

# Brandon Amos

✉ bda@fb.com • 🌐 bamos.github.io • in bdamos  
🐦 brandondamos • 🌐 bamos • Last updated on March 5, 2021

## Current Position

Research Scientist | Facebook AI | NYC

2019 – Present

## Education

**Ph.D. in Computer Science** (0.00/0.00) 2019

Carnegie Mellon University | Pittsburgh, PA

*Differentiable Optimization-Based Modeling for Machine Learning*

Advisors: J. Zico Kolter (2016 – 2019), Mahadev Satyanarayanan (2014 – 2016)

**B.S. in Computer Science** (3.99/4.00) 2014

Virginia Tech | Blacksburg, VA

Advisors: Layne Watson, Jules White, Binoy Ravindran

Northside High School | Roanoke, VA 2011

## Research Internships

**Intel Labs** | Santa Clara, CA | Host: Vladlen Koltun 2018

**Google DeepMind** | London, UK | Hosts: Misha Denil and Nando de Freitas 2017

**Adobe Research** | San Jose, CA | Host: David Tompkins 2014

## Honors & Awards

NSF Graduate Research Fellowship 2016 – 2019

Nine undergraduate scholarships 2011 – 2014

Benjamin F. Bock, Gay B. Shober, I. Luck Gravett, VT IC CAE, Roanoke County Public Schools Engineering, Papa John's, Pamplin Leader, Scottish Rite of Freemasonry, Salem–Roanoke County Chamber of Commerce

## Publications

Google Scholar ID: [d8gdZR4AAAAJ](https://scholar.google.com/citations?user=d8gdZR4AAAAJ)

**2021a** R. T. Q. Chen, **B. Amos**, M. Nickel. “Learning Neural Event Functions for Ordinary Differential Equations”. In: *ICLR*. URL: <https://arxiv.org/abs/2011.03902>.

**2021b** R. T. Q. Chen, **B. Amos**, M. Nickel. “Neural Spatio-Temporal Point Processes”. In: *ICLR*. URL: <https://arxiv.org/abs/2011.04583>.

**2021c** S. Cohen, G. Luise, A. Terenin, **B. Amos**, M. P. Deisenroth. “Aligning Time Series on Incomparable Spaces”. In: *AISTATS*. URL: <https://arxiv.org/abs/2006.12648>.

**2021d** D. Yarats, A. Zhang, I. Kostrikov, **B. Amos**, J. Pineau, R. Fergus. “Improving Sample Efficiency in Model-Free Reinforcement Learning from Images”. In: *AAAI*. URL: <https://arxiv.org/abs/1910.01741>.

**2020a** **B. Amos**, D. Easterling, L. Watson, W. Thacker, B. Castle, M. Trosset. “QNSTOP: Quasi-Newton Algorithm for Stochastic Optimization”. In: URL: <https://vtechworks.lib.vt.edu/bitstream/handle/10919/49672/qnTOMS14.pdf>.

**2020b** **B. Amos**, S. Stanton, D. Yarats, A. G. Wilson. *On the model-based stochastic value gradient for continuous reinforcement learning*. URL: <https://arxiv.org/abs/2008.12775>.

**2020c** **B. Amos** and D. Yarats. “The Differentiable Cross-Entropy Method”. In: *ICML*. URL: <https://arxiv.org/abs/1909.12830>.

**2020d** N. Lambert, **B. Amos**, O. Yadan, R. Calandra. “Objective Mismatch in Model-based Reinforcement Learning”. In: *L4DC*. URL: <https://arxiv.org/abs/2002.04523>.

- 2019a** A. Agrawal\*, **B. Amos\***, S. Barratt\*, S. Boyd\*, S. Diamond\*, J. Z. Kolter\*. "Differentiable Convex Optimization Layers". In: *NeurIPS*. URL: [http://web.stanford.edu/~boyd/papers/pdf/diff\\_cvxpy.pdf](http://web.stanford.edu/~boyd/papers/pdf/diff_cvxpy.pdf).
- 2019b** **B. Amos**. "Differentiable Optimization-Based Modeling for Machine Learning". PhD thesis. Carnegie Mellon University. URL: [https://github.com/bamos/thesis/raw/master/bamos\\_thesis.pdf](https://github.com/bamos/thesis/raw/master/bamos_thesis.pdf).
- 2019c** **B. Amos**, V. Koltun, J. Z. Kolter. "The Limited Multi-Label Projection Layer". In: *arXiv preprint arXiv:1906.08707*. URL: <https://arxiv.org/abs/1906.08707>.
- 2019d** E. Grefenstette, **B. Amos**, D. Yarats, P. M. Htut, A. Molchanov, F. Meier, D. Kiela, K. Cho, S. Chintala. "Generalized Inner Loop Meta-Learning". In: *arXiv preprint arXiv:1910.01727*. URL: <https://arxiv.org/abs/1910.01727>.
- 2018a** **B. Amos**, L. Dinh, S. Cabi, T. Rothörl, S. G. Colmenarejo, A. Muldal, T. Erez, Y. Tassa, N. Freitas, M. Denil. "Learning Awareness Models". In: *International Conference on Learning Representations*. URL: <https://openreview.net/forum?id=r1HhRfWRZ>.
- 2018b** **B. Amos**, I. D. J. Rodriguez, J. Sacks, B. Boots, J. Z. Kolter. "Differentiable MPC for End-to-end Planning and Control". In: *NeurIPS*. URL: <https://arxiv.org/abs/1810.13400>.
- 2018c** N. Brown, T. Sandholm, **B. Amos**. "Depth-Limited Solving for Imperfect-Information Games". In: *NeurIPS*. URL: <http://arxiv.org/abs/1805.08195>.
- 2018d** J. Wang, **B. Amos**, A. Das, P. Pillai, N. Sadeh, M. Satyanarayanan. "Enabling Live Video Analytics with a Scalable and Privacy-Aware Framework". In: *ACM Transactions on Multimedia Computing, Communications, and Applications (TOMM)* 14.3s, p. 64. URL: <https://dl.acm.org/citation.cfm?id=3209659>.
- 2017a** **B. Amos** and J. Z. Kolter. "OptNet: Differentiable Optimization as a Layer in Neural Networks". In: *ICML*. URL: <http://arxiv.org/abs/1703.00443>.
- 2017b** **B. Amos**, L. Xu, J. Z. Kolter. "Input Convex Neural Networks". In: *ICML*. URL: <http://arxiv.org/abs/1609.07152>.
- 2017c** M. Chen, **B. Amos**, L. T. Watson, J. Tyson, Y. Cao, C. Shaffer, M. Trosset, C. Oguz, G. Kakoti. "Quasi-Newton Stochastic Optimization Algorithm for Parameter Estimation of a Stochastic Model of the Budding Yeast Cell Cycle". In: *IEEE/ACM Transactions on Computational Biology and Bioinformatics*. URL: <https://par.nsf.gov/servlets/purl/10111392>.
- 2017d** Z. Chen. "An Empirical Study of Latency in an Emerging Class of Edge Computing Applications for Wearable Cognitive Assistance". In: *Proceedings of the Second ACM/IEEE Symposium on Edge Computing*. ACM, p. 12. URL: <https://www.cs.cmu.edu/~zhuoc/papers/latency2017.pdf>.
- 2017e** P. L. Donti, **B. Amos**, J. Z. Kolter. "Task-based End-to-end Model Learning". In: *NeurIPS*. URL: <http://arxiv.org/abs/1703.04529>.
- 2017f** K. Ha, Y. Abe, T. Eiszler, Z. Chen, W. Hu, **B. Amos**, R. Upadhyaya, P. Pillai, M. Satyanarayanan. "You can teach elephants to dance: agile VM handoff for edge computing". In: *Proceedings of the Second ACM/IEEE Symposium on Edge Computing*. ACM, p. 12. URL: <https://www.cs.cmu.edu/~15-821/READINGS/PAPERS/ha2017.pdf>.
- 2017g** J. Wang, **B. Amos**, A. Das, P. Pillai, N. Sadeh, M. Satyanarayanan. "A Scalable and Privacy-Aware IoT Service for Live Video Analytics". In: *Proceedings of the 8th ACM on Multimedia Systems Conference*. ACM, pp. 38–49. URL: <http://elijah.cs.cmu.edu/DOCS/wang-mmsys2017.pdf>.
- 2016a** **B. Amos**, B. Ludwiczuk, M. Satyanarayanan. *OpenFace: A general-purpose face recognition library with mobile applications*. Tech. rep. Technical Report CMU-CS-16-118, CMU School of Computer Science. URL: <http://reports-archive.adm.cs.cmu.edu/anon/anon/2016/CMU-CS-16-118.pdf>.
- 2016b** N. A. J. Davies, N. Taft, M. Satyanarayanan, S. Clinch, **B. Amos**. "Privacy mediators: helping IoT cross the chasm". In: *HotMobile*. URL: <http://eprints.lancs.ac.uk/78255/1/44691.pdf>.
- 2016c** W. Hu, Y. Gao, K. Ha, J. Wang, **B. Amos**, Z. Chen, P. Pillai, M. Satyanarayanan. "Quantifying the impact of edge computing on mobile applications". In: *Proceedings of the 7th ACM SIGOPS Asia-Pacific Workshop on Systems*. ACM, p. 5. URL: <https://dl.acm.org/doi/10.1145/2967360.2967369>.
- 2016d** H. Zhao, T. Adel, G. Gordon, **B. Amos**. "Collapsed Variational Inference for Sum-Product Networks". In: *ICML*. URL: <http://proceedings.mlr.press/v48/zhaoa16.html>.
- 2015a** Z. Chen, L. Jiang, W. Hu, K. Ha, **B. Amos**, P. Pillai, A. Hauptmann, M. Satyanarayanan. "Early Implementation Experience with Wearable Cognitive Assistance Applications". In: *WearSys*. URL: <http://www.cs.cmu.edu/~satya/docdir/chen-wearsys2015.pdf>.
- 2015b** Y. Gao, W. Hu, K. Ha, **B. Amos**, P. Pillai, M. Satyanarayanan. *Are Cloudlets Necessary?* Tech. rep. Technical Report CMU-CS-15-139, CMU School of Computer Science. URL: <http://reports-archive.adm.cs.cmu.edu/anon/anon/2015/CMU-CS-15-139.pdf>.

- 2015c** K. Ha, Y. Abe, Z. Chen, W. Hu, **B. Amos**, P. Pillai, M. Satyanarayanan. *Adaptive VM handoff across cloudlets*. Tech. rep. Technical Report CMU-CS-15-113, CMU School of Computer Science. URL: <http://ra.adm.cs.cmu.edu/anon/2015/CMU-CS-15-113.pdf>.
- 2015d** W. Hu, **B. Amos**, Z. Chen, K. Ha, W. Richter, P. Pillai, B. Gilbert, J. Harkes, M. Satyanarayanan. "The Case for Offload Shaping". In: *HotMobile*. URL: <http://www.cs.cmu.edu/~satya/docdir/hu-hotmobile2015.pdf>.
- 2015e** M. Satyanarayanan, P. Simoens, Y. Xiao, P. Pillai, Z. Chen, K. Ha, W. Hu, **B. Amos**. "Edge Analytics in the Internet of Things". In: *IEEE Pervasive Computing* 2, pp. 24–31. URL: <https://www.cs.cmu.edu/~satya/docdir/satya-edge2015.pdf>.
- 2015f** H. Turner, J. White, J. A. Camelio, C. Williams, **B. Amos**, R. Parker. "Bad Parts: Are Our Manufacturing Systems at Risk of Silent Cyberattacks?" In: *Security & Privacy, IEEE* 13.3, pp. 40–47. URL: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7118094>.
- 2014** T. Andrew, **B. Amos**, D. Easterling, C. Oguz, W. Baumann, J. Tyson, L. Watson. "Global Parameter Estimation for a Eukaryotic Cell Cycle Model in Systems Biology". In: *Summer Simulation Multiconference, Society for Modeling and Simulation International*. URL: <http://dl.acm.org/citation.cfm?id=2685662>.
- 2013** **B. Amos**, H. Turner, J. White. "Applying machine learning classifiers to dynamic Android malware detection at scale". In: *IWCMC Security, Trust and Privacy Symposium*. URL: <http://bamos.github.io/data/papers/amos-iwcmc2013.pdf>.

## Repositories

<a href="#">facebookresearch/dcem</a>   ★77   <i>The Differentiable Cross-Entropy Method</i>	2020
<a href="#">facebookresearch/higher</a>   ★1.1k   <i>PyTorch higher-order gradients</i>	2019
<a href="#">bamos/thesis</a>   ★238   <i>Thesis LaTeX source code</i>	2019
<a href="#">cvxgrp/cvxpylayers</a>   ★862   <i>Differentiable convex optimization layers</i>	2019
<a href="#">locuslab/mpc.pytorch</a>   ★436   <i>Differentiable model-predictive control</i>	2018
<a href="#">locuslab/icnn</a>   ★212   <i>Input Convex Neural Network Experiments</i>	2017
<a href="#">locuslab/optnet</a>   ★360   <i>OptNet Experiments</i>	2017
<a href="#">locuslab/qpth</a>   ★461   <i>Differentiable PyTorch QP solver</i>	2017
<a href="#">bamos/densenet.pytorch</a>   ★681   <i>PyTorch DenseNet implementation</i>	2017
<a href="#">bamos/block</a>   ★253   <i>Intelligent block matrix constructions</i>	2017
<a href="#">bamos/setGPU</a>   ★92   <i>Automatically use the least-loaded GPU</i>	2017
<a href="#">bamos/dcgan-completion.tensorflow</a>   ★1.3k   <i>Image completion with GANs</i>	2016
<a href="#">cmusatyalab/openface</a>   ★13.9k   <i>Face recognition with deep neural networks</i>	2015
<a href="#">bamos/zsh-history-analysis</a>   ★160   <i>Analyze and plot your zsh history</i>	2014
<a href="#">bamos/cv</a>   ★307   <i>My YAML/LaTeX/Markdown cv</i>	2013
<a href="#">bamos/dotfiles</a>   ★222   <i>Linux, mutt, xmonad, i3, vim, emacs, zsh</i>	2012

## Invited Talks

Max Planck Institute for Intelligent Systems (Tübingen) Seminar	2020
Montreal Institute for Learning Algorithms Seminar	2020
ECCV Deep Declarative Networks Tutorial	2020
CVPR Deep Declarative Networks Workshop	2020
Caltech CS 159, Guest Lecture	2020
SIAM MDS Minisymposium on Learning Parameterized Energy Minimization Models	2020
New York University CILVR Seminar	2019
INFORMS Session on Prediction and Optimization	2019
Facebook AI Research	2019
ISMP Session on Machine Learning and Optimization	2018
Google Brain	2018
Bosch Center for AI	2018
Waymo Research	2018

Tesla AI	2018
NVIDIA Robotics	2018
Salesforce Research	2018
OpenAI	2018
NNAISENSE	2018

## Students & Advising

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Aaron Lou (Cornell), FAIR Intern (with Max Nickel)	2020
Ricky Chen (Toronto), FAIR Intern (with Max Nickel)	2020
Paul Liang (CMU), FAIR Intern (with Ed Grefenstette and Tim Rocktäschel)	2020
Phillip Wang (CMU), Undergraduate Researcher	2018
Lei Xu (Tsinghua), CMU Intern (with J. Zico Kolter)	2016

## Professional Activities

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Reviewing: AAAI, ICML, NeurIPS, ICLR*, ICCV, CVPR, ICRA	*Outstanding reviewer
NeurIPS Learning Meets Combinatorial Optimization Workshop Organizer	2020
CVPR Deep Declarative Workshop Organizer	2020
ECCV Deep Declarative Tutorial Organizer	2020
CMU CSD MS Admissions	2014 – 2015

## Teaching

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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

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Languages	C, C++, Fortran, Haskell, Java, Lua, Make, Mathematica, Python, R, Scala
Frameworks	JAX, NumPy, Pandas, PyTorch, SciPy, TensorFlow, Torch7
Tools	Linux, emacs, vim, evil, org, mu4e, xmonad, i3, git, tmux, zsh