

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*

EMPLOYMENT HISTORY

Research Staff Member 2022–Present

IBM Research, Thomas J. Watson Research Center · Yorktown Heights, NY

RESEARCH EXPERIENCES

Federated Learning with Randomized Douglas-Rachford Splitting Methods Aug. 2020–June. 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.

INDUSTRY EXPERIENCES

Summer Machine Learning Intern

2021

Blue River Technology Inc. · Sunnyvale, CA

- ◇ Analyse effectiveness of training with random augmentation versus baseline performance.
- ◇ Investigate whether instance segmentation can improve model performance than semantic segmentation by using transfer learning on existing models.

Summer Research Intern

2020

IBM Research, Thomas J. Watson Research Center · Yorktown Heights, NY

- ◇ Develop prediction-optimization framework to maximize the prediction output over different possible options on control variables, where the relationship in each plant is captured via a regression model.
- ◇ Implement primal-dual algorithms under different types of regression model with or without derivative information (white-box and black-box models).

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. 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.
2. 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.
3. 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.
4. 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.

5. **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.
6. **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.
7. 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.
8. 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.
9. **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.
10. **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.
11. T.-D. D. Phan, **N. H. Pham**, K.-N. Le-Huu, and A.-V. D. Dinh. Quadrotor Helicopter: A Practical Design Approach. *IEICE International Conference on Integrated Circuits, Design and Verification*, pp.156-163, 2013, Ho Chi Minh, Vietnam.

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)

<i>International Conference on Machine Learning (ICML)</i>	2020-2022
<i>Conference on Neural Information Processing Systems (NIPS/NeurIPS)</i>	2020-2021
<i>International Conference on Artificial Intelligence and Statistics (AISTATS)</i>	2021-2022
<i>International Conference on Learning Representations (ICLR)</i>	2021-2022
<i>AAAI Conference on Artificial Intelligence</i>	2022

REVIEWER (PEER-REVIEWED JOURNALS)

<i>Machine Learning</i>	2021
<i>Journal of Scientific Computing (JOMP)</i>	2022
<i>Journal of Machine Learning Research (JMLR)</i>	2022
<i>Computational Optimization and Applications (COAP)</i>	2022
<i>IEEE Transactions on Automatic Control (IEEE TAC)</i>	2022
<i>IEEE Transactions on Neural Networks and Learning Systems (IEEE TNNLS)</i>	2022

OTHER EXPERIENCES

Graduate Teaching Assistant <i>STOR 455: Methods of Data Analysis</i> <i>STOR 155: Introduction to Data Models and Inference</i> <i>Department of Statistics and Operations Research · University of North Carolina at Chapel Hill</i>	2020–2021
Graduate Teaching Fellow <i>STOR 113: Decision Models for Business and Economics</i> <i>Department of Statistics and Operations Research · University of North Carolina at Chapel Hill</i>	2019
Graduate Teaching Assistant <i>STOR 113: Decision Models for Business and Economics</i> <i>STOR 155: Introduction to Data Models and Inference</i> <i>Department of Statistics and Operations Research · University of North Carolina at Chapel Hill</i>	2017–2018
Graduate Teaching Assistant <i>CPE 301: Embedded Systems Design</i> <i>CS 302: Data Structures</i> <i>Department of Computer Science and Engineering · University of Nevada, Reno</i>	2015–2017
Lab Assistant <i>Renesas SuperH Lab</i> <i>Department of Computer Science and Engineering · Ho Chi Minh City University of Technology</i>	2013–2015
Organizing Assistant <i>BKIT Car Rally</i> <i>Department of Computer Science and Engineering · Ho Chi Minh City University of Technology</i>	2014
Robot Control Software Developer <i>BK4 aka BKIT Number One Team · Vietnam National Robot Contest</i> <i>Department of Computer Science and Engineering · Ho Chi Minh City University of Technology</i>	2013
Embedded Software Developer <i>ChipFC Team · Texas Instruments National MCU Design Contest—1st Place Winner</i>	2012

HONORS & AWARDS

Graduate Access Grant Regents' Higher Education Opportunity Award <i>University of Nevada, Reno · Reno, NV</i>	2016–2017
International Graduate Student Award Regents' Higher Education Opportunity Award <i>University of Nevada, Reno · Reno, NV</i>	2016–2017
Poster Exhibition—1st Place Winner <i>CSE Graduate Club—Department of Computer Science and Engineering</i> <i>University of Nevada, Reno · Reno, NV</i>	2016
Outstanding Academic Student Scholarship <i>Department of Computer Science and Engineering</i> <i>Ho Chi Minh City University of Technology · Ho Chi Minh City, Vietnam</i>	2008–2013