2022–Mar. 2023

- ◇ Build a configurable search system that allows automated rapid experimentation for tuning foundation models on data management tasks.
- ◇ Experimenting with different reward functions for reinforcement learning (RL) fine-tuning for Column-to-Concept mapping use-case.

Automated Decision Optimization *Jan. 2022–Mar. 2023*

- ◇ Design the application framework and system architecture for data and knowledge-driven Automated Decision Optimization ((AutoDO)).
- ◇ Demonstrate, benchmark, and experiment for effectiveness and solution quality from AutoDO.
- ◇ AutoDO is available on IBM API Hub portal.

Evaluating Robustness of Cooperative MARL: A Model-based approach *Jul. 2021–May 2023*
Joint work with: Dr. Lam M. Nguyen, Dr. Jie Chen, Dr. Hoang Thanh Lam, Dr. Subhro Das, and Dr. Tsui-Wei Weng.
Accepted for the 2023 IEEE International Conference on Data Mining (ICDM), eprint.

- ◇ Propose the first model-based adversarial attacks, called cMBA, for cooperative multi-agent reinforcement learning by solving a constrained nonconvex optimization problem at every timestep.
- ◇ Propose a new victim agent selection strategy which has not been considered in previous works.
- ◇ Conduct experiments on multi-agent MuJoCo environments.

Federated Learning with Randomized Douglas-Rachford Splitting Methods *Aug. 2020–Jun. 2021*
Graduate Research Assistant, Supervisor: Dr. Quoc Tran-Dinh, Dr. Lam M. Nguyen.
Accepted for the 35th Conference on Neural Information Processing Systems, eprint.

- ◇ Propose two new algorithms, FedDR and asyncFedDR, to solve finite-sum nonconvex problems in federated learning by combining Douglas-Rachford splitting, randomized strategy, and asynchronous update.
- ◇ Achieve best-known communication complexity and handle data heterogeneity.

◇ Conduct experiments on federated learning examples using synthetic and real datasets.

Regression Optimization for System-level Production Control *Jun. 2020–Aug. 2020*
IBM Research Intern, Supervisor: Dr. Roman Vaculin, Dr. Dzung T. Phan, Dr. Lam M. Nguyen.
Accepted for the 2021 American Control Conference (ACC).

Stochastic Gauss-Newton Algorithms for Nonconvex Compositional Optimization *Sept. 2019–Feb. 2020*
Graduate Research Assistant, Supervisors: Dr. Quoc Tran-Dinh, Dr. Lam M. Nguyen.
Accepted for the 37th International Conference on Machine Learning, eprint.

◇ Propose two new Stochastic Gauss-Newton algorithms to solve stochastic nonconvex compositional problems that use both classical stochastic and SARAH estimators for function values and Jacobian estimators.
◇ Give first stochastic Gauss-Newton algorithm with global complexity analysis.
◇ Conduct numerical experiments on two examples: stochastic nonlinear equations and asset allocation problem.

Regularization Techniques on Deep Learning *Sept. 2019–Dec. 2019*
SAMSI Research Fellow, Supervisor: Dr. Quoc Tran-Dinh.

◇ Study the principle of different regularization techniques on training Deep Neural Networks (DNNs).
◇ Conduct numerical experiments on different DNN models consisting two or more regularizers on both model parameters (e.g., ℓ_2-norm, max-norm constraint, etc.) and training process (dropout, batch normalization, etc.).

Hybrid Stochastic Policy Gradient Algorithm for Reinforcement Learning *Jul. 2019–Dec. 2019*
Graduate Research Assistant, Supervisors: Dr. Quoc Tran-Dinh, Dr. Lam M. Nguyen.
Accepted for the 23rd International Conference on Artificial Intelligence and Statistics (AISTATS 2020), eprint.

◇ Propose new biased policy gradient estimator from REINFORCE/GPOMDP and adopted SARAH estimators and use it to derive first algorithm that has convergence guarantee to solve a composite policy optimization problem in reinforcement learning.
◇ Prove proposed algorithm achieves best-known convergence rate over existing methods and conduct experiments to verify the advantage using OpenAI `gym` environments.

Hybrid Optimization Framework for Composite Nonconvex Optimization *Feb. 2019–Aug. 2019*
Graduate Research Assistant, Supervisors: Dr. Quoc Tran-Dinh, Dr. Lam M. Nguyen.
Accepted for Mathematical Programming, eprint.

◇ Introduce a new stochastic gradient estimator that combines SGD and SARAH estimators and use it to develop a new algorithm for composite nonconvex optimization problems which achieves best-known convergence rate.
◇ Verify the effectiveness of the proposed algorithm via numerical experiments using Python and Tensorflow.

ProxSARAH: A Framework for Stochastic Composite Nonconvex Optimization *Aug. 2018–Feb. 2019*
Graduate Research Assistant, Supervisors: Dr. Quoc Tran-Dinh, Dr. Lam M. Nguyen.
Accepted for Journal of Machine Learning Research (JMLR), eprint.

◇ Develop new stochastic algorithm for composite nonconvex optimization problems which utilizes existing SARAH estimator and achieves the best-known convergence rate.
◇ Conduct numerical experiments to illustrate advantage of proposed algorithms on three examples: Non-negative PCA, classification with 3 nonconvex losses, and neural network training using Python and Tensorflow.

Autonomous Robots for Bridge Inspection *Aug. 2015–Feb. 2017*
Graduate Research Assistant, Supervisor: Dr. Hung M. La.
In Proceedings of the 54th Annual Allerton Conference on Communication, Control, and Computing, eprint.
In Proceedings of the 2017 IEEE International Conference on Robotics and Automation (ICRA), eprint.
The 33rd International Symposium on Automation and Robotics in Construction and Mining (ISARC), eprint.

◇ Propose four-wheeled robot for steel bridge inspection with permanent magnets embedded inside each wheel equipped with different type of sensors: visual camera, 3D sensor, IMU for localization and mapping purposes.
◇ Build controller unit with minicomputer (Intel NUC) running Robot Operating System communicating with low-level controller (Arduino-based) for sensory data collection, implement sensor fusion and mapping algorithms.

PREPRINTS

1. T. T. Doan, L. M. Nguyen, **N. H. Pham**, and J. Romberg. Convergence Rates of Accelerated Markov Gradient Descent with Applications in Reinforcement Learning. *arXiv:2002.02873*, 2020.
2. T. T. Doan, L. M. Nguyen, **N. H. Pham**, and J. Romberg. Finite-Time Analysis of Stochastic Gradient Descent under Markov Randomness. *arXiv:2003.10973*, 2020.

PUBLICATIONS

1. **N. H. Pham**, L. M. Nguyen, J. Chen, H. T. Lam, S. Das, T. W. Weng. Evaluating Robustness of Cooperative MARL: A Model-based Approach. 2023 IEEE International Conference on Data Mining (ICDM), pp. 1271-1276, Shanghai, China, 2023.
2. Q. Tran-Dinh, **N. H. Pham**, D. T. Phan, and L. M. Nguyen. FedDR–Randomized Douglas-Rachford Splitting Algorithms for Nonconvex Federated Composite Optimization. *The 35th Conference on Neural Information Processing Systems*, 2021.
3. D. T. Phan, L. M. Nguyen, P. Murali, **N. H. Pham**, H. Liu, and J. R. Kalagnanam. Regression Optimization for System-level Production Control. *American Control Conference* (*ACC*), 2021.
4. Q. Tran-Dinh, **N. H. Pham**, D. T. Phan, and L. M. Nguyen. A Hybrid Stochastic Optimization Framework for Composite Nonconvex Optimization. *Mathematical Programming*, 2021.
5. Q. Tran-Dinh, **N. H. Pham**, and L. M. Nguyen. Stochastic Gauss-Newton Algorithms for Nonconvex Compositional Optimization. *Proceedings of the 37th International Conference on Machine Learning*, PMLR 119:9572-9582, 2020.
6. **N. H. Pham**, L. M. Nguyen, D. T. Phan, and Q. Tran-Dinh. ProxSARAH: An Efficient Algorithmic Framework for Stochastic Composite Nonconvex Optimization. *Journal of Machine Learning Research*, 2020.
7. **N. H. Pham**, L. M. Nguyen, D. T. Phan, P. H. Nguyen, M. van Dijk, and Q. Tran-Dinh. A Hybrid Stochastic Policy Gradient Algorithm for Reinforcement Learning. *The 23rd International Conference on Artificial Intelligence and Statistics* (*AISTATS*), 2020, Palermo, Italy.
8. H. M. La, T. H. Dinh, **N. H. Pham**, Q. P. Ha, and A. Q. Pham. Automated Robotic Monitoring and Inspection of Steel Structures and Bridges. *Robotica*, Cambridge University Press, 1-21, 2018.
9. T. D. Le, S. Gibb, **N. H. Pham**, H. M. La, L. Falk, and T. Berendsen. Autonomous Robotic System using Non-Destructive Evaluation methods for Bridge Deck Inspection. In *Proceedings of the 2017 IEEE International Conference on Robotics and Automation* (*ICRA*), May 29-June 3, 2017, Singapore.
10. **N. H. Pham** and H. M. La. Design and Implementation of an Autonomous Robot for Steel Bridge Inspection. In *Proceedings of the 54th Annual Allerton Conference on Communication, Control, and Computing*, pages 1-8, Sept. 27-30, 2016, Urbana-Champaign, Illinois, USA.
11. **N. H. Pham**, H. M. La, Q. P. Ha, S. N. Dang, A. H. Vo, and Q. H. Dinh. Visual and 3D Mapping for Steel Bridge Inspection Using a Climbing Robot. *The 33rd International Symposium on Automation and Robotics in Construction and Mining* (*ISARC*), pages 1-8, July 18-21, 2016, Auburn, Alabama, USA.

PATENT APPLICATIONS

1. E. Lobo, **N. H. Pham**, L. Vu, T. Mummert, and D. Subramanian. A novel system for metadata to glossary matching in data lakes using generative models. *To be filed*.
2. L. Vu, **N. H. Pham**, D. Subramanian, T. Mummert. System and Method for Combining Data Selection and Reward Function for Tuning LLMs using Reinforcement Learning. *Filed on Jan. 11, 2024*.
3. T. L. Hoang, M. M. Galindo, G. Picco, M. Zayats, **N. H. Pham**, L. M. Nguyen, M. L. Sbodio, D. T. Phan, and V. L. Garcia. Evolution and regression generative models and sequence representation learning from multi sequence alignment and phylogenetic trees data. *Filed on Jun. 30, 2023*.
4. L. Vu, P. Kirchner, R. Marinescu, D. Subramanian, and **N. H. Pham**. A novel meta-hyperparameter tuning system for RL using sequence model. *Filed on Jun. 26, 2023*.
5. E. Lobo, **N. H. Pham**, D. Subramanian, and T. Pedapati. A novel meta-hyperparameter tuning system for RL using sequence model. *Filed on Jun. 23, 2023*.
6. **N. H. Pham**, L. M. Nguyen, J. Chen, T. L. Hoang, S. Das. A systematic approach for evaluating robustness of cooperative multi-agent reinforcement learning. *Filed on Sep. 28, 2022*.
7. D. T. Phan, **N. H. Pham**, L. M. Nguyen. Site-Wide Optimization for Mixed Regression Models and Mixed Control Variables. *Filed on May 25, 2021*.

TUTORIALS/LAB

AAAI 2023 Tutorial and Lab Organizer *Feb. 2023*
Title: *Automated AI For Decision Optimization with Reinforcement Learning.*

INVITED TALKS

MIT-IBM Guest Seminar *Jul. 2021*
Title: *Stochastic Recursive Gradient Algorithms for Stochastic Composite Nonconvex Optimization and Policy Optimization.*

INFORMS Annual Meeting 2020 Virtual *Nov. 2020*
Title: *A Hybrid Stochastic Policy Gradient Algorithm for Reinforcement Learning.*

INFORMS Annual Meeting 2019 Seattle *Oct. 2019*
Title: *ProxSARAH: An Efficient Algorithmic Framework for Stochastic Composite Nonconvex Optimization.*

SKILLS & QUALIFICATIONS

Technical Python, Tensorflow, Keras, Pytorch, Scikit-learn, C/C++, Matlab, Data Structures & Algorithms
Other skills Linux Development Environment, Robotics, Embedded Systems

PROFESSIONAL SERVICES

REVIEWER (PEER-REVIEWED CONFERENCES)

International Conference on Machine Learning (ICML) *2020–2024*

Conference on Neural Information Processing Systems (NIPS/NeurIPS) *2020–2024*

International Conference on Artificial Intelligence and Statistics (AISTATS) *2021–2024*

International Conference on Learning Representations (ICLR) *2021–2024*

AAAI Conference on Artificial Intelligence *2022–2024*

Conference on Uncertainty in Artificial Intelligence *2022*

REVIEWER (PEER-REVIEWED JOURNALS)

Automatica *2024*

Applied Intelligence *2023–2024*

Transactions on Machine Learning Research (TMLR) *2023–2024*

IEEE Transactions on Neural Networks and Learning Systems (IEEE TNNLS) *2022–2023*

Machine Learning *2021–2023*

Journal of Machine Learning Research (JMLR) *2022–2023*

IEEE Transactions on Automatic Control (IEEE TAC) *2022–2023*

IMA Journal of Numerical Analysis (IMAJNA) *2022–2023*

Journal of Scientific Computing (JOMP) *2022*

Neural Networks (NEUNET) *2022*

Computational Optimization and Applications (COAP) *2021–2022*

OTHER EXPERIENCES

Graduate Teaching Assistant *2020-2021*
STOR 455: Methods of Data Analysis
STOR 155: Introduction to Data Models and Inference
Department of Statistics and Operations Research · University of North Carolina at Chapel Hill

Graduate Teaching Fellow *2019*
STOR 113: Decision Models for Business and Economics
Department of Statistics and Operations Research · University of North Carolina at Chapel Hill

Graduate Teaching Assistant *2017–2018*
STOR 113: Decision Models for Business and Economics
STOR 155: Introduction to Data Models and Inference
Department of Statistics and Operations Research · University of North Carolina at Chapel Hill

Graduate Teaching Assistant *2015–2017*
CPE 301: Embedded Systems Design

CS 302: Data Structures
Department of Computer Science and Engineering · University of Nevada, Reno

HONORS & AWARDS

Graduate Access Grant *2016—2017*
Regents' Higher Education Opportunity Award
University of Nevada, Reno · Reno, NV

International Graduate Student Award *2016–2017*
Regents' Higher Education Opportunity Award
University of Nevada, Reno · Reno, NV

Poster Exhibition–1st Place Winner *2016*
CSE Graduate Club–Department of Computer Science and Engineering
University of Nevada, Reno · Reno, NV