


# Fred Hohman

Data science + visualization researcher

 Georgia Institute of Technology  
Klaus Advanced Computing Building  
Atlanta, GA 30332

 [fredhohman.com](http://fredhohman.com)  
 [fredhohman@gatech.edu](mailto:fredhohman@gatech.edu)  
 [@fredhohman](https://twitter.com/fredhohman)  
 [github.com/fredhohman](https://github.com/fredhohman)

*Last updated: April 16, 2018*

My research combines **data mining and machine learning** techniques with principles from **human-computer interaction and visualization** to make interactive tools to help people explore large graph data and interpret machine learning models. In 2018 I received the NASA Space Technology Research Fellowship.

## Education

- Present —  
Aug. 2015 **Ph.D. Computational Science and Engineering**  
*Georgia Institute of Technology, Atlanta, GA*  
Advisor: Polo Chau, Co-advisor: Alex Endert  
Minor: "User-Centered Design in Data Science"  
Overall GPA: 4.00/4.00
- May 2018 **M.S. Computational Science and Engineering**  
*Georgia Institute of Technology, Atlanta, GA*
- May 2015 —  
Aug. 2011 **B.S. Mathematics**, Area of Emphasis in Applied Mathematics  
**B.S. Physics**  
*University of Georgia, Athens, GA*  
Thesis: "3D Printing the Trefoil Knot and its Pages"  
Overall GPA: 3.84/4.00, Magna Cum Laude

## Industry Research Experience

- Summer 2018 **Microsoft Research**, Redmond, WA  
*Research Intern, Human-Computer Interaction Group*  
Mentor: Steven Drucker  
Exploring how visual analytics can help explain and interpret deep learning models..
- Summer 2017 **NASA Jet Propulsion Lab**, Pasadena, CA  
*Creative Computer Scientist, Human Interfaces Group*  
Mentor: Scott Davidoff, Arun Viswanathan  
Joint work between NASA JPL, Caltech, and Art Center creating interactive data visualizations for current scientific research.
- Summer 2016 **Pacific Northwest National Lab**, Richland, WA  
*National Security Ph.D. Intern, Data Science and Analytics Group*  
Mentor: Nathan Hodas  
Built visualization tools that generate images from deep neural networks to explain classifier's learned semantics.

## Academic Research Experience

- Present —  
Aug. 2016 **Georgia Institute of Technology**, Atlanta, GA  
*Graduate Research Assistant, School of Computational Science and Engineering*  
Advisor: Polo Chau, Co-advisor: Alex Endert  
Member of the Polo Club of Data Science where we bridge and innovate at the intersection of data mining and human-computer interaction to synthesize scalable, interactive, and interpretable tools that amplify human's ability to understand and interact with big data.

May 2016 — **Georgia Institute of Technology**, Atlanta, GA  
Aug. 2015  
*Graduate Research Assistant, School of Computational Science and Engineering*  
Advisor: Surya Kalidindi  
Conducted research in physical data science and material informatics by creating property-structure linkages using machine learning to predict material properties. Contributed to direction and code of PyMKS: Materials Knowledge Systems in Python.

May 2015 — **University of Georgia**, Athens, GA  
Jan. 2013  
*Undergraduate Research Assistant, Department of Mathematics*  
Mentor: David Gay  
Explored 3D printing and mathematical exposition in topology. Programmed, designed, and 3D printed 34-piece, color-coordinated, and magnetized 3D puzzle of the trefoil knot fibration. Led 3D printing research and education in mathematics department.

Summer 2014 **NSF REU in Mathematics and Computational Science**, Fairfield, CT  
*Undergraduate Researcher, Fairfield University, Department of Engineering*  
Mentor: Shanon Reckinger  
Directly compared numerical solutions derived from the Navier-Stokes equations to designed experiments performed at the lab-scale to model specific ocean phoneme. Configured MIT General Circulation Model on a linux computer cluster to run parallel computational fluid dynamics simulations.

## Honors and Awards

- 2018-2021 **NASA Space Technology Research Fellowship**  
For my Ph.D. work on "Understanding Deep Neural Networks Through Attribution and Interactive Experimentation"
- 2017-2018 **Microsoft Azure for Research Award: AI for Earth**  
For our work on "Deep Learning for Fine-scale Population Maps"
- 2017 **Best Demo, Honorable Mention at ACM SIGMOD/PODS Conference**  
For "Visual Graph Query Construction and Refinement"
- 2015-2019 **President's Fellowship at Georgia Institute of Technology**  
Selected incoming Ph.D. students who bring exemplary scholarship and innovation to their academic departments
- 2015 **Outstanding Poster at JMM Undergraduate Poster Session in Computational Math**  
For "Experimental and Numerical Comparison of Oceanic Overflow"
- 2015 **UGA CURO Research Graduation Distinction**  
Awarded to undergraduates who write a thesis, present at the CURO Symposium, and complete 9 research credit hours
- 2014 **UGA CURO Research Assistantship**  
Stipend awarded to outstanding undergraduates that actively participate in faculty-mentored research
- 2013 **Presidential Scholar**  
Achieved a 4.0 GPA during a semester with minimum 14 credit hours
- 2011-2015 **Dean's List**  
Achieved at least a 3.5 GPA during a semester with minimum 14 credit hours
- 2011-2015 **Georgia HOPE Scholarship**  
Merit-based award to Georgia residents providing tuition assistance for their undergraduate degree
- 2011 **Mission of Blessed Trinity: Artistic Sensibility (one of two students to receive upon graduation)**  
One of two students to receive the Mission Statement award upon high-school graduation
- 2009 **Eagle Scout Award**  
Highest achievement attainable in the Boy Scouts of America, only 4% of scouts granted this rank

## Publications

**Interactive Classification for Deep Learning Interpretation.** Angel Cabrera, Fred Hohman, Jason Lin, Duen Horng Chau. *Demo, Conference on Computer Vision and Pattern Recognition (CVPR). June 18, 2018. Salt Lake City, USA.*

**Shield: Fast, Practical Defense and Vaccination for Deep Learning using JPEG Compression.** Nilaksh Das, Madhuri Shanbhogue, Shang-Tse Chen, Fred Hohman, Siwei Li, Li Chen, Michael E. Kounavis, Duen Horng Chau. *arXiv:1802.06816*. Feb 19, 2017.

**Visual Analytics in Deep Learning: An Interrogative Survey for the Next Frontiers.** Fred Hohman, Minsuk Kahng, Robert Pienta, Duen Horng Chau. *arXiv:1801.06889*. Jan 21, 2017.

**A Deep Learning Approach for Population Estimation from Satellite Imagery.** Caleb Robinson, Fred Hohman, Bistra Dilkina. *ACM SIGSPATIAL Workshop on Geospatial Humanities*. Nov 7, 2017. *Microsoft AI for Earth Award*.

**VIGOR: Interactive Visual Exploration of Graph Query Results.** Robert Pienta, Fred Hohman, Alex Endert, Acar Tamersoy, Kevin Roundy, Chris Gates, Shamkant Navathe, Duen Horng Chau. *IEEE Transactions on Visualization and Computer Graphics (Proc. VAST'17)*. Jan 2018. Phoenix, USA.

**3D Exploration of Graph Layers via Vertex Cloning.** James Abello\*, Fred Hohman\*, Duen Horng Chau. *Poster, IEEE Visual Analytics Science and Technology (VAST)*. Oct 1-6, 2017. Phoenix, USA.

**A Viz of Ice and Fire: Exploring Entertainment Video Using Color and Dialogue.** Fred Hohman, Sandeep Soni, Ian Stewart, John Stasko. *2<sup>nd</sup> Workshop on Visualization for the Digital Humanities at IEEE VIS*. Oct 1-6, 2017. Phoenix, USA.

**mHealth Visual Discovery Dashboard.** Dezhi Fang, Fred Hohman, Peter Polack, Hillol Sarker, Minsuk Kahng, Moushumi Sharmin, Mustafa al'Absi, Duen Horng Chau. *Demo, ACM International Joint Conference on Pervasive and Ubiquitous Computing (UBICOMP)*. Sept 11-15, 2017. Maui, USA.

**Keeping the Bad Guys Out: Protecting and Vaccinating Deep Learning with JPEG Compression.** Nilaksh Das, Madhuri Shanbhogue, Shang-Tse Chen, Fred Hohman, Li Chen, Michael E. Kounavis, Duen Horng Chau. *arXiv:1705.02900*. May 8, 2017.

**Visual Graph Query Construction and Refinement.** Robert Pienta, Fred Hohman, Acar Tamersoy, Alex Endert, Shamkant Navathe, Hanghang Tong, Duen Horn Chau. *Demo, ACM International Conference on Management of Data (SIGMOD/PODS) Conference*. May 14-19, 2017. Chicago, USA. *Best Demo, Honorable Mention*.

**ShapeShop: Towards Understanding Deep Learning Representations via Interactive Experimentation.** Fred Hohman, Nathan Hodas, Duen Horng Chau. *Late-Breaking Work, ACM Conference on Human Factors in Computing Systems (CHI)*. May 6-11, 2017. Denver, CO, USA.

**Experimental and Numerical Comparison of Oceanic Overflow.** Thomas Gibson, Fred Hohman, Theresa Morrison, Shanon Reckinger, Scott Reckinger. *Abstract, American Physical Society Division of Fluid Dynamics*. Nov 23-25, 2014. San Francisco, CA, USA.

## Presentations

Dec. 2017 **Graph Playgrounds: 3D Exploration of Graph Layers via Vertex Cloning**  
AT&T Research Labs Graduate Student Symposium.

Oct. 2017 **A Viz of Ice and Fire: Exploring Entertainment Video Using Color and Dialogue**  
2nd Workshop on Visualization for the Digital Humanities at IEEE VIS.

Aug. 2017 **Constellation: Visualizing Cybersecurity in Real Time**  
NASA Jet Propulsion Lab (JPL).  
Aug. 2017 California Institute of Technology.

Nov. 2016 **Visualizing Learned Semantics with Deep Learning**  
Georgia Tech. Ph.D. Qualifying Oral Exam.

### **Drawing Semantics with Deep Learning**

July 2016 Pacific Northwest National Laboratory. National Security Internship Program Research Symposium.

### **3D Printing The Trefoil Knot And Its Pages**

Mar. 2015 UGA Center for Undergraduate Research Symposium. Hands on demo.

### **Experimental and Numerical Studies of Oceanic Overflow**

June 2015 American Meteorological Society's 20th Conference on Atmospheric and Oceanic Fluid Dynamics.

Jan. 2015 Joint Mathematics Meeting. Outstanding Poster at Student Poster Session in Computational Math.

Nov. 2014 American Physical Society Division of Fluid Dynamics.

Aug. 2014 Invited and presented on behalf at Brown University, Los Alamos National Lab.

July 2014 Northeast REU Mini-Conference at Yale University.

July 2014 University of Rhode Island Bay Campus.

### **3D Printing in Topology**

Mar. 2014 UGA Center for Undergraduate Research Symposium. Hands on demo.

## Press

Dec. 2017 "Georgia Tech Team To Use Microsoft Grant to Study Human Migration Dynamics." Georgia Tech, College of Computing.

Sept. 2015 "Georgia Tech PhD Student Puts Finishing Touches on 3D Printed Trumpety Trefoil." 3dprint.com.

2015 "Student Profile: Fred Hohman." 2015 UGA Mathematics Department Newsletter.

Feb. 2015 "Falling Water." MITgcm.org.

Dec. 2014 "Mathematics/Physics Student Creates 3D Printed Puzzle of Trefoil Knot, Catches Mathematical Community's Interest." 3dprint.com.

July 2014 "Day 311 - Trefoil Trumpet." Makerhome.com.

April 2014 "Mathematics with 3D Printing". Sketches of Topology.

## Teaching

### **Graduate Teaching Assistant**

*Georgia Institute of Technology, Atlanta, GA*

Data and Visual Analytics CSE6242 / CX4242, Instructor: Polo Chau

Designed homeworks, held weekly office hours, and mentored student team projects for Data and Visual Analytics (CSE6242 / CX4242) a graduate course with 220+ students enrolled.

### **Student Notetaker**

*University of Georgia, Athens, GA*

Generated notes for undergraduate mathematics and physics courses for students with disabilities.

### **Tutor**

*University of Georgia, Athens, GA*

Specialized in tutoring calculus to undergraduates.

## Grants and Funding

### **Understanding Deep Neural Networks Through Attribution and Interactive Experimentation**

*NSTRF: NASA Space Technology Research Fellowship*

Co-PIs: Duen Horng Chau

Funded \$75,000/year, August 2018 - May 2021

2017 - 2018 **Deep Learning for Fine-scale Population Maps**

*Microsoft Azure for Research Award: AI for Earth*

Co-PIs: Caleb Robinson, Bistra Dilkina

Funded \$15,000, August 2017 - August 2018

2014 **3D Printing the Trefoil Knot and its Pages**

*UGA CURO Research Assistantship*

Co-PIs: David Gay

Funded \$1,000, Fall 2014

## Design

2017 **IDEA Workshop Proceedings Cover**

*ACM SIGKDD Workshop on Interactive Data Exploration and Analytics (IDEA), Halifax, Canada*

Designed workshop poster and conference proceedings cover.

2017 **Brad Myers Advisee Tree**

*ACM Conference on Human Factors in Computing Systems (CHI), Denver, USA*

Designed and implemented an interactive visualization of Brad Myers's advisee tree shown during his CHI 2017 Lifetime Research Award talk. Designed accompanying ribbon worn by attendees at the conference.

2014 **3D Printed Cube Decomposition Trophy**

*University of Georgia Mathematics Department, Athens, USA*

Designed, modeled, and 3D printed cube decomposition trophy for annual UGA High School Math Tournament that was given to the top scoring teams and participants.

2014 **3D Printed UGA Keychain**

*University of Georgia Lamar Dodd School of Art, Athens, USA*

Created 3D printed UGA keychain and presentation notes given at Experience UGA: a interdisciplinary event that exposes middle-school and high-school students to hands-on learning activities.

## Technology Skills

**OS:** Mac OS X, Ubuntu, Unix Command Line, Windows

**Programming:** Python, Matlab, Mathematica, C

**Web:** HTML, CSS, JavaScript, D3, SQL, Bootstrap,  $\text{\LaTeX}$ , Markdown, Jekyll, Git

**Graphics:** Affinity Designer, Pixelmator, Matplotlib, Blender, Keynote, Meshlab, MakerBot Desktop

**HCI:** Contextual Inquiry, Think-Alouds, User Personas, Rapid Paper Prototyping, Affinity Diagramming

## Professional Activities

### Reviewer

1st Deep Learning and Security Workshop (**DLS**) at IEEE SP 2018

Symposium on Visualization in Data Science (**VDS**) at IEEE VIS 2017

IEEE Visual Analytics Science and Technology (**VAST**) 2017

ACM SIGKDD Conference on Knowledge Discovery and Data Mining (**KDD**) 2017

IEEE International Conference on Distributed Computing Systems (**ICDCS**) 2017

SIAM International Conference on Data Mining (**SDM**) 2017

ACM Conference on Human Factors in Computing Systems (**CHI**) 2017, 2018

### Member

Present-2016 Association for Computing Machinery (**ACM**)

Present-2016 Institute of Electrical and Electronics Engineers (**IEEE**)

2012-2015 UGA Mathematics Club

2012-2013 Society of Physics Students, UGA Chapter (**SPS**)  
2011-2015 National Society of Collegiate Scholars (**NSCS**)

## References

**Dr. Polo Chau**, Assistant Professor  
School of Computational Science and Engineering  
Georgia Institute of Technology  
Atlanta, GA, USA  
[cc.gatech.edu/~dchau/](http://cc.gatech.edu/~dchau/)

**Dr. Alex Endert**, Assistant Professor  
School of Interactive Computing  
Georgia Institute of Technology  
Atlanta, GA, USA  
[va.gatech.edu/endert/](http://va.gatech.edu/endert/)

**Dr. Scott Davidoff**, Manager  
Human Interfaces Group  
NASA Jet Propulsion Lab  
Pasadena, CA, USA  
[scottdavidoff.com/](http://scottdavidoff.com/)

**Dr. Nathan Hodas**, Senior Research Scientist  
Data Sciences and Analytics Group  
Pacific Northwest National Laboratory  
Richland, WA, USA  
[signatures.pnnl.gov/bios/nathan-hodas](http://signatures.pnnl.gov/bios/nathan-hodas)

**Dr. David Gay**, Associate Professor  
Department of Mathematics  
University of Georgia  
Athens, GA, USA  
[euclidlab.org/david-gay/](http://euclidlab.org/david-gay/)