

# Fred Hohman

Research Scientist (*ML + HCI*)

I research how to enable **machine learning interpretability** at scale and for everyone, by designing and developing interactive interfaces to help people confidently understand data-driven systems. Besides building tools, I also create **data visualizations** and write interactive articles to simply communicate complex ideas.

I have collaborated with researchers, designers, developers, and artists while working at Apple, Microsoft Research, NASA Jet Propulsion Lab, and Pacific Northwest National Lab.

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 CV PDF

 @fredhohman

 @fredhohman

 Google Scholar

## Education

Dec. 2020 — Aug. 2015

### Ph.D. in Computational Science & Engineering

Georgia Institute of Technology, Atlanta, GA

Advisor: Duen Horng (Polo) Chau, Co-advisor: Alex Endert

Thesis: *Interactive Scalable Interfaces for Machine Learning Interpretability*

Committee: Duen Horng (Polo) Chau, Alex Endert, Chao Zhang, Nathan Hodas, Scott Davidoff, Steven Drucker

 Thesis Project Page  Thesis  Thesis Recording

May 2018

### M.S. in Computational Science & Engineering

Georgia Institute of Technology, Atlanta, GA

GPA: 4.00/4.00

May 2015 — Aug. 2011

### B.S. in Mathematics, B.S. in Physics

University of Georgia, Athens, GA

Thesis: *3D Printing the Trefoil Knot and its Pages*

Overall GPA: 3.84/4.00, Magna Cum Laude, Area of Emphasis in Applied Mathematics

 Thesis Project Page  Thesis

## Industry Research Experience

Present — Jan. 2021

### Apple, Seattle, WA

*Research Scientist, Design + Visualization Group*

Research and design for everyone in the machine learning process—the developers who build models, the designers who create experiences, and the people who use technology.

Summer 2019

### Apple, Seattle, WA

*Research Intern, Turi Human-centered Machine Learning Group*

Mentor: Kanit Wongsuphasawat, Kayur Patel

Designed and developed interactive visualizations for data iteration in machine learning, published at CHI 2020.

Summer 2018

### Microsoft Research, Redmond, WA

*Research Intern, Human-Computer Interaction Group*

Mentor: Steven Drucker

Designed, developed, and deployed interactive interface for operationalizing machine learning interpretability, published at CHI 2019.

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. Prototype presented to lab leadership and secured funding to be incorporated into Mars 2020 mission.

Summer 2016

### Pacific Northwest National Lab, Richland, WA

*National Security Ph.D. Intern, Data Sciences & Analytics Group*

Mentor: Nathan Hodas  
Built interactive tools that generate synthetic images to explain deep learning classifiers, published at CHI 2017.

## Academic Research Experience

Present — Aug. 2016

**Georgia Institute of Technology**, Atlanta, GA

*Graduate Research Assistant, School of Computational Science and Engineering*

Advisor: Duen Horng (Polo) Chau, 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 — Aug. 2015

**Georgia Institute of Technology**, Atlanta, GA

*Graduate Research Assistant, School of Computational Science and Engineering*

Mentor: 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 — Jan. 2013

**University of Georgia**, Athens, GA

*Undergraduate Research Assistant, Department of Mathematics*

Advisor: 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

**REU in Mathematics and Computational Science**, Fairfield, CT

*Fairfield University, Department of Mathematics*

Mentor: Shanon Reckinger

Directly compared numerical solutions from Navier-Stokes equations to designed lab-scale experiments to model specific ocean phoneme. Configured MIT General Circulation Model on CPU cluster to run parallel computational fluid dynamics simulations.

## Honors and Awards

- 2019 Best Paper at ACM CHI Conference  
For "Managing Messes in Computational Notebooks"
- 2018 Best Paper, Honorable Mention at VISxAI Workshop at IEEE VIS  
For "The Beginner's Guide to Dimensionality Reduction"
- 2018 – 2021 NASA Space Technology Research Fellowship  
For my Ph.D. work on "Understanding Deep Neural Networks Through Attribution and Interactive Experimentation"
- 2018 Audience Appreciation Award, Runner Up at ACM SIGKDD Conference  
For "Shield: Fast, Practical Defense and Vaccination for Deep Learning using JPEG Compression"
- 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  
Select number of 1st year doctoral students who bring exemplary levels of 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
- 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

# Publications

## Selected: Latest & Greatest

### **Neo: Generalizing Confusion Matrix Visualization to Hierarchical and Multi-Output Labels**

Jochen Görtler, Fred Hohman, Dominik Moritz, Kanit Wongsuphasawat, Donghao Ren, Rahul Nair, Marc Kirchner, Kayur Patel

*arXiv:2110.12536. 2021.*

[🔗 Project](#) [PDF](#) [BibTeX](#)

### **Communicating with Interactive Articles**

Fred Hohman, Matthew Conlen, Jeffrey Heer, Duen Horng (Polo) Chau  
*Distill. 2020.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Code](#) [BibTeX](#) [DOI](#) [★ Invited Commentary](#) [Interactive Article](#)

### **CNN Explainer: Learning Convolutional Neural Networks with Interactive Visualization**

Zijie J. Wang, Robert Turko, Omar Shaikh, Haekyu Park, Nilaksh Das, Fred Hohman, Minsuk Kahng, Duen Horng (Polo) Chau

*IEEE Transactions on Visualization and Computer Graphics (TVCG). Salt Lake City, UT, USA, 2021.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Video](#) [Recording](#) [Code](#) [BibTeX](#) [DOI](#) [★ Top of Github Trending](#), [Top 4 TVCG Papers invited to SIGGRAPH](#)

### **Understanding and Visualizing Data Iteration in Machine Learning**

Fred Hohman, Kanit Wongsuphasawat, Mary Beth Kery, Kayur Patel

*ACM Conference on Human Factors in Computing Systems (CHI). Honolulu, HI, USA, 2020.*

[🔗 Project](#) [PDF](#) [Video](#) [Preview](#) [Recording](#) [Slides](#) [BibTeX](#) [DOI](#)

### **Summit: Scaling Deep Learning Interpretability by Visualizing Activation and Attribution Summarizations**

Fred Hohman, Haekyu Park, Caleb Robinson, Duen Horng (Polo) Chau

*IEEE Transactions on Visualization and Computer Graphics (TVCG). Vancouver, Canada, 2020.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Video](#) [Recording](#) [Slides](#) [Code](#) [BibTeX](#) [DOI](#)

### **Gamut: A Design Probe to Understand How Data Scientists Understand Machine Learning Models**

Fred Hohman, Andrew Head, Rich Caruana, Robert DeLine, Steven Drucker

*ACM Conference on Human Factors in Computing Systems (CHI). Glasgow, UK, 2019.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Blog](#) [Video](#) [Preview](#) [Slides](#) [BibTeX](#) [DOI](#) [★ Deployed at Microsoft Research](#)

## Journal

### J6 **NeuroCartography: Scalable Automatic Visual Summarization of Concepts in Deep Neural Networks**

Haekyu Park, Nilaksh Das, Rahul Duggal, Austin P. Wright, Omar Shaikh, Fred Hohman, Duen Horng (Polo) Chau

*IEEE Transactions on Visualization and Computer Graphics (TVCG). New Orleans, LA, USA, 2022.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Code](#) [BibTeX](#) [DOI](#)

### J5 **Communicating with Interactive Articles**

Fred Hohman, Matthew Conlen, Jeffrey Heer, Duen Horng (Polo) Chau

*Distill. 2020.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Code](#) [BibTeX](#) [DOI](#) [★ Invited Commentary](#) [Interactive Article](#)

### J4 **CNN Explainer: Learning Convolutional Neural Networks with Interactive Visualization**

Zijie J. Wang, Robert Turko, Omar Shaikh, Haekyu Park, Nilaksh Das, Fred Hohman, Minsuk Kahng, Duen Horng (Polo) Chau

*IEEE Transactions on Visualization and Computer Graphics (TVCG). Salt Lake City, UT, USA, 2021.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Video](#) [Recording](#) [Code](#) [BibTeX](#) [DOI](#) [★ Top of Github Trending](#), [Top 4 TVCG Papers invited to SIGGRAPH](#)

### J3 **Summit: Scaling Deep Learning Interpretability by Visualizing Activation and Attribution Summarizations**

Fred Hohman, Haekyu Park, Caleb Robinson, Duen Horng (Polo) Chau

*IEEE Transactions on Visualization and Computer Graphics (TVCG). Vancouver, Canada, 2020.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Video](#) [Recording](#) [Slides](#) [Code](#) [BibTeX](#) [DOI](#)

J2 **Visual Analytics in Deep Learning: An Interrogative Survey for the Next Frontiers**

Fred Hohman, Minsuk Kahng, Robert Pienta, Duen Horng (Polo) Chau

*IEEE Transactions on Visualization and Computer Graphics (TVCG). Berlin, Germany, 2018.*

[Project](#) [Demo](#) [PDF](#) [Blog](#) [Video](#) [Slides](#) [Code](#) [BibTeX](#) [DOI](#)

J1 **VIGOR: Interactive Visual Exploration of Graph Query Results**

Robert Pienta, Fred Hohman, Alex Endert, Acar Tamersoy, Kevin Roundy, Chris Gates, Shamkant Navathe, Duen Horng (Polo) Chau

*IEEE Transactions on Visualization and Computer Graphics (TVCG). Phoenix, AZ, USA, 2018.*

[Project](#) [PDF](#) [Video](#) [Preview](#) [BibTeX](#) [DOI](#)

## Conference

C11 **Bluff: Interactively Deciphering Adversarial Attacks on Deep Neural Networks**

Nilaksh Das\*, Haekyu Park\*, Zijie J. Wang, Fred Hohman, Robert Firstman, Emily Rogers, Duen Horng (Polo) Chau

*IEEE Visualization Conference (VIS). Salt Lake City, UT, USA, 2020.*

[Project](#) [Demo](#) [PDF](#) [Recording](#) [Code](#) [BibTeX](#) [DOI](#) \*Authors contributed equally

C10 **Image: Fluid Moves Between Code and Graphical Work in Computational Notebooks**

Mary Beth Kery, Donghao Ren, Fred Hohman, Dominik Moritz, Kanit Wongsuphasawat, Kayur Patel  
*ACM Symposium on User Interface Software and Technology (UIST). Minneapolis, MN, USA, 2020.*

[Project](#) [PDF](#) [BibTeX](#) [DOI](#)

C9 **Understanding and Visualizing Data Iteration in Machine Learning**

Fred Hohman, Kanit Wongsuphasawat, Mary Beth Kery, Kayur Patel

*ACM Conference on Human Factors in Computing Systems (CHI). Honolulu, HI, USA, 2020.*

[Project](#) [PDF](#) [Video](#) [Preview](#) [Recording](#) [Slides](#) [BibTeX](#) [DOI](#)

C8 **FairVis: Visual Analytics for Discovering Intersectional Bias in Machine Learning**

Angel Cabrera, Will Epperson, Fred Hohman, Minsuk Kahng, Jamie Morgenstern, Duen Horng (Polo) Chau

*IEEE Conference on Visual Analytics Science and Technology (VAST). Vancouver, Canada, 2019.*

[Project](#) [Demo](#) [PDF](#) [Blog](#) [Recording](#) [Slides](#) [Code](#) [BibTeX](#) [DOI](#)

C7 **TeleGam: Combining Visualization and Verbalization for Interpretable Machine Learning**

Fred Hohman\*, Arjun Srinivasan\*, Steven Drucker

*IEEE Visualization Conference (VIS). Vancouver, Canada, 2019.*

[Project](#) [Demo](#) [PDF](#) [Preview](#) [Recording](#) [Slides](#) [Code](#) [BibTeX](#) [DOI](#) \*Authors contributed equally

C6 **ElectroLens: Understanding Atomistic Simulations through Spatially-resolved Visualization of High-dimensional Features**

Xiangyun Lei, Fred Hohman, Duen Horng (Polo) Chau, Andrew Medford

*IEEE Visualization Conference (VIS). Vancouver, Canada, 2019.*

[Project](#) [PDF](#) [Code](#) [BibTeX](#) [DOI](#)

C5 **Gamut: A Design Probe to Understand How Data Scientists Understand Machine Learning Models**

Fred Hohman, Andrew Head, Rich Caruana, Robert DeLine, Steven Drucker

*ACM Conference on Human Factors in Computing Systems (CHI). Glasgow, UK, 2019.*

[Project](#) [Demo](#) [PDF](#) [Blog](#) [Video](#) [Preview](#) [Slides](#) [BibTeX](#) [DOI](#) ★ Deployed at Microsoft Research

C4 **Managing Messes in Computational Notebooks**

Andrew Head, Fred Hohman, Titus Barik, Steven Drucker, Robert DeLine

*ACM Conference on Human Factors in Computing Systems (CHI). Glasgow, UK, 2019.*

[Project](#) [Demo](#) [PDF](#) [Video](#) [Preview](#) [Slides](#) [Code](#) [BibTeX](#) [DOI](#) 🏆 Best Paper

C3 **Atlas: Local Graph Exploration in a Global Context**

James Abello\*, Fred Hohman\*, Varun Bezzam, Duen Horng (Polo) Chau

*ACM Conference on Intelligent User Interfaces (IUI). Los Angeles, CA, USA, 2019.*

[Project](#) [PDF](#) [Video](#) [Talk](#) [Slides](#) [Code](#) [BibTeX](#) [DOI](#) \*Authors contributed equally

C2 **Scalable K-Core Decomposition for Static Graphs Using a Dynamic Graph Data Structure**

Alok Tripathy, Fred Hohman, Duen Horng (Polo) Chau, Oded Green

*IEEE International Conference on Big Data (Big Data). Seattle, WA, USA, 2018.*

[Project](#) [PDF](#) [BibTeX](#) [DOI](#)

C1 **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 (Polo) Chau

*ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD). London, UK, 2018.*

[🔗 Project](#) [PDF](#) [Video](#) [Code](#) [BibTeX](#) [DOI](#) [Audience Appreciation Award, Runner Up](#)

## Workshop

### W6 Launching the Parametric Press

Matthew Conlen, Fred Hohman

*Visualization for Communication at IEEE VIS (VisComm). Vancouver, Canada, 2019.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Code](#) [BibTeX](#)

### W5 Discovery of Intersectional Bias in Machine Learning Using Automatic Subgroup Generation

Angel Cabrera, Minsuk Kahng, Fred Hohman, Jamie Morgenstern, Duen Horng (Polo) Chau

*Debugging Machine Learning Models Workshop at ICLR (Debug ML). New Orleans, LA, USA, 2019.*

[🔗 Project](#) [PDF](#) [BibTeX](#)

### W4 The Beginner's Guide to Dimensionality Reduction

Matthew Conlen, Fred Hohman

*Workshop on Visualization for AI Explainability at IEEE VIS (VISxAI). Berlin, Germany, 2018.*

[🔗 Project](#) [▶ Demo](#) [Slides](#) [Code](#) [BibTeX](#) [Best Paper, Honorable Mention](#)

### W3 Compression to the Rescue: Defending from Adversarial Attacks Across Modalities

Nilaksh Das, Madhuri Shanbhogue, Shang-Tse Chen, Fred Hohman, Siwei Li, Li Chen, Michael E. Kounavis, Duen Horng (Polo) Chau

*Project Showcase, ACM SIGKDD Conference on Knowledge Discovery and Data Mining. London, UK, 2018.*

[🔗 Project](#) [PDF](#) [Code](#) [BibTeX](#)

### W2 A Viz of Ice and Fire: Exploring Entertainment Video Using Color and Dialogue

Fred Hohman, Sandeep Soni, Ian Stewart, John Stasko

*2nd Workshop on Visualization for the Digital Humanities at IEEE VIS (VIS4DH). Phoenix, AZ, USA, 2017.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Slides](#) [Code](#) [Data](#) [BibTeX](#)

### W1 A Deep Learning Approach for Population Estimation from Satellite Imagery

Caleb Robinson, Fred Hohman, Bistra Dilkina

*1st ACM SIGSPATIAL Workshop on Geospatial Humanities (GeoHum.). Redondo Beach, CA, USA, 2017.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Code](#) [BibTeX](#) [Microsoft AI for Earth Award](#)

## Poster

### P6 The Future of Notebook Programming Is Fluid

Mary Beth Kery, Donghao Ren, Kanit Wongsuphasawat, Fred Hohman, Kayur Patel

*Extended Abstracts on ACM Human Factors in Computing Systems (CHI). Honolulu, HI, USA, 2020.*

[🔗 Project](#) [PDF](#) [BibTeX](#) [DOI](#)

### P5 CNN 101: Interactive Visual Learning for Convolutional Neural Networks

Zijie J. Wang, Robert Turko, Omar Shaikh, Haekyu Park, Nilaksh Das, Fred Hohman, Minsuk Kahng, Duen Horng (Polo) Chau

*Extended Abstracts on ACM Human Factors in Computing Systems (CHI). Honolulu, HI, USA, 2020.*

[🔗 Project](#) [PDF](#) [Video](#) [Code](#) [BibTeX](#) [DOI](#)

### P4 Massif: Interactive Interpretation of Adversarial Attacks on Deep Learning

Nilaksh Das\*, Haekyu Park\*, Zijie J. Wang, Fred Hohman, Robert Firstman, Emily Rogers, Duen Horng (Polo) Chau

*Extended Abstracts on ACM Human Factors in Computing Systems (CHI). Honolulu, HI, USA, 2020.*

[🔗 Project](#) [PDF](#) [BibTeX](#) [DOI](#) \*Authors contributed equally

### P3 NeuralDivergence: Exploring and Understanding Neural Networks by Comparing Activation Distributions

Haekyu Park, Fred Hohman, Duen Horng (Polo) Chau

*Poster, IEEE Pacific Visualization Symposium (PacificVis). Bangkok, Thailand, 2019.*

[🔗 Project](#) [▶ Demo](#) [PDF](#) [Slides](#) [Poster](#) [BibTeX](#)

### P2 3D Exploration of Graph Layers via Vertex Cloning

James Abello\*, Fred Hohman\*, Duen Horng (Polo) Chau

*Poster, IEEE Conference on Visual Analytics Science and Technology (VAST). Phoenix, AZ, USA, 2017.*

P1 **ShapeShop: Towards Understanding Deep Learning Representations via Interactive Experimentation**

Fred Hohman, Nathan Hodas, Duen Horng (Polo) Chau

*Extended Abstracts on ACM Human Factors in Computing Systems (CHI). Denver, CO, USA, 2017.*

[Project](#) [PDF](#) [Video](#) [Poster](#) [Code](#) [BibTeX](#) [DOI](#)

## Demo

D3 **Interactive Classification for Deep Learning Interpretation**

Angel Cabrera, Fred Hohman, Jason Lin, Duen Horng (Polo) Chau

*Demo, Conference on Computer Vision and Pattern Recognition (CVPR). Salt Lake City, UT, USA, 2018.*

[Project](#) [Demo](#) [PDF](#) [Video](#) [Code](#) [BibTeX](#)

D2 **mHealth Visual Discovery Dashboard**

Dezhi Fang, Fred Hohman, Peter Polack, Hillol Sarker, Minsuk Kahng, Moushumi Sharmin, Mustafa al'Absi, Duen Horng (Polo) Chau

*Demo, ACM International Joint Conference on Pervasive and Ubiquitous Computing (Ubicomp). Maui, HI, USA, 2017.*

[Project](#) [PDF](#) [Video](#) [Poster](#) [BibTeX](#) [DOI](#)

D1 **Visual Graph Query Construction and Refinement**

Robert Pienta, Fred Hohman, Acar Tamersoy, Alex Endert, Shamkant Navathe, Hanghang Tong, Duen Horng (Polo) Chau

*Demo, ACM International Conference on Management of Data (SIGMOD/PODS). Chicago, IL, USA, 2017.*

[Project](#) [PDF](#) [Video](#) [Poster](#) [BibTeX](#) [DOI](#) 

## Miscellaneous

M4 **Neo: Generalizing Confusion Matrix Visualization to Hierarchical and Multi-Output Labels**

Jochen Görtler, Fred Hohman, Dominik Moritz, Kanit Wongsuphasawat, Donghao Ren, Rahul Nair, Marc Kirchner, Kayur Patel

*arXiv:2110.12536. 2021.*

[Project](#) [PDF](#) [BibTeX](#)

M3 **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 (Polo) Chau

*arXiv:1705.02900. 2017.*

[Project](#) [PDF](#) [Code](#) [BibTeX](#)

M2 **The Effect of Numerical Parameters on Eddies in Oceanic Overflows: A Laboratory and Numerical Study**

Shanon Reckinger, Thomas Gibson, Fred Hohman, Theresa Morrison, Scott Reckinger, Mateus Carvalho *International Journal of Computational Methods and Experimental Measurements (CMEM). 2019.*

[Project](#) [PDF](#) [BibTeX](#)

M1 **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 (APS DFD). San Francisco, CA, USA, 2014.*

[Project](#) [Blog](#) [Poster](#)

## Talks

**Interactive Scalable Interfaces for Machine Learning Interpretability**

Nov. 2021 Carnegie Mellon University, Data Visualization Course Guest Lecture

Oct. 2020 University of Wisconsin-Madison, Data Visualization Course Guest Lecture

Oct. 2020 Georgia Tech Thesis Defense

May 2020 IBM Research

Apr. 2020 Microsoft Research

Apr. 2020 Apple

Apr. 2020 Autodesk Research

Dec. 2019 Georgia Tech Thesis Proposal

	<b>Summit: Scaling Deep Learning Interpretability by Visualizing Activation and Attribution Summarizations</b>
Mar. 2020	NVIDIA GTC
Oct. 2019	IEEE Visualization
	<b>TeleGam: Combining Visualization and Verbalization for Interpretable Machine Learning</b>
Oct. 2019	IEEE Visualization
	<b>Gamut: A Design Probe to Understand How Data Scientists Understand Machine Learning Models</b>
June 2019	Microsoft Machine Learning and Data Science Summit
May 2019	ACM Conference on Human Factors in Computing Systems
	<b>Explaining Machine Learning Models Using Interactive Visualization</b>
Mar. 2019	Georgia Tech School of CSE Strategic Partnership Program Summit
Apr. 2019	Georgia Tech CSE 6242 Data and Visual Analytics
Mar. 2019	Symantec Research Labs
Mar. 2019	NASA Jet Propulsion Laboratory
	<b>Atlas: Local Graph Exploration in a Global Context</b>
Mar. 2019	ACM Intelligent User Interfaces
	<b>Visual Analytics in Deep Learning: An Interrogative Survey for the Next Frontiers</b>
Jan. 2019	Carnegie Mellon University
Oct. 2018	University of Georgia
Oct. 2018	IEEE Visualization
	<b>The Beginner's Guide to Dimensionality Reduction</b>
Oct. 2018	VISxAI Workshop at IEEE Visualization
	<b>Comparing Interactive Local and Global Explanation Paradigms for Human-assisted Machine Learning Tasks</b>
July 2018	Microsoft Research
	<b>Graph Playgrounds: 3D Exploration of Graph Layers via Vertex Cloning</b>
Dec. 2017	AT&T Research Labs Graduate Student Symposium
	<b>A Viz of Ice and Fire: Exploring Entertainment Video Using Color and Dialogue</b>
Oct. 2017	2nd Workshop on Visualization for the Digital Humanities at IEEE Visualization
	<b>Constellation: Visualizing Cybersecurity in Real Time</b>
Aug. 2017	NASA Jet Propulsion Laboratory
Aug. 2017	California Institute of Technology
	<b>Visualizing Learned Semantics with Deep Learning</b>
Nov. 2016	Georgia Tech Ph.D. Qualifying Oral Exam
	<b>Drawing Semantics with Deep Learning</b>
2016	Pacific Northwest National Laboratory
	<b>3D Printing The Trefoil Knot And Its Pages</b>
Mar. 2015	UGA Center for Undergraduate Research Symposium, included hands-on demo
	<b>Experimental and Numerical Studies of Oceanic Overflow</b>
June 2015	AMS Conference on Atmospheric and Oceanic Fluid Dynamics
Jan. 2015	Joint Mathematics Meeting
Nov. 2014	APS 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
	<b>3D Printing in Topology</b>
Mar. 2014	UGA Center for Undergraduate Research Symposium, included hands-on demo

## Press

- Nov. 2020 "How interactive, visual storytelling helps readers better retain information," Storybench
- Nov. 2020 "Dense Discovery Issue 112," Dense Discovery
- Oct. 2020 "Numlock Sunday: Halden Lin and Aatish Bhatia on the Parametric Press Climate Issue," Numlock News
- Oct. 2020 "Web Archives as Digital Publications / Digital Publications as Web Archives," Webrecorder
- Oct. 2020 "Interactive data essays on climate change," Flowing Data
- July 2020 "Python in Visual Studio Code - VSCode Features You Need to Know," Tech With Tim
- July 2020 "Python in Visual Studio Code - July 2020 Release," Microsoft Developer Blog
- June 2020 "How Do Neural Networks Learn?," Two Minute Papers
- Mar. 2020 "Visualizing Fairness in Machine Learning," Data Stories Podcast
- Nov. 2019 "The Interactive News Platform for Everyone," Stack Overflow Blog
- Oct. 2019 "Is this the dynamic web we were promised?," Hanselminutes Podcast
- June 2019 "Myth of the impartial machine," Flowing Data
- May 2019 "The Secret Life of a JPEG," Fast Company
- Dec. 2018 "'Human Rights' May Help Shape Artificial Intelligence in 2019," Georgia Tech, College of Computing
- Dec. 2018 "Designers, Programmers, and Researchers Join Forces to Create a New Kind of Digital Magazine Called the Parametric Press," Georgia Tech, College of Computing
- June 2018 "Georgia Tech Teams up with Intel to Protect Artificial Intelligence from Malicious Attacks Using SHIELD," Georgia Tech, College of Computing
- 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
- Spring 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
- Apr. 2014 "Mathematics with 3D Printing," Sketches of Topology

## Teaching

- Spring 2019 **Graduate Teaching Assistant**  
*Georgia Institute of Technology, Atlanta, GA*  
Information Visualization (CS 4460), Instructor: Alex Endert  
Designed homeworks, held weekly office hours, and mentored student team projects for Information Visualization (CS 4460), an undergraduate course with 134 students enrolled.
- Spring 2017 **Graduate Teaching Assistant**  
*Georgia Institute of Technology, Atlanta, GA*  
Data and Visual Analytics (CSE 6242 / CX 4242), Instructor: Duen Horng (Polo) Chau  
Designed homeworks, held weekly office hours, and mentored student team projects for Data and Visual Analytics (CSE 6242 / CX 4242), a graduate course with 214 students enrolled.
- 2014 – 2015 **Student Notetaker**  
*University of Georgia, Athens, GA*  
Generated notes for undergraduate mathematics and physics courses for students with disabilities.
- 2012 **Tutor**  
*University of Georgia, Athens, GA*  
Specialized in tutoring calculus to undergraduates.

## Mentoring

- Spring + Summer 2021 **Alex Bäuerle** at Apple  
*Ph.D. in Information Technology, Ulm University*  
Reusable, exploratory, and sharable data science components

Summer 2021	<b>Angel Alexander Cabrera</b> at Apple <i>Ph.D. in Human-computer Interaction, Carnegie Mellon University</i> Reusable, exploratory, and sharable data science components
Summer 2020	<b>Jochen Görtler</b> at Apple <i>Ph.D. in Computer Science, University of Konstanz</i> Interactive confusion matrices and visualization for error analysis in machine learning
Summer 2020	<b>Aspen Hopkins</b> at Apple <i>Ph.D. in Computer Science, Massachusetts Institute of Technology</i> Designing data and proactive data collection for machine learning
Fall 2020 — Fall 2019	<b>Omar Shaikh</b> <i>B.S. in Computer Science, Georgia Institute of Technology</i> Visualization for machine learning education 🔗 Sigma Xi Best Undergraduate Research Award, Georgia Institute of Technology
Fall 2020 — Fall 2019	<b>Robert Turko</b> <i>B.S. in Computer Science, Georgia Institute of Technology</i> Visualization for machine learning education 🔗 Outstanding Senior Award, College of Computing, Georgia Institute of Technology
Spr. 2020 — Fall 2019	<b>Rob Firstman</b> <i>B.S. in Computer Science, Georgia Institute of Technology</i> Visualization for deep learning interpretability
Spr. 2020 — Spr. 2019	<b>Will Epperson</b> <i>B.S. in Computer Science, Georgia Institute of Technology</i> Visual analytics for machine learning fairness 🔗 Stamps President's Scholar Now: PhD Student (HCI) at Carnegie Mellon University
Spr. 2020 — Spr. 2019	<b>Siwei Li</b> <i>B.S. in Computer Science, Georgia Institute of Technology</i> Visual graph analytics 🔗 Outstanding Undergraduate Researcher, College of Computing, Georgia Institute of Technology 🔗 President's Undergraduate Research Award Now: Software Engineer II at Google
Spr. 2019 — Spr. 2018	<b>Angel Alexander Cabrera</b> <i>B.S. in Computer Science, Georgia Institute of Technology</i> Visual analytics for machine learning fairness, interactive classification for deep learning 🔗 National Science Foundation Graduate Research Fellowship Program (NSF GRFP) 🔗 Love Family Foundation Scholarship (most outstanding graduating senior), Georgia Institute of Technology 🔗 Stamps President's Scholar Now: PhD Student (HCI) at Carnegie Mellon University
Spr. 2018 — Fall 2016	<b>Dezhi Fang</b> <i>B.S. in Computer Science, Georgia Institute of Technology</i> Interactive visual motif discovery 🔗 Outstanding Undergraduate Researcher, College of Computing, Georgia Institute of Technology 🔗 Faculty Materials, Supplies, and Travel Grants for Undergraduate Research 🔗 Awarded President's Undergraduate Research Travel Award Now: Software Development Engineer at Airbnb
Spr. 2018 — Fall 2017	<b>Prasenjeet Biswal</b> <i>M.S. in Computer Science, Georgia Institute of Technology</i> Visualization for deep learning attribution Now: Software Development Engineer at Oath

## Grants and Funding

2018 — 2021	<b>Understanding Deep Neural Networks Through Attribution and Interactive Experimentation</b> NSTRF: NASA Space Technology Research Fellowship Co-PIs: Duen Horng (Polo) Chau Funded \$80,000/year for 3 years
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2017 – 2018	<b>Deep Learning for Fine-scale Population Maps</b> Microsoft Azure for Research Award: AI for Earth Co-PIs: Caleb Robinson, Bistra Dilkina Funded \$15,000
Fall 2014	<b>3D Printing the Trefoil Knot and its Pages</b> UGA CURO Research Assistantship Co-PIs: David Gay Funded \$1,000
<h2>Interactive Articles</h2>	
December 2021 <b>Interpretable Adaptive Optimization</b> on Apple ML Research Algorithms for measuring and understanding the best user experiences	
October 2021 <b>On-device Panoptic Segmentation for Camera Using Transformers</b> on Apple ML Research Efficient pixel-level understanding for the Camera	
September 2021 <b>Improving Neural Network Subspaces</b> on Apple ML Research Training regions in neural network subspaces to find high-accuracy solutions	
August 2021 <b>Learning to Generate Radiance Fields of Indoor Scenes</b> on Apple ML Research Developing new generative models that can learn probability distributions over realistic and unconstrained indoor scenes	
July 2021 <b>Recognizing People in Photos Through Private On-Device Machine Learning</b> on Apple ML Research Improving the Photos experience by identifying people who matter most to us in situations where previously impossible	
May 2021 <b>Making Mobile Applications Accessible with Machine Learning</b> on Apple ML Research Creating accessibility metadata for mobile applications from pixels	
October 2020 <b>Parametric Press, Issue 02: The Climate Issue</b> Matthew Conlen, Fred Hohman, Sara Stalla, Andrew Sass Interactively analyze our climate's past, present, and future	
<p><b>Your Personal Carbon History</b> by Aatish Bhatia Why you've lived through a period of unprecedented carbon emissions.</p> <p><b>The Corporations Behind Climate Change</b> by Geoffrey Litt, Seth Thompson Seven simple demands to hold fossil fuel companies accountable.</p> <p><b>Tiny Algae and the Political Theater of Planting One Trillion Trees</b> by Benjamin Cooley To fight climate change, it's time to start thinking big by thinking small.</p> <p><b>Drought of the Sinking Delta</b> by Christina Orieschnig Things are out of joint in the delta of the Mekong, Southeast Asia's largest river.</p> <p><b>The Hidden Cost of Digital Consumption</b> by Halden Lin, Aishwarya Nirmal, Shobhit Hathi, Lilian Liang Digital doesn't mean green. How much carbon dioxide was released when you loaded this article?</p>	
May 2019 <b>Parametric Press, Issue 01: Science + Society</b> Matthew Conlen, Fred Hohman, Sara Stalla, Victoria Uren, Andrew Sass An experimental, born-digital magazine dedicated to showcasing the expository power that's possible when the audio, visual, and interactive capabilities of dynamic media are effectively combined, ★ Top of Hacker News, twice	
<p><b>Unraveling the JPEG</b> by Omar Shehata JPEG images are everywhere, but behind them are algorithms that remove details that are imperceptible to the human eye.</p> <p><b>The Myth of the Impartial Machine</b> by Alice Feng, Shuyan Wu Machine learning models reproduce inequalities within data they're fed. Can programmers free their models from prejudice?</p> <p><b>Data Science for Fair Housing</b> by Alyson Powell Key In Atlanta, how effective is a new nonprofit's plan to resist displacement by supporting the city's most vulnerable residents?</p> <p><b>Flatland Follies: An Adjunct Simulator</b> by James McGirk Play your way through the daily struggles of teaching and preserving art at a declining college.</p> <p><b>On Particle Physics</b> by Riccardo Maria Bianchi A CERN particle physicist walks through the history and science of particle physics, and why you should care about it.</p> <p><b>Anything That Flies, On Anything That Moves</b> by Megan Vo Dig into data of over two million bombings during a covert US assault on Southeast Asian countries from the 1960s and 70s.</p>	
November 2018	<b>Blueberry Pancakes</b> Caleb Robinson, Fred Hohman

July 2018	<b>The Beginner's Guide to Dimensionality Reduction</b> Matthew Conlen, Fred Hohman Explore the methods data scientists use to visualize high-dimensional data, ★ <b>VISxAI Best Paper, Honorable Mention</b>
June 2018	<b>The Math of Card Shuffling</b> Fred Hohman Riffling from factory order to complete randomness, ★ <b>Top of Hacker News, twice</b>
October 2017	<b>A Viz of Ice and Fire</b> Fred Hohman, Sandeep Soni, Ian Stewart, John Stasko Exploring and visualizing Game of Thrones using color and dialogue

## Service

### Organizer

Workshop on Visualization for AI Explainability (**VISxAI**) at IEEE VIS 2020, 2019

### Program Committee

ACM International Conference on Intelligent User Interfaces (**IUI**) 2022, 2021, 2020, 2019

Debugging Machine Learning Models Workshop (**DebugML**) at ICLR 2019

Symposium on Visualization in Data Science (**VDS**) at IEEE VIS 2018

Workshop on Visualization for AI Explainability (**VISxAI**) at IEEE VIS 2018

Workshop on Interactive Data Exploration and Analytics (**IDEA**) at KDD 2018

### Reviewer

ACM Conference on Human Factors in Computing Systems (**CHI**) 2022, 2021, 2020, 2019, 2018, 2017

Rethinking ML Papers at ICLR 2021

ACM Designing Interactive Systems (**DIS**) 2021

ACM Transactions on Interactive Intelligent Systems (**TIIS**) 2021

IEEE Pacific Visualization Conference (**PacificVis**) 2021

IEEE Visualization (**VIS**) 2021, 2020, 2019, 2018, 2017

ACM User Interface Software and Technology Symposium (**UIST**) 2021, 2020

Symposium on Visualization in Data Science (**VDS**) at IEEE VIS 2020, 2019, 2018

Distill Research Journal (**Distill**) 2019

ACM SIGKDD Conference on Knowledge Discovery and Data Mining (**KDD**) 2019, 2017

ACM Conference on Computer Supported Cooperative Work and Social Computing (**CSCW**) 2019

Human-Centered Machine Learning Perspectives Workshop (**HCMLP**) at CHI 2019

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

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

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

### Institutional

Georgia Tech CSE Graduate Student Association, Vice President, 2018 – 2020

Georgia Tech CSE Chair Search Committee, 2019 – 2020

### 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**)

## Design

2017 – 2018 **IDEA Workshop Proceedings Cover (2017, 2018)**

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

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

Aug. 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

Aug. 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

## References

**Dr. Polo Chau**, Associate Professor

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[cc.gatech.edu/~dchau/](http://cc.gatech.edu/~dchau/)

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**Dr. Scott Davidoff**, Senior Manager

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**Dr. Steven Drucker**, Partner and Research Manager

Visualization and Interactive Data Analysis Group

*Microsoft Research*

[microsoft.com/en-us/research/people/sdrucker](http://microsoft.com/en-us/research/people/sdrucker)

**Dr. Nathan Hodas**, Senior Research Scientist

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