# Akshay Agrawal

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## Education

**Stanford University**

*MS in Computer Science, Theoretical Track.* — GPA: 4.0. 2015–2017

*BS in Computer Science, Systems Track. Minor in Mathematics. Graduated with distinction.* — GPA: 3.89. 2012–2016

Theory: Optimization, Streaming, & Randomized Algorithms; Machine Learning; Artificial Intelligence; Deep Learning & Natural Language Processing; Probabilistic Graphical Models; Convex Optimization; Linear Dynamical Systems; Linear Algebra; Combinatorics; Stochastic Methods; Theoretical Machine Learning

Systems: Computer Networking; Operating Systems; Distributed Systems; Parallel Computing; Databases; Computer Architecture

Monta Vista High School  *GPA: 4.0; Relevant Courses: AP Computer Science*

## Skills

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

## Employment

**Google**

*Software Engineering Intern, Platforms Performance* — *June–September 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–September 2015*

Devised a methodology to conduct fleet-wide analyses of distributed operations passing through the storage stack, and applied it to optimize Colossus, Google File System's successor, and chunkservers. Developed reporting and analytics tools for investigations into tail latencies. Findings led to an estimated 6 percent reduction in disk read system calls. (C++/Python)

*Software Engineering Intern, Flash File System* — *June–September 2014*

As a member of a team authoring a file system for flash memory, researched and implemented policies to decrease garbage collection on solid-state drives. Simulations on production workloads consistently reduced overhead by 50 percent, and findings resulted in changes to the production code base. (C++)

*Freshman Engineering Practicum, Production Linux Kernel* — *June–September 2013*

Designed and developed tools using C to ensure proper functioning of the production kernel, including:
- a memory allocator that safeguards against buffer overflows, forbidden memory access, and unaligned accesses;
- an automated test suite to exercise kernel's cryptographic key retention service; patched a kernel vulnerability along the way.

**Stanford**

*Research in Mathematical Optimization under Professor Stephen Boyd.* — *September 2016–Present*

Devising, mathematically analyzing, and empirically evaluating algorithms for solving convex cone programs, a generalization of linear programs, with applications to machine learning, radiation treatment planning, finance, control, and more.

*Teaching Assistant. CS221: Artificial Intelligence, Principles and Techniques* — *September–December 2016*

Editing Professor Percy Liang's lecture notes; mentoring groups on applied AI projects; holding office hours; grading assignments.

*Teaching Assistant. CS109: Probability for Computer Scientists* — *Jaunuary–June 2016*

Held office hours and graded for CS109, a required class in probability taught by Professor Mehran Sahami and Chris Piech.

*Section Leader. CS106A: Programming Methodology* — *January–March 2014*

As part of CS198, led weekly discussion sections, graded assignments, provided feedback in 1:1 sessions, and held office hours.

*Teaching Assistant. Computer Networking* — *January–March 2014*

As a teaching assistant under Professors Nick McKeown and Philip Levis for a MOOC version of Stanford's CS144: An Introduction to Computer Networking, offered through Stanford Online, answered students' technical questions and facilitated course operation.

## Projects & Publications

**YouEDU: Staging Intelligent Interventions in MOOC Discussion Forums**

*Published in the 8th International Conference on Educational Data Mining* — *Stanford Infolab*

Compiled the first human-tagged, open dataset describing affect in Massive Open Online Course discussion forums; authored edxclassify, an open source machine learning pipeline for affect detection; and authored a publication describing YouEDU, a recommender system that automatically addresses confusion in discussion forums.

**Xavier: A Reinforcement-Learning Approach to TCP Congestion Control** — *Academic Project*

Designed and implemented a reinforcement learning congestion control policy and studied its performance via simulation.

**B-CRAM: A Byzantine-Fault-Tolerant Challenge-Response Authentication Mechanism** — *Academic Project*

Designed and implemented B-CRAM, a public-key-based distributed authentication protocol resilient to node failures, malicious or otherwise. B-RAM provides availability and security by distributing a trusted third party using the BFT2F replication algorithm.

**Random Number Generation with Cloud Chambers**

*Synopsys Science Fair: First place in engineering, US Army Honorable Mention* — *Independent Research*

Constructed a cloud chamber and analyzed its viability as a true random number generator. Used OpenCV to extract muon streak midpoints in a 2D plane. Midpoints translated into 128-bit numbers; NIST test suite did not detect non-randomness.

## Activities

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| *The Stanford Daily,* Staff Writer, Deputy News Desk and Investigate News Editor | *2015-2016* |
| Stanford Undergraduate Liaison to Computer Science Faculty Retreat | *2014* |
| 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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| *Investigations into Accelerating Alternating Projections* [research notebook] | *September 2016 - Present* |
| *Gaussian Random Walks: The N-Step Distribution* [blog post] | *July 2016* |
| *Graphical Model Sketch, Notes* [academic notes] | *June 2016* |
| *Max Stability and Misra Gries* [academic notes] | *April 2016* |
| *Learning about Learning: Machine Learning and MOOCs* [blog post] | *September 2015* |
| *YouEDU: Staging Intelligent Interventions in MOOC Discussion Forums* [publication] | *June 2015* |
| *Machines that Learn: Making Distributed Storage Smarter* [blog post] | *September 2014* |
| *A Small Glass Box: Creating a Cloud Chamber* [blog post] | *August 2014* |
| *A Breakdown of IGN's Game Rating Distribution* [blog post] | *July 2013* |