

# Akshay Agrawal

450 Serra Mall, Stanford, CA 94305

(408) 340 3645 • [✉ akshayka@cs.stanford.edu](mailto:akshayka@cs.stanford.edu) • [🏠 www.akshayagrwal.com](http://www.akshayagrwal.com)  
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## Education

### Stanford University

*PhD in Machine Learning & Optimization. Electrical Engineering dept. Advised by Stephen Boyd.* 2018–2021  
*MS in Computer Science; AI and theory.* GPA: 4.0. 2016–2017  
*BS in Computer Science, systems track. Minor in Mathematics. With distinction.* GPA: 3.89. 2012–2016

## Skills

**Fields:** Machine Learning, Convex Optimization, Computer Systems   **Languages:** Python, C++, C

## Industry

### Aurora Technology

*Software Engineering Intern, Motion Planning* June–Sept. 2019  
Applied machine learning and optimization to motion planning and control for self-driving cars. (Python/C++)

### Google

*Software Engineer, Google Brain* Sept. 2017–Sept. 2018  
Enabled research by shaping the next generation of TensorFlow via [eager execution](#). Extended the C++ runtime to partition graph functions across devices, and enabled multi-core inference on Tensor Processing Units (TPUs) in production. (Python/C++)

*Software Engineering Intern, Platforms Performance* June–Sept. 2016  
Applied techniques from data science, machine learning, and mathematical optimization to better understand Google workloads and provided actionable recommendations on how to better provision hardware for Google datacenters. (Python)

*Software Engineering Intern, Distributed Storage* June–Sept. 2015  
Devised a method for fleet-wide analysis of operations passing through the distributed storage stack; applied it to optimize Google's distributed filesystem. Findings led to a 6 percent reduction in disk read syscalls and changes to flash read policies. (Python/C++)

*Software Engineering Intern, Flash File System* June–Sept. 2014  
Wrote a solid-state drive simulator and explored policies to decrease garbage collection. Simulations on production workloads reduced overhead by 50 percent, resulting in production changes. Presented a report at an internal research conference. (C++)

*Freshman Engineering Practicum, Production Linux Kernel* June–Sept. 2013  
Made test tools for the production linux kernel (e.g., a memory allocator that detects improper accesses); patched a kernel bug. (C)

## Research

### Stanford

*Convex Optimization and Machine Learning. Supervised by Professor Stephen Boyd.* Sept. 2016–Sept. 2017; Sept. 2018–Present  
Applications of convex optimization and machine learning, and foundational tools for both.

*Applied machine learning. Supervised by Senior Research Scientist Andreas Paepcke, Infolab.* Mar. 2014–July 2015  
Compiled the first human-tagged [dataset](#) describing affect in Massive Open Online Course discussion forums; authored [edxclassify](#), a package with affect classifiers; and published a recommender system that automatically addresses confusion in discussion forums.

### Google

*Systems for machine learning.* Sept. 2017–Sept. 2018  
Contributed to the design and implementation of TensorFlow Eager, a multi-stage domain-specific language for numerical computation, machine learning, and derivative-based optimization.

## Publications

- A. Agrawal, S. Barratt, et al. (2019). Learning Convex Optimization Control Policies. *Pre-print*. [\[pdf\]](#) [\[code\]](#)
- A. Agrawal, B. Amos, et al. (2019). Differentiable Convex Optimization Layers. *NeurIPS 2019*. [\[pdf\]](#) [\[code\]](#)
- A. Agrawal and S. Boyd (2019). Disciplined Quasiconvex Programming. *Optimization Letters*, to appear in 2020. [\[pdf\]](#) [\[code\]](#)
- A. Agrawal, S. Barratt, S. Boyd, E. Busseti, W. Moursi (2019). Differentiating through a Cone Program. *Journal of Applied and Numerical Optimization*. [\[pdf\]](#) [\[code\]](#)
- A. Agrawal, A. Modi, et al. (2019). TensorFlow Eager: A Multi-Stage, Python-embedded DSL for Machine Learning. *Systems for Machine Learning (SysML)*. [\[pdf\]](#) [\[code\]](#)
- A. Agrawal, S. Diamond, S. Boyd (2019). Disciplined Geometric Programming. *Optimization Letters*. [\[pdf\]](#) [\[code\]](#)
- A. Agrawal, R. Verschuere, S. Diamond, S. Boyd (2018). A Rewriting System for Convex Optimization Problems. *Journal of Control and Decision*. [\[pdf\]](#) [\[code\]](#)
- A. Agrawal, J. Venkatraman, S. Leonard, A. Paepcke (2015). YouEDU: Addressing Confusion in MOOC Discussion Forums by

## Teaching

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- [EE364a: Convex Optimization I](#) Mar.–June 2017  
Taught weekly discussion sections and helped write the take-home final for a PhD course in convex optimization.
- [CS221: Artificial Intelligence, Principles and Techniques](#) Sept.–Dec. 2016  
Edited Professor Percy Liang’s lecture notes; mentored groups on applied AI projects; held office hours; graded assignments.
- [CS109: Probability for Computer Scientists](#) Jan.–Mar. 2016, Mar.–June 2016, Jan.–Mar. 2017  
Held office hours and graded for CS109, a required class in probability taught by Professors Mehran Sahami and Chris Piech.
- [CS106A: Programming Methodology](#) Jan.–Mar. 2014  
As part of [CS198](#), led weekly discussion sections, graded assignments, provided feedback in 1:1 sessions, and held office hours.
- [CS 144 \(MOOC\): Computer Networking](#) Jan.–Mar. 2014  
Answered students’ technical questions and facilitated operation of an online course run by Professors McKeown and Levis.

## Technical Reports

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- A Cutting-Plane, Alternating Projections Algorithm for Conic Optimization Problems.* June 2017  
Analyzed a family of cutting-plane algorithms for conic optimization using a testbed for projection algorithms. [\[pdf\]](#) [\[code\]](#)
- Siamese Models for Stance Detection* Dec. 2016  
Designed a shallow neural network for the Fake News Challenge that took first place in a class competition and trained and tested in ten minutes on a laptop CPU; competitors’ networks took multiple hours and many GPUs to train. [\[pdf\]](#) [\[code\]](#)
- Xavier: A Reinforcement-Learning Approach to TCP Congestion Control* Dec. 2015  
Designed a reinforcement learning congestion control policy and studied its performance via simulation. [\[pdf\]](#) [\[code\]](#)
- B-CRAM: A Byzantine-Fault-Tolerant Challenge-Response Authentication Mechanism* Dec. 2014  
Designed B-CRAM, a public-key-based distributed authentication protocol resilient to malicious node failures. [\[pdf\]](#) [\[code\]](#)
- Random Number Generation with Cloud Chambers* Mar. 2011  
Built a cloud chamber and analyzed its viability as a random number generator. Extracted muon streak midpoints in a 2D plane. NIST test suite [did not detect non-randomness](#). *Synopsys Science Fair: First place in engineering, US Army Honorable Mention*

## Activities

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- The Stanford Daily*, Staff Writer, Deputy News Desk and Investigate News Editor 2015-2016  
Business Association of Stanford Entrepreneurial Students, Officer 2013-2014  
News Editor, Staff Writer, and Webmaster of *El Estoque*, Monta Vista High School’s student news publication 2010-2012  
YMCA Basketball Head Coach 2008-2012

## Selected Writings

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- Research Paper Summaries* [\[notes\]](#) Sept. 2016–Present  
*Mathematical Foundations* [\[notes\]](#) Sept. 2016–Present  
*Gaussian Random Walks: The N-Step Distribution* [\[blog post\]](#) July 2016  
*Graphical Model Sketch* [\[notes\]](#) June 2016  
*Max Stability and Misra Gries* [\[notes\]](#) Apr. 2016  
*A Look at Stimulants and Study Drugs on Campus* [\[investigative news\]](#) Jan. 2016  
*Learning about Learning: Machine Learning and MOOCs* [\[blog post\]](#) Sept. 2015  
*ASSU Survey Measures Student Opinions of Mental Health Services* [\[news\]](#) Apr. 2015  
*Machines that Learn: Making Distributed Storage Smarter* [\[blog post\]](#) Sept. 2014  
*A Small Glass Box: Creating a Cloud Chamber* [\[blog post\]](#) Aug. 2014  
*A Breakdown of IGN’s Game Rating Distribution* [\[blog post\]](#) July 2013

## Awards

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- Stanford Graduate Fellowship 2019  
NSF Graduate Research Fellowship, Honorable Mention 2019  
B.S. in Computer Science, Stanford, with distinction 2016  
Stanford Undergraduate Liaison to Computer Science Faculty Retreat 2014