# 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** 2017–2022 (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

**Stochastic Gauss-Newton Algorithms for Nonconvex Compositional Optimization** *Sept. 2019–Feb. 2020*
*Graduate Research Assistant*, Supervisor: 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

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.
3. Q. Tran-Dinh, **N. H. Pham**, D. T. Phan, and L. M. Nguyen. *A Hybrid Stochastic Optimization Framework for Composite Nonconvex Optimization*. *arXiv:1907.03793*, 2019. (Under review for Mathematical Programming)

## PUBLICATIONS

1. 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.
2. 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.
3. **N. H. Pham**, L. M. Nguyen, D. T. Phan, and Q. Tran-Dinh. ProxSARAH: An efficient algorithmic frame- work for stochastic composite nonconvex optimization. *Journal of Machine Learning Research*, 2020.
4. **N. H. Pham**, L. M. Nguyen, 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.
5. 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.
6. 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.
7. **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.
8. **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.
9. 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, Scikit-learn, C/C++, Matlab, Data Structures & Algorithms |
| **Other skills** | Linux Development Environment, Robotics, Embedded Systems |

## INDUSTRY EXPERIENCES

**Summer Research Intern** *2020*

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

## OTHER EXPERIENCES

**Graduate Teaching Assistant** *2020-current*
*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*

**Organizing Assistant** *2014*
*BKIT Car Rally*
*Department of Computer Science and Engineering · Ho Chi Minh City University of Technology*

**Robot Control Software Developer** *2013*
*BK4 aka BKIT Number One Team · Vietnam National Robot Contest*
*Department of Computer Science and Engineering · Ho Chi Minh City University of Technology*

**Embedded Software Developer** *2012*
*ChipFC Team · Texas Instruments National MCU Design Contest*–**1st Place Winner**

## HONORS & AWARDS

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

**International Graduate Student Award** *Spring 2016–Spring 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*

**Outstanding Academic Student Scholarship** *2008–2013*
*Department of Computer Science and Engineering*
*Ho Chi Minh City University of Technology · Ho Chi Minh City, Vietnam*