# Brandon Amos

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## Education

**Ph.D. in Computer Science** (0.00/0.00) 2019
Carnegie Mellon University | Pittsburgh, Pennsylvania
*Differentiable Optimization-Based Modeling for Machine Learning*
Advisors: J. Zico Kolter (2016 – 2019), Mahadev Satyanarayanan (2014 – 2016)

**B.S. in Computer Science, Honors** (3.99/4.00) 2014
Virginia Tech | Blacksburg, Virginia
Advisors: Layne Watson, Jules White, Binoy Ravindran

Northside High School | Roanoke, Virginia 2011

## Experience

**Research Scientist** | Facebook AI | New York, New York 2019 – Present
**Research Intern** | Intel Labs | Santa Clara, California 2018
Host: Vladlen Koltun
**Research Intern** | Google DeepMind | London, UK 2017
Hosts: Misha Denil and Nando de Freitas
**Data Scientist Intern** | Adobe Research | San Jose, California 2014
**Software Intern** | Snowplow | London, UK (Remote) 2013
**Software Intern** | Qualcomm | San Diego, California 2013
**Software Intern** | Phoenix Integration | Blacksburg, Virginia 2012
**Network Administrator Intern** | Sunapsys | Vinton, Virginia 2011

## 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

## Service

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

## Skills

| | |
|---|---|
| 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 |

## 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 |

## Publications

Google Scholar ID: 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.

**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.

**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.

## 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

| | |
|---|---|
| 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 |

## Open Source

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