

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 **mage: 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.

[Project](#) [PDF](#) [Video](#) [Poster](#) [BibTeX](#) *Authors contributed equally

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](#) [Best Demo, Honorable Mention](#)

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

Summit: Scaling Deep Learning Interpretability by Visualizing Activation and Attribution

Summarizations

Mar. 2020 NVIDIA GTC

Oct. 2019 IEEE Visualization

TeleGam: Combining Visualization and Verbalization for Interpretable Machine Learning

Oct. 2019 IEEE Visualization

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

June 2019 Microsoft Machine Learning and Data Science Summit

May 2019 ACM Conference on Human Factors in Computing Systems

Explaining Machine Learning Models Using Interactive Visualization

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

Atlas: Local Graph Exploration in a Global Context

Mar. 2019 ACM Intelligent User Interfaces

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

Jan. 2019 Carnegie Mellon University

Oct. 2018 University of Georgia

Oct. 2018 IEEE Visualization

The Beginner's Guide to Dimensionality Reduction

Oct. 2018 VISxAI Workshop at IEEE Visualization

Comparing Interactive Local and Global Explanation Paradigms for Human-assisted Machine Learning Tasks

July 2018 Microsoft Research

Graph Playgrounds: 3D Exploration of Graph Layers via Vertex Cloning

Dec. 2017 AT&T Research Labs Graduate Student Symposium

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

Oct. 2017 2nd Workshop on Visualization for the Digital Humanities at IEEE Visualization

Constellation: Visualizing Cybersecurity in Real Time

Aug. 2017 NASA Jet Propulsion Laboratory

Aug. 2017 California Institute of Technology

Visualizing Learned Semantics with Deep Learning

Nov. 2016 Georgia Tech Ph.D. Qualifying Oral Exam

Drawing Semantics with Deep Learning

2016 Pacific Northwest National Laboratory

3D Printing The Trefoil Knot And Its Pages

Mar. 2015 UGA Center for Undergraduate Research Symposium, included hands-on demo

Experimental and Numerical Studies of Oceanic Overflow

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

3D Printing in Topology

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	<p>Graduate Teaching Assistant <i>Georgia Institute of Technology, Atlanta, GA</i> 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.</p>
Spring 2017	<p>Graduate Teaching Assistant <i>Georgia Institute of Technology, Atlanta, GA</i> 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.</p>
2014 – 2015	<p>Student Notetaker <i>University of Georgia, Athens, GA</i> Generated notes for undergraduate mathematics and physics courses for students with disabilities.</p>
2012	<p>Tutor <i>University of Georgia, Athens, GA</i> Specialized in tutoring calculus to undergraduates.</p>

Mentoring

Spring + Summer 2021	<p>Alex Bäuerle at Apple <i>Ph.D. in Information Technology, Ulm University</i> Reusable, explorable, and sharable data science components</p>
Summer 2021	<p>Angel Alexander Cabrera at Apple</p>

- Summer 2021 **Angel Alexander Cabrera** at Apple
Ph.D. in Human-computer Interaction, Carnegie Mellon University
 Reusable, explorable, and sharable data science components
- Summer 2020 **Jochen Görtler** at Apple
Ph.D. in Computer Science, University of Konstanz
 Interactive confusion matrices and visualization for error analysis in machine learning
- Summer 2020 **Aspen Hopkins** at Apple
Ph.D. in Computer Science, Massachusetts Institute of Technology
 Designing data and proactive data collection for machine learning
- Fall 2020 — Fall 2019 **Omar Shaikh**
B.S. in Computer Science, Georgia Institute of Technology
 Visualization for machine learning education
 🏆 Sigma Xi Best Undergraduate Research Award, Georgia Institute of Technology
- Fall 2020 — Fall 2019 **Robert Turko**
B.S. in Computer Science, Georgia Institute of Technology
 Visualization for machine learning education
 🏆 Outstanding Senior Award, College of Computing, Georgia Institute of Technology
- Spr. 2020 — Fall 2019 **Rob Firstman**
B.S. in Computer Science, Georgia Institute of Technology
 Visualization for deep learning interpretability
- Spr. 2020 — Spr. 2019 **Will Epperson**
B.S. in Computer Science, Georgia Institute of Technology
 Visual analytics for machine learning fairness
 🏆 Stamps President's Scholar
 Now: PhD Student (HCI) at Carnegie Mellon University
- Spr. 2020 — Spr. 2019 **Siwei Li**
B.S. in Computer Science, Georgia Institute of Technology
 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 **Angel Alexander Cabrera**
B.S. in Computer Science, Georgia Institute of Technology
 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 **Dezhi Fang**
B.S. in Computer Science, Georgia Institute of Technology
 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 **Prasenjeet Biswal**
M.S. in Computer Science, Georgia Institute of Technology
 Visualization for deep learning attribution
 Now: Software Development Engineer at Oath

Grants and Funding

- 2018 — 2021 **Understanding Deep Neural Networks Through Attribution and Interactive Experimentation**
 NSTRF: NASA Space Technology Research Fellowship
 Co-PIs: Duen Horng (Polo) Chau
 Funded \$80,000/year for 3 years

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

Fall 2014 **3D Printing the Trefoil Knot and its Pages**
UGA CURO Research Assistantship
Co-PIs: David Gay
Funded \$1,000

Interactive Articles

- January 2022 **Modeling the Impact of User Mobility on COVID-19 Infection Rates Over Time** on Apple ML Research
Developing flexible, interpretable models to assess how the effect of mobility changes
- December 2021 **Interpretable Adaptive Optimization** on Apple ML Research
Algorithms for measuring and understanding the best user experiences
- October 2021 **On-device Panoptic Segmentation for Camera Using Transformers** on Apple ML Research
Efficient pixel-level understanding for the Camera
- September 2021 **Improving Neural Network Subspaces** on Apple ML Research
Training regions in neural network subspaces to find high-accuracy solutions
- August 2021 **Learning to Generate Radiance Fields of Indoor Scenes** on Apple ML Research
Developing new generative models that can learn probability distributions over realistic and unconstrained indoor scenes
- July 2021 **Recognizing People in Photos Through Private On-Device Machine Learning** on Apple ML Research
Improving the Photos experience by identifying people who matter most to us in situations where previously impossible
- May 2021 **Making Mobile Applications Accessible with Machine Learning** on Apple ML Research
Creating accessibility metadata for mobile applications from pixels
- October 2020 **Parametric Press, Issue 02: The Climate Issue**
Matthew Conlen, Fred Hohman, Sara Stalla, Andrew Sass
Interactively analyze our climate's past, present, and future
- Your Personal Carbon History** by Aatish Bhatia
Why you've lived through a period of unprecedented carbon emissions.
 - The Corporations Behind Climate Change** by Geoffrey Litt, Seth Thompson
Seven simple demands to hold fossil fuel companies accountable.
 - Tiny Algae and the Political Theater of Planting One Trillion Trees** by Benjamin Cooley
To fight climate change, it's time to start thinking big by thinking small.
 - Drought of the Sinking Delta** by Christina Orieschnig
Things are out of joint in the delta of the Mekong, Southeast Asia's largest river.
 - The Hidden Cost of Digital Consumption** by Halden Lin, Aishwarya Nirmla, Shobhit Hathi, Lilian Liang
Digital doesn't mean green. How much carbon dioxide was released when you loaded this article?
- May 2019 **Parametric Press, Issue 01: Science + Society**
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](#)
- Unraveling the JPEG** by Omar Shehata
JPEG images are everywhere, but behind them are algorithms that remove details that are imperceptible to the human eye.
 - The Myth of the Impartial Machine** by Alice Feng, Shuyan Wu
Machine learning models reproduce inequalities within data they're fed. Can programmers free their models from prejudice?
 - Data Science for Fair Housing** 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?
 - Flatland Follies: An Adjunct Simulator** by James McGirk
Play your way through the daily struggles of teaching and preserving art at a declining college.
 - On Particle Physics** by Riccardo Maria Bianchi
A CERN particle physicist walks through the history and science of particle physics, and why you should care about it.
 - Anything That Flies, On Anything That Moves** 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.

- November 2018 **Blueberry Pancakes**
Caleb Robinson, Fred Hohman
A toy algorithms problem
- July 2018 **The Beginner's Guide to Dimensionality Reduction**
Matthew Conlen, Fred Hohman
Explore the methods data scientists use to visualize high-dimensional data, ★ [VISxAI Best Paper, Honorable Mention](#)
- June 2018 **The Math of Card Shuffling**
Fred Hohman
Riffing from factory order to complete randomness, ★ [Top of Hacker News, twice](#)
- October 2017 **A Viz of Ice and Fire**
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 2022, 2021, 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

Visualization Meets AI at PacificVis 2022

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
School of Computational Science and Engineering
Georgia Institute of Technology
cc.gatech.edu/~dchau/

Dr. Alex Endert, Associate Professor
School of Interactive Computing
Georgia Institute of Technology
va.gatech.edu/endert

Dr. Scott Davidoff, Senior Manager
Human-Centered Design Group
NASA Jet Propulsion Lab
scottdavidoff.com

Dr. Steven Drucker, Partner and Research Manager
Visualization and Interactive Data Analysis Group
Microsoft Research
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Dr. Nathan Hodas, Senior Research Scientist
Data Sciences and Analytics Group
Pacific Northwest National Laboratory
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