

Brandon Amos

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Current Position

Research Scientist, *Meta AI, Fundamental AI Research (FAIR)*, New York City 2019 – Present

Education

Ph.D. in Computer Science, *Carnegie Mellon University* (0.00/0.00) 2014 – 2019

Thesis: [Differentiable Optimization-Based Modeling for Machine Learning](#)

Advisor: [J. Zico Kolter](#)

B.S. in Computer Science, *Virginia Tech* (3.99/4.00) 2011 – 2014

Previous Positions

Research Assistant, *Carnegie Mellon University* (with [J. Zico Kolter](#) on ML and optimization) 2016 – 2019

Research Intern, *Intel Labs*, Santa Clara (with [Vladlen Koltun](#) on computer vision) 2018

Research Intern, *Google DeepMind*, London (with [Nando de Freitas](#) and [Misha Denil](#) on RL) 2017

Research Assistant, *Carnegie Mellon University* (with [Mahadev Satyanarayanan](#) on mobile systems) 2014 – 2016

Research Intern, *Adobe Research*, San Jose (with [David Tompkins](#) on distributed systems) 2014

Research Assistant, *Virginia Tech* (with [Layne Watson](#) and [David Easterling](#) on optimization) 2013 – 2014

Research Assistant, *Virginia Tech* (with [Jules White](#) and [Hamilton Turner](#) on mobile systems) 2012 – 2014

Research Assistant, *Virginia Tech* (with [Binoy Ravindran](#) and [Alastair Murray](#) on compilers) 2012 – 2014

Software Intern, *Snowplow* (Scala development) 2013 – 2014

Software Intern, *Qualcomm*, San Diego (Python and C++ development) 2013

Software Intern, *Phoenix Integration*, Virginia (C++, C#, and Java development) 2012

Network Administrator Intern, *Sunapsys*, Virginia 2011

Honors & Awards

NeurIPS Top Reviewer 2022

ICML Outstanding Reviewer 2022

ICLR Outstanding Reviewer 2019

NSF Graduate Research Fellowship 2016 – 2019

Nine undergraduate scholarships 2011 – 2014

Roanoke County Public Schools Engineering, Salem–Roanoke County Chamber of Commerce, Papa John's, Scottish Rite of Freemasonry, VT Intelligence Community Center for Academic Excellence, VT Pamplin Leader, VT Benjamin F. Bock, VT Gay B. Shober, VT I. Luck Gravett

Publications [[Google Scholar](#): 6.2k+ citations and an h-index of 32]

Selected publications are highlighted.

2023

1. [Tutorial on amortized optimization for learning to optimize over continuous domains](#) [code]

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Foundations and Trends in Machine Learning 2023

2. [On amortizing convex conjugates for optimal transport](#) [code]

Brandon Amos

ICLR 2023

3. [End-to-End Learning to Warm-Start for Real-Time Quadratic Optimization](#) [code]
Rajiv Sambharya, Georgina Hall, **Brandon Amos**, and Bartolomeo Stellato
L4DC 2023
4. [Meta Optimal Transport](#) [code]
Brandon Amos, Samuel Cohen, Giulia Luise, and Ievgen Redko
ICML 2023
5. [Multisample Flow Matching with Optimal Transport Couplings](#)
Aram-Alexandre Pooladian, Heli Ben-Hamu, Carles Domingo-Enrich, **Brandon Amos**, Yaron Lipman, and Ricky T. Q. Chen
ICML 2023
6. [Semi-Supervised Offline Reinforcement Learning with Action-Free Trajectories](#)
Qinqing Zheng, Mikael Henaff, **Brandon Amos**, and Aditya Grover
ICML 2023

2022

7. [Cross-Domain Imitation Learning via Optimal Transport](#) [code]
Arnaud Fickinger, Samuel Cohen, Stuart Russell, and **Brandon Amos**
ICLR 2022
8. [Matching Normalizing Flows and Probability Paths on Manifolds](#) [code]
Heli Ben-Hamu*, Samuel Cohen*, Joey Bose, **Brandon Amos**, Aditya Grover, Maximilian Nickel, Ricky T. Q. Chen, and Yaron Lipman
ICML 2022
9. [Semi-Discrete Normalizing Flows through Differentiable Tessellation](#)
Ricky T. Q. Chen, **Brandon Amos**, and Maximilian Nickel
NeurIPS 2022
10. [Theseus: A Library for Differentiable Nonlinear Optimization](#) [code]
Luis Pineda, Taosha Fan, Maurizio Monge, Shobha Venkataraman, Paloma Sodhi, Ricky Chen, Joseph Ortiz, Daniel DeTone, Austin Wang, Stuart Anderson, Jing Dong, **Brandon Amos**, and Mustafa Mukadam
NeurIPS 2022
11. [Nocturne: a driving benchmark for multi-agent learning](#) [code]
Eugene Vinitzky, Nathan Lichtlé, Xiaomeng Yang, **Brandon Amos**, and Jakob Foerster
NeurIPS Datasets and Benchmarks Track 2022

2021

12. [On the model-based stochastic value gradient for continuous reinforcement learning](#) [code] [slides]
Brandon Amos, Samuel Stanton, Denis Yarats, and Andrew Gordon Wilson
L4DC 2021 (Oral)
13. [Riemannian Convex Potential Maps](#) [code] [slides]
Samuel Cohen*, **Brandon Amos***, and Yaron Lipman
ICML 2021
14. [CombOptNet: Fit the Right NP-Hard Problem by Learning Integer Programming Constraints](#) [code]
Anselm Paulus, Michal Rolínek, Vít Musil, **Brandon Amos**, and Georg Martius
ICML 2021

15. *Scalable Online Planning via Reinforcement Learning Fine-Tuning*
Arnaud Fickinger, Hengyuan Hu, **Brandon Amos**, Stuart Russell, and Noam Brown
NeurIPS 2021
16. *Aligning Time Series on Incomparable Spaces* [code] [slides]
Samuel Cohen, Giulia Luise, Alexander Terenin, **Brandon Amos**, and Marc Peter Deisenroth
AISTATS 2021
17. *Learning Neural Event Functions for Ordinary Differential Equations* [code]
Ricky T. Q. Chen, **Brandon Amos**, and Maximilian Nickel
ICLR 2021
18. *Neural Spatio-Temporal Point Processes* [code]
Ricky T. Q. Chen, **Brandon Amos**, and Maximilian Nickel
ICLR 2021
19. *Improving Sample Efficiency in Model-Free Reinforcement Learning from Images* [code]
Denis Yarats, Amy Zhang, Ilya Kostrikov, **Brandon Amos**, Joelle Pineau, and Rob Fergus
AAAI 2021
20. *Neural Fixed-Point Acceleration for Convex Optimization* [code]
Shobha Venkataraman* and **Brandon Amos***
ICML AutoML Workshop 2021
21. *Sliced Multi-Marginal Optimal Transport*
Samuel Cohen, Alexander Terenin, Yannik Pitcan, **Brandon Amos**, Marc Peter Deisenroth, and K S Sesh Kumar
NeurIPS OTML Workshop 2021
22. *Input Convex Gradient Networks*
Jack Richter-Powell, Jonathan Lorraine, and **Brandon Amos**
NeurIPS OTML Workshop 2021
23. *Imitation Learning from Pixel Observations for Continuous Control*
Samuel Cohen, **Brandon Amos**, Marc Peter Deisenroth, Mikael Henaff, Eugene Vitisnky, and Denis Yarats
NeurIPS DeepRL Workshop 2021
24. *MBRL-Lib: A Modular Library for Model-based Reinforcement Learning* [code]
Luis Pineda, **Brandon Amos**, Amy Zhang, Nathan Lambert, and Roberto Calandra
arXiv 2021

2020

25. *The Differentiable Cross-Entropy Method* [code] [slides]
Brandon Amos and Denis Yarats
ICML 2020
26. *Objective Mismatch in Model-based Reinforcement Learning*
Nathan Lambert, **Brandon Amos**, Omry Yadan, and Roberto Calandra
L4DC 2020
27. *QNSTOP: Quasi-Newton Algorithm for Stochastic Optimization* [code]
Brandon Amos, David Easterling, Layne T. Watson, William Thacker, Brent Castle, and Michael Trosset
ACM TOMS 2020

28. *Neural Potts Model*
Tom Sercu, Robert Verkuil, Joshua Meier, **Brandon Amos**, Zeming Lin, Caroline Chen, Jason Liu, Yann LeCun, and Alexander Rives
MLCB 2020
29. *Deep Riemannian Manifold Learning*
Aaron Lou, Maximilian Nickel, and **Brandon Amos**
NeurIPS Geo4dI Workshop 2020

2019

30. *Differentiable Optimization-Based Modeling for Machine Learning* [code]
Brandon Amos
Ph.D. Thesis 2019
31. *Differentiable Convex Optimization Layers* [code]
Akshay Agrawal*, **Brandon Amos***, Shane Barratt*, Stephen Boyd*, Steven Diamond*, and J. Zico Kolter*
NeurIPS 2019
32. *The Limited Multi-Label Projection Layer* [code]
Brandon Amos, Vladlen Koltun, and J. Zico Kolter
arXiv 2019
33. *Generalized Inner Loop Meta-Learning* [code]
Edward Grefenstette, **Brandon Amos**, Denis Yarats, Phu Mon Htut, Artem Molchanov, Franziska Meier, Douwe Kiela, Kyunghyun Cho, and Soumith Chintala
arXiv 2019

2018

34. *Learning Awareness Models*
Brandon Amos, Laurent Dinh, Serkan Cabi, Thomas Rothörl, Sergio Gómez Colmenarejo, Alistair Muldal, Tom Erez, Yuval Tassa, Nando de Freitas, and Misha Denil
ICLR 2018
35. *Differentiable MPC for End-to-end Planning and Control* [code]
Brandon Amos, Ivan Dario Jimenez Rodriguez, Jacob Sacks, Byron Boots, and J. Zico Kolter
NeurIPS 2018
36. *Depth-Limited Solving for Imperfect-Information Games*
Noam Brown, Tuomas Sandholm, and **Brandon Amos**
NeurIPS 2018
37. *Enabling Live Video Analytics with a Scalable and Privacy-Aware Framework*
Junjue Wang, **Brandon Amos**, Anupam Das, Padmanabhan Pillai, Norman Sadeh, and Mahadev Satyanarayanan
ACM TOMM 2018

2017

38. *OptNet: Differentiable Optimization as a Layer in Neural Networks* [code] [slides]
Brandon Amos and J. Zico Kolter
ICML 2017

- 39. *Input Convex Neural Networks* [code] [slides]
Brandon Amos, Lei Xu, and J. Zico Kolter
ICML 2017
- 40. *Task-based End-to-end Model Learning* [code]
Priya L. Donti, **Brandon Amos**, and J. Zico Kolter
NeurIPS 2017
- 41. *Quasi-Newton Stochastic Optimization Algorithm for Parameter Estimation of a Stochastic Model of the Budding Yeast Cell Cycle*
Minghan Chen, **Brandon Amos**, Layne T. Watson, John Tyson, Yang Cao, Cliff Shaffer, Michael Trosset, Cihan Oguz, and Gisella Kakoti
IEEE/ACM TCBB 2017
- 42. *You can teach elephants to dance: agile VM handoff for edge computing*
Kiryong Ha, Yoshihisa Abe, Thomas Eiszler, Zhuo Chen, Wenlu Hu, **Brandon Amos**, Rohit Upadhyaya, Padmanabhan Pillai, and Mahadev Satyanarayanan
SEC 2017
- 43. *An Empirical Study of Latency in an Emerging Class of Edge Computing Applications for Wearable Cognitive Assistance*
Zhuo Chen, Wenlu Hu, Junjue Wang, Siyan Zhao, **Brandon Amos**, Guanhong Wu, Kiryong Ha, Khalid Elgazzar, Padmanabhan Pillai, Roberta Klatzky, Daniel Siewiorek, and Mahadev Satyanarayanan
SEC 2017
- 44. *A Scalable and Privacy-Aware IoT Service for Live Video Analytics* [code]
Junjue Wang, **Brandon Amos**, Anupam Das, Padmanabhan Pillai, Norman Sadeh, and Mahadev Satyanarayanan
ACM MMSys 2017 (Best Paper)

2016

- 45. *OpenFace: A general-purpose face recognition library with mobile applications* [code]
Brandon Amos, Bartosz Ludwiczuk, and Mahadev Satyanarayanan
CMU 2016
- 46. *Collapsed Variational Inference for Sum-Product Networks*
Han Zhao, Tameem Adel, Geoff Gordon, and **Brandon Amos**
ICML 2016
- 47. *Quantifying the impact of edge computing on mobile applications*
Wenlu Hu, Ying Gao, Kiryong Ha, Junjue Wang, **Brandon Amos**, Zhuo Chen, Padmanabhan Pillai, and Mahadev Satyanarayanan
ACM SIGOPS 2016
- 48. *Privacy mediators: helping IoT cross the chasm*
Nigel Davies, Nina Taft, Mahadev Satyanarayanan, Sarah Clinch, and **Brandon Amos**
HotMobile 2016

2015 and earlier

- 49. *Edge Analytics in the Internet of Things*
Mahadev Satyanarayanan, Pieter Simoens, Yu Xiao, Padmanabhan Pillai, Zhuo Chen, Kiryong Ha, Wenlu Hu, and **Brandon Amos**
IEEE Pervasive Computing 2015

50. [Bad Parts: Are Our Manufacturing Systems at Risk of Silent Cyberattacks?](#)
Hamilton Turner, Jules White, Jaime A. Camelio, Christopher Williams, **Brandon Amos**, and Robert Parker
IEEE Security & Privacy 2015
51. [Early Implementation Experience with Wearable Cognitive Assistance Applications](#)
Zhuo Chen, Lu Jiang, Wenlu Hu, Kiryong Ha, **Brandon Amos**, Padmanabhan Pillai, Alex Hauptmann, and Mahadev Satyanarayanan
WearSys 2015
52. [The Case for Offload Shaping](#)
Wenlu Hu, **Brandon Amos**, Zhuo Chen, Kiryong Ha, Wolfgang Richter, Padmanabhan Pillai, Benjamin Gilbert, Jan Harkes, and Mahadev Satyanarayanan
HotMobile 2015
53. [Are Cloudlets Necessary?](#)
Ying Gao, Wenlu Hu, Kiryong Ha, **Brandon Amos**, Padmanabhan Pillai, and Mahadev Satyanarayanan
CMU 2015
54. [Adaptive VM handoff across cloudlets](#)
Kiryong Ha, Yoshihisa Abe, Zhuo Chen, Wenlu Hu, **Brandon Amos**, Padmanabhan Pillai, and Mahadev Satyanarayanan
CMU 2015
55. [Global Parameter Estimation for a Eukaryotic Cell Cycle Model in Systems Biology](#)
Tricity Andrew, **Brandon Amos**, David Easterling, Cihan Oguz, William Baumann, John Tyson, and Layne T. Watson
SummerSim 2014
56. [Applying machine learning classifiers to dynamic Android malware detection at scale](#) [code]
Brandon Amos, Hamilton Turner, and Jules White
IWCMC 2013

Open Source Repositories

27.3k+ GitHub stars across all repositories.

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|--|------|
| 1. facebookresearch/amortized-optimization-tutorial ★154 <i>Tutorial on amortized optimization</i> | 2023 |
| 2. facebookresearch/w2ot ★36 <i>Wasserstein-2 optimal transport in JAX</i> | 2023 |
| 3. facebookresearch/theseus ★1.3k <i>Differentiable non-linear optimization library</i> | 2022 |
| 4. facebookresearch/meta-ot ★83 <i>Meta Optimal Transport</i> | 2022 |
| 5. bamos/presentations ★109 <i>Source for my major presentations</i> | 2022 |
| 6. facebookresearch/rcpm ★63 <i>Riemannian Convex Potential Maps</i> | 2021 |
| 7. facebookresearch/svg ★50 <i>Model-based stochastic value gradient</i> | 2021 |
| 8. facebookresearch/mbrl-lib ★797 <i>Model-based reinforcement learning library</i> | 2021 |
| 9. facebookresearch/dcem ★118 <i>The Differentiable Cross-Entropy Method</i> | 2020 |
| 10. facebookresearch/higher ★1.5k <i>PyTorch higher-order gradient and optimization library</i> | 2019 |
| 11. bamos/thesis ★301 <i>Ph.D. Thesis LaTeX source code</i> | 2019 |
| 12. cvxgrp/cvxpylayers ★1.5k <i>Differentiable Convex Optimization Layers</i> | 2019 |
| 13. locuslab/lml ★56 <i>The Limited Multi-Label Projection Layer</i> | 2019 |
| 14. locuslab/mpc.pytorch ★677 <i>Differentiable PyTorch Model Predictive Control library</i> | 2018 |
| 15. locuslab/differentiable-mpc ★147 <i>Differentiable MPC experiments</i> | 2018 |
| 16. locuslab/icnn ★255 <i>Input Convex Neural Network experiments</i> | 2017 |

17. locuslab/optnet ★444 <i>OptNet experiments</i>	2017
18. locuslab/qpth ★585 <i>Differentiable PyTorch QP solver</i>	2017
19. bamos/densenet.pytorch ★786 <i>PyTorch DenseNet implementation</i>	2017
20. bamos/block ★284 <i>Intelligent block matrix constructions</i>	2017
21. bamos/setGPU ★104 <i>Automatically use the least-loaded GPU</i>	2017
22. bamos/dcgan-completion.tensorflow ★1.3k <i>Image completion with GANs</i>	2016
23. cmusatyalab/openface ★14.7k <i>Face recognition with deep neural networks</i>	2015
24. vtopt/qnstop ★10 <i>Fortran Quasi-newton stochastic optimization library</i>	2014
25. bamos/snowglobe ★27 <i>Haskell-driven, self-hosted web analytics with minimal configuration</i>	2014
26. bamos/zsh-history-analysis ★197 <i>Analyze and plot your zsh history</i>	2014
27. bamos/beamer-snippets ★109 <i>Beamer and TikZ snippets</i>	2014
28. bamos/latex-templates ★359 <i>LaTeX templates</i>	2013
29. cparse/cparse ★311 <i>C++ expression parser using Dijkstra's shunting-yard algorithm</i>	2013
30. bamos/cv ★380 <i>Source for this CV: Creates LaTeX/Markdown from YAML/BibTeX</i>	2013
31. bamos/python-scripts ★197 <i>Short and fun Python scripts</i>	2013
32. bamos/reading-list ★188 <i>YAML reading list and notes system</i>	2013
33. bamos/dotfiles ★235 ♥ <i>Linux, xmonad, emacs, vim, zsh, tmux</i>	2012

Invited Talks

Slides for my major presentations are open-sourced with a CC-BY license at [bamos/presentations](#).

1. <i>Introduction to Control for ML, ICML Learning, Control, and Dynamical Systems Workshop</i>	2023
2. <i>Tutorial on amortized optimization, Brown University</i>	2023
3. <i>Learning with differentiable and amortized optimization, NYU AI Seminar</i>	2023
4. <i>Learning with differentiable and amortized optimization, Vanderbilt ML Seminar</i>	2023
5. <i>Learning with differentiable and amortized optimization, Microsoft Research</i>	2022
6. <i>Amortized optimization for computing optimal transport maps, Flatiron Workshop</i>	2022
7. <i>Learning with differentiable and amortized optimization, Cornell AI Seminar</i>	2022
8. <i>Learning with differentiable and amortized optimization, Cornell Tech Seminar</i>	2022
9. <i>Learning with differentiable and amortized optimization, Argonne National Laboratory</i>	2022
10. <i>Theseus: A library for differentiable nonlinear optimization, NYU</i>	2022
11. <i>Theseus: A library for differentiable nonlinear optimization, University of Zurich</i>	2022
12. <i>Differentiable optimization-based modeling for machine learning, Colorado Mines AMS Colloquium</i>	2022
13. <i>Differentiable optimization, IJCAI Tutorial</i>	2022
14. <i>Differentiable optimization for control and RL, ICML Workshop on Decision Awareness in RL</i>	2022
15. <i>Differentiable optimization-based modeling for machine learning, CPAIOR Master Class</i>	2022
16. <i>Tutorial on amortized optimization, ICCOPT</i>	2022
17. <i>Differentiable optimization for control and RL, Gridmatic</i>	2022
18. <i>Learning for control with differentiable optimization and ODEs, Columbia University</i>	2021
19. <i>Differentiable optimization-based modeling for machine learning, IBM Research</i>	2021
20. <i>Differentiable optimization for control, Max Planck Institute (Tübingen)</i>	2020
21. <i>Differentiable optimization-based modeling for machine learning, Mila Seminar</i>	2020
22. <i>Deep Declarative Networks, ECCV Tutorial</i>	2020
23. <i>On differentiable optimization for control and vision, CVPR Deep Declarative Networks Workshop</i>	2020
24. <i>Differentiable optimization-based modeling for machine learning, Caltech CS 159 (Guest Lecture)</i>	2020
25. <i>Unrolled optimization for learning deep energy models, SIAM MDS Minisymposium</i>	2020
26. <i>Differentiable optimization-based modeling for machine learning, NYU CILVR Seminar</i>	2019
27. <i>Differentiable optimization-based modeling for machine learning, INFORMS</i>	2019
28. <i>Differentiable optimization-based modeling for machine learning, Facebook AI Research</i>	2019
29. <i>Differentiable optimization-based modeling for machine learning, ISMP</i>	2018
30. <i>Differentiable optimization-based modeling for machine learning, Google Brain</i>	2018

31. <i>Differentiable optimization-based modeling for machine learning</i> , Bosch Center for AI	2018
32. <i>Differentiable optimization-based modeling for machine learning</i> , Waymo Research	2018
33. <i>Differentiable optimization-based modeling for machine learning</i> , Tesla AI	2018
34. <i>Differentiable optimization-based modeling for machine learning</i> , NVIDIA Robotics	2018
35. <i>Differentiable optimization-based modeling for machine learning</i> , Salesforce Research	2018
36. <i>Differentiable optimization-based modeling for machine learning</i> , OpenAI	2018
37. <i>Differentiable optimization-based modeling for machine learning</i> , NNAISENSE	2018
38. <i>Differentiable optimization and control</i> , UC Berkeley	2018

Interns and Students

Aram-Alexandre Pooladian (visiting FAIR from NYU)	2022 – present
Carles Domingo-Enrich (visiting FAIR from NYU)	2022 – present
Sanae Lotfi (visiting FAIR from NYU)	2022 – present
Dishank Bansal (AI resident at FAIR)	2022 – present
Arnaud Fickinger (visiting FAIR from Berkeley)	2021 – 2022
Aaron Lou (visiting FAIR from Cornell and Stanford)	2020 – 2022
Eugene Vinitzky (visiting FAIR from Berkeley, now incoming professor at NYU)	2021 – 2022
Samuel Cohen (visiting FAIR from UCL, now CEO at FairGen)	2021 – 2022
Ricky Chen (visiting FAIR from Toronto, now scientist at FAIR)	2020
Paul Liang (visiting FAIR from CMU)	2020
Phillip Wang (at CMU, now CEO at Gather)	2018

Professional Activities

NeurIPS Area Chair	2023
AAAI Senior Program Committee	2023
NeurIPS Learning Meets Combinatorial Optimization Workshop Organizer	2020
CVPR Deep Declarative Networks Workshop Organizer	2020
ECCV Deep Declarative Networks Tutorial Organizer	2020
CMU CSD MS Admissions	2014 – 2015

Reviewing

AAAI Conference on Artificial Intelligence
 American Controls Conference (ACC)
 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
 IEEE Conference on Decision and Control (CDC)
 IEEE Control Systems Letters (L-CSS)
 IEEE International Conference on Computer Vision (ICCV)
 IEEE International Conference on Intelligent Robots and Systems (IROS)
 IEEE International Conference on Robotics and Automation (ICRA)
 International Conference on the Constraint Programming, AI, and Operations Research (CPAIOR)
 International Conference on Learning Representations (ICLR)
 International Conference on Machine Learning (ICML)
 Journal of Machine Learning Research (JMLR)
 Learning for Dynamics and Control (L4DC)
 Mathematical Programming Computation (MPC)
 Neural Information Processing Systems (NeurIPS)
 Neural Information Processing Systems (NeurIPS) Datasets and Benchmarks Track
 Neural Information Processing Systems (NeurIPS) OPT Workshop

Neural Information Processing Systems (NeurIPS) DiffCVGP Workshop
Neural Information Processing Systems (NeurIPS) Deep RL Workshop
Optimization Letters
Transactions on Machine Learning Research (TMLR)

Teaching

Graduate AI (CMU 15-780), TA	S2017
Distributed Systems (CMU 15-440/640), TA	S2016
Software Design and Data Structures (VT CS2114), TA	S2013

Skills

Programming	C, C++, Fortran, Haskell, Java, Lua, Make, Mathematica, Python, R, Scala
Frameworks	JAX, NumPy, Pandas, PyTorch, SciPy, TensorFlow, Torch7
Toolbox	Linux, emacs, vim, evil, org, mu4e, xmonad, git, tmux, zsh