

# NHAN H. PHAM

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## RESEARCH INTERESTS

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

## EDUCATION

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### Ph.D. in Operations Research

2017–2021 (Expected)

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

## RESEARCH EXPERIENCES

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### Federated Learning with Randomized Douglas-Rachford Splitting Methods

Aug. 2020–Feb. 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. Dzong T. Phan, Dr. Lam M. Nguyen.

Accepted for the 2021 American Control Conference (ACC).

- ◇ 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 type of regression model with or without derivative information.

### 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.,  $\ell_2$ -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

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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

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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.

## SKILLS & QUALIFICATIONS

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

## INVITED TALKS

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**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.*

## PROFESSIONAL ACTIVITIES

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**Reviewer - Peer-reviewed Conferences**  
*NeurIPS (2019-2021), ICML (2020-2021), AISTATS (2021-2022), AAAI (2021), ICLR (2021-2022)*

**Reviewer - Peer-reviewed Journals**  
*Machine Learning (2021), Journal of Scientific Computing (2021)*

## INDUSTRY EXPERIENCES

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**Research Scientist** 2022  
*IBM T. J. Watson Research Center · Yorktown Heights, NY*

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

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

## OTHER EXPERIENCES

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**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*

**Lab Assistant** 2013-2015  
*Renesas SuperH Lab*  
*Department of Computer Science and Engineering · Ho Chi Minh City University of Technology*

<b>Organizing Assistant</b> <i>BKIT Car Rally</i> <i>Department of Computer Science and Engineering · Ho Chi Minh City University of Technology</i>	2014
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<b>Robot Control Software Developer</b> <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
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<b>Embedded Software Developer</b> <i>ChipFC Team · Texas Instruments National MCU Design Contest—1st Place Winner</i>	2012
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## **HONORS & AWARDS**

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