

George H. Chen

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Research Interests

I build and study machine learning and data analysis methods grounded firmly in a diverse range of applications including social data analytics, recommendation systems, medical image computing, and remote sensing for social good. My work straddles theory and application with the latter heavily steering the former. My goal is to provide practitioners in different application domains with insights and algorithms for analyzing their data.

Academic Appointments

Carnegie Mellon University	Pittsburgh, PA	1/2017 –
Assistant Professor, Heinz College of Public Policy and Information Systems		
Massachusetts Institute of Technology	Cambridge, MA	9/2015 – 12/2016
Postdoctoral Associate & MITx Digital Learning Fellow, Computer Science and Artificial Intelligence Lab		

Education

Massachusetts Institute of Technology	Cambridge, MA	9/2010 – 6/2015
Ph.D. in Electrical Engineering and Computer Science, 6/2015 GPA: 5.0/5.0		
▪ Thesis: <i>Latent Source Models for Nonparametric Inference</i> Received the George M. Sprowls award for best thesis in Computer Science		
▪ Advisors: Polina Golland, Devavrat Shah		
▪ Thesis reader: Sahand Negahban		
Electrical Engineer (post-master's degree focused on coursework), 6/2014 GPA: 5.0/5.0		
S.M. in Electrical Engineering and Computer Science, 6/2012 GPA: 5.0/5.0		
▪ Thesis: <i>Deformation-Invariant Sparse Coding</i>		
▪ Advisor: Polina Golland		
University of California, Berkeley	Berkeley, CA	8/2006 – 5/2010
B.S. with dual majors: Electrical Engineering and Computer Sciences (<i>Highest Honors</i>) Engineering Mathematics and Statistics (<i>Highest Honors</i>) GPA: 3.98/4.0		

Selected Professional Experience

Co-Founder and Data Scientist, GridForm	Cambridge, MA	1/2014 – present
<i>Spatial analytics for rural infrastructure development.</i> Our team analyzes satellite images of rural villages to help plan infrastructure development projects. We currently focus on helping renewable energy companies bring electricity to rural villages in India. Our software automatically analyzes how much it would cost to wire up hundreds of villages. We won the \$10,000 grand prize at the 2014 MIT IDEAS Global Challenge competition and our work has resulted in four villages thus far being wired up in India. I specifically develop machine learning algorithms for automatically analyzing enormous tracts of rural land.		
Research & Development Intern, Data Science Team, Celect, Inc.	Boston, MA	5/2015 – 8/2015
<i>Predictive analytics.</i> I developed machine learning solutions for recommending products to people for different retailers. My work involved deep learning/neural networks, collaborative filtering, and other inference tools for big data.		

Research Assistant, MIT Computer Science and Artificial Intelligence Lab Cambridge, MA 9/2010 – 6/2015

Theory for analyzing social data and medical images. To forecast whether a news topic will go viral on Twitter, we can compare it to past news topics with similar Tweet activity. More generally, we can make a prediction based on an observation by looking at similar past observations. My Ph.D. thesis develops theory to understand when, why, and how well such so-called “nearest-neighbor” methods work in applications such as forecasting trends on Twitter (time series classification), recommending products to people in systems like Netflix (online collaborative filtering), and finding where a human organ is in medical images by looking at image patches (patch-based image segmentation).

Modeling brain activation patterns. Brain activation patterns can vary significantly across people when they read the same sentences. My master’s thesis captures this variability in a new model for how different people’s brains respond to the same functional task such as language processing.

Real-time medical image analysis. Many algorithms for analyzing images use dimensionality reduction that is not fast enough for real-time applications. I developed a method that speeds up dimensionality reduction, enabling real-time medical imaging analysis such as tracking a patient’s breathing during radiation therapy and monitoring tissue heating when a patient is in an MR scanner.

Research Assistant, UC Berkeley Video and Image Processing Lab Berkeley, CA 5/2008 – 5/2010

Backpack with sensors for automated indoor modeling. I developed algorithms for tracking where a backpack is inside a building using data from laser scanners attached to the backpack. Thus, a person wearing the backpack could obtain accurate information on the backpack’s location over time even within buildings without reliable GPS access. The location information also fed into our team’s algorithms for constructing 3D models of building interiors.

Analyzing aerial images of cities. Urban planners often use labeled maps of cities to make decisions. I worked on algorithms for automatically locating where buildings, trees, road, and water are in aerial LIDAR images of cities.

Intern, Real-time Vision and Modeling Group, Siemens Corporate Research Princeton, NJ 7/2006 – 8/2006

Creating animated simulations of human crowds. I coded a PYTHON crowd simulator interfacing with POSER to create 3D animations of people in public indoor locations such as a subway. These synthetic animations could be used as test data for computer vision algorithms that recognize different human actions.

Teaching Experience

Computer Science Instructor, Middle East Entrepreneurs of Tomorrow (MEET) Summer 2015, Summer 2016

MEET brings promising high school Palestinian and Israeli students together for a three-year program that teaches them computer science, entrepreneurship, and a deeper understanding of the conflict in the region. MEET aims to educate and empower these young leaders to create positive political and social change in the Middle East. I co-taught a three-week introduction to web development in Jerusalem for the students in their second year of MEET. For their final project, the students worked in binational teams to develop socially responsible web apps that promote cultural diversity, which they presented to Google Tel Aviv. Our material coverage included HTML, CSS, Bootstrap, Python, SQLAlchemy, Flask, and JavaScript. I created new lectures and labs on building web apps with Flask.

Teaching Assistant, *Introduction to Inference* (MIT 6.S080, now 6.008) Fall 2012, Spring 2014

New undergraduate core Electrical Engineering and Computer Science course introducing statistical inference and probabilistic graphical models. I taught for the class during the first two semesters that it had ever been offered. I developed substantial portions of the courseware, including Khan Academy style videos for students, a series of PYTHON robot tracking coding projects, new recitation notes, new problem sets, and more. For my teaching and courseware development, I won a departmental teaching award as well as the top campus-wide teaching award given to grad students.

Lecturer, *Statistics for Research Projects* (MIT 6.S085) January 2014

Two-week introduction to statistics course with an emphasis on recognizing when and how to apply different statistical tools to research problems. I updated the lectures to fold in ideas from predictive analytics and mathematical statistics.

Teaching Assistant, *Algorithms for Inference* (MIT 6.438) Fall 2011

Introductory graduate-level course on probabilistic graphical models. I made Khan Academy style videos and helped typeset the first complete set of lecture notes for the class. I also delivered three lectures for the Fall 2013 class.

Teaching Assistant, *Structure and Interpretation of Systems and Signals* (UCB EE20) Fall 2007, Spring 2008, Fall 2008

Undergraduate core Electrical Engineering and Computer Sciences course introducing the math behind processing images, audio, and video, and behind systems for communication (e.g., radio) and control (e.g., robotic manipulators). My third time teaching for this course (Fall 2008), I was the head teaching assistant, managing seven other teaching assistants. My teaching effectiveness was recognized by a campus teaching award.

Research supervision:

- Real-time time series forecasting: Andrei Ivanov (undergraduate, Fall 2014–Spring 2015), Nils Molina (master's student, Fall 2014–Spring 2015)
- Tools for automating rural electrification planning: Kim Asenbeck (undergraduate, Fall 2015), Stephen Lee (master's student, Fall 2015–Spring 2016)

Online courseware development supervision (for Fall 2016 edX class on computational probability and inference): Ali C. Soylemezoglu (undergraduate, Spring 2016), William Li (MIT Ph.D. graduate, Spring 2016)

Selected Awards and Honors

MIT George M. Sprowls Award 2015

Best Ph.D. thesis in Computer Science at MIT

MIT Goodwin Medal 2015

Top campus-wide teaching award given to graduate students; selectivity: typically 1 student across all of MIT chosen per year (occasionally 2 students)

MIT IDEAS Global Challenge 2014: \$10,000 Grand Prize Winning Team

Annual MIT innovation and entrepreneurship competition focused on public service; selectivity: 4 teams out of 37

MIT EECS Frederick C. Hennie III Teaching Award 2013

Departmental teaching award; selectivity: ~1–3 students in the EECS department chosen per year

National Defense Science and Engineering Graduate Fellowship 2012–2015 (award year: 2012)

Three-year funding for graduate school; selectivity: ~200 US graduate students per year

National Science Foundation Graduate Research Fellowship 2011–2012 (award year: 2010)

Three-year funding for graduate school (I forfeited most of this due to other fellowships); selectivity: ~2,000 US graduate students per year

Siebel Scholarship 2011–2012

Funding for final year of my master's degree program; selectivity: within MIT EECS, 5 grad students chosen per year

MIT Irwin Mark Jacobs and Joan Klein Jacobs Presidential Fellowship 2010–2011

Funding for first year of graduate school; selectivity: ~15 out of the ~150 admitted EECS students per year

Eta Kappa Nu Outstanding Electrical and Computer Engineering Student Award 2010

For academic achievements, moral character, and service: 1 student chosen per year across universities with accredited electrical and computer engineering programs (nominations are done by Eta Kappa Nu chapters but the recipient need not be a member of Eta Kappa Nu)

UC Berkeley Engineering Science Departmental Citation 2010

Top graduating senior in UC Berkeley's Engineering Science program

UC Berkeley Outstanding Graduate Student Instructor Award 2009

Campus-wide teaching award (received as an undergraduate teaching assistant); selectivity: ~10% of teaching assistants

Intel International Science and Engineering Fair 2006: 1st place team

For high school research in computer science; selectivity: 7 teams out of 236

Asteroid named after me: <http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=21437>

Papers

Note: "♣" denotes an author list that is alphabetical by last name, as is customary in fields like mathematics and theoretical computer science

11. "A Latent Source Model for Patch-Based Image Segmentation"
George H. Chen, Devavrat Shah, Polina Golland
Medical Image Computing and Computer Assisted Interventions, October 2015
10. "Targeting Villages for Rural Development Using Satellite Image Analysis"
Kush R. Varshney, George H. Chen, Brian Abelson, Kendall Nowocin, Vivek Sakhrani, Ling Xu, Brian L. Spatocco
Big Data, March 2015
9. "A Latent Source Model for Online Collaborative Filtering"
♣ Guy Bresler, George H. Chen, Devavrat Shah
Neural Information Processing Systems, December 2014
Selected for spotlight (one of 62/1678 submissions)
8. "A Latent Source Model for Nonparametric Time Series Classification"
♣ George H. Chen, Stanislav Nikolov, Devavrat Shah
Neural Information Processing Systems, December 2013
7. "Sparse Projections of Medical Images onto Manifolds"
George H. Chen, Christian Wachinger, Polina Golland
Information Processing in Medical Imaging, June–July 2013
6. "Deformation-Invariant Sparse Coding for Modeling Spatial Variability of Functional Patterns in the Brain"
George H. Chen, Evelina G. Fedorenko, Nancy G. Kanwisher, Polina Golland
Neural Information Processing Systems Workshop on Machine Learning and Interpretation in Neuroimaging, December 2011
5. "Indoor Localization and Visualization Using a Human-Operated Backpack System"
Timothy Liu, Matthew Carlberg, George Chen, Jacky Chen, John Kua, Avideh Zakhor
International Conference on Indoor Positioning and Indoor Navigation, September 2010
4. "Indoor Localization Algorithms for a Human-Operated Backpack System"
George Chen, John Kua, Stephen Shum, Nikhil Naikal, Matthew Carlberg, Avideh Zakhor
International Symposium on 3D Data Processing, Visualization and Transmission, May 2010
3. "Classifying Urban Landscape in Aerial LIDAR Using 3D Shape Analysis"
Matthew Carlberg, Peiran Gao, George Chen, Avideh Zakhor
International Conference on Image Processing, November 2009
2. "2D Tree Detection in Large Urban Landscapes Using Aerial LIDAR Data"
George Chen, Avideh Zakhor
International Conference on Image Processing, November 2009
1. "Image Augmented Laser Scan Matching for Indoor Dead Reckoning"
Nikhil Naikal, John Kua, George Chen, Avideh Zakhor
International Conference on Intelligent Robots and Systems, October 2009

Selected Volunteer Service

- Deputy Head of Curriculum, Middle East Entrepreneurs of Tomorrow (MEET) 10/2015 – present
Working with the Head of Curriculum and the team stationed in Jerusalem to establish the entrepreneurship and computer science curriculum for the 2016-2017 MEET school year that brings together Palestinian and Israeli high school students to learn and work together
- Member, Task Force on the Future of MIT Education 4/2013 – 7/2014
Discussed and made recommendations for the future of MIT education both on and off campus, accounting for the growing prevalence of digital learning tools; I also led student outreach events and helped assemble student and faculty surveys on MIT education
- Vice President of Resources, MIT Sidney-Pacific Graduate Community 4/2012 – 4/2013
Helped run the largest MIT graduate dorm Sidney-Pacific (700 residents) as one of the five executive officers, working with 50 other graduate student officers, the housemasters, and the building manager to put on copious amounts of events, start a community garden, launch a new website, overhaul building resources, handle severe conflicts, and more; I managed 10 officers and the \$140,000 budget
- Organizer, MIT Machine Learning Tea Fall 2011, Spring 2012, Fall 2012, Spring 2013
Lined up speakers for informal student talks that gathered researchers interested in machine learning
- Tutor, UC Berkeley Eta Kappa Nu Spring 2008, Fall 2008, Spring 2009, Spring 2010
Provided free weekly drop-in tutoring for students; I specialized in teaching probability, signal processing, and introductory computer science
- Reviewer for: *Neural Information Processing Systems* (2016), *Machine Learning for Health Care* (2016), *Machine Learning* (2015), *Digital Signal Processing* (2015), *Medical Image Computing and Computer Assisted Interventions* (2013)

References

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