







# Fred Hohman

Research Scientist (*HCI* + *ML*)

I design and develop **interactive interfaces** to help people **understand machine learning** models and 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.

 fredhohman.com  
 fredhohman@gatech.edu  
 CV PDF

 @fredhohman  
 @fredhohman  
 Google Scholar

## Education

Dec. 2020 — Aug. 2015

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

Georgia Institute of Technology, Atlanta, GA

Thesis: *Interactive Scalable Interfaces for Machine Learning Interpretability*

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

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

 ACM SIGCHI Outstanding Dissertation Award

 Georgia Tech College of Computing Dissertation Award

 [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

2022 **ACM SIGCHI Outstanding Dissertation Award**

For my dissertation "Interactive Scalable Interfaces for Machine Learning Interpretability"

2022 **Georgia Tech College of Computing Dissertation Award**

For my dissertation "Interactive Scalable Interfaces for Machine Learning Interpretability"

2022 **Best Paper at ACM CHI Conference**

For "Neo: Generalizing Confusion Matrix Visualization to Hierarchical and Multi-Output Labels"

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

2011

#### Mission of Blessed Trinity: Artistic Sensibility

One of two students to receive the Mission Statement award upon high-school graduation

## Publications

### Selected: Latest & Greatest

#### Symphony: Composing Interactive Interfaces for Machine Learning

Alex Bäuerle\*, Ángel Alexander Cabrera\*, Fred Hohman, Megan Maher, David Koski, Xavier Suau, Titus Barik, Dominik Moritz

*ACM Conference on Human Factors in Computing Systems (CHI). New Orleans, LA, USA, 2022.*

→ More coming soon! [Project](#) [PDF](#) [BibTeX](#) [DOI](#) \*Authors contributed equally

#### 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

*ACM Conference on Human Factors in Computing Systems (CHI). New Orleans, LA, USA, 2022.*

→ More coming soon! [Project](#) [Demo](#) [PDF](#) [Code](#) [BibTeX](#) [DOI](#) 🏆 Best Paper

#### 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](#) [Recording](#) [Code](#) [BibTeX](#) [DOI](#) ★ Top 4 TVCG Papers invited to SIGGRAPH

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

- C13 **Symphony: Composing Interactive Interfaces for Machine Learning**  
Alex Bäuerle\*, Ángel Alexander Cabrera\*, Fred Hohman, Megan Maher, David Koski, Xavier Suau, Titus Barik, Dominik Moritz  
*ACM Conference on Human Factors in Computing Systems (CHI). New Orleans, LA, USA, 2022.*  
→ [More coming soon!](#) [Project](#) [PDF](#) [BibTeX](#) [DOI](#) \*Authors contributed equally
- C12 **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  
*ACM Conference on Human Factors in Computing Systems (CHI). New Orleans, LA, USA, 2022.*  
→ [More coming soon!](#) [Project](#) [Demo](#) [PDF](#) [Code](#) [BibTeX](#) [DOI](#) 🏆 [Best Paper](#)
- 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**  
Ángel Alexander 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**



## 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** ★ **Deployed in VS Code**

### 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**

Ángel Alexander 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**

Ángel Alexander 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

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, Scott Reckinger, Mateus Carvalho

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

July 2018	Microsoft Research
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### Graph Playgrounds: 3D Exploration of Graph Layers via Vertex Cloning

Dec. 2017	AT&T Research Labs Graduate Student Symposium
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### 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
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### 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
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### Drawing Semantics with Deep Learning

2016	Pacific Northwest National Laboratory
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### 3D Printing The Trefoil Knot And Its Deriva

### 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 **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, explorable, and sharable data science components

Summer 2021

**Ángel 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

**Ángel 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

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👤 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 Nirmal, 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

an experimental, semi-digital magazine dedicated to showcasing the expressive 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

ACM Conference on Fairness, Accountability, and Transparency (**FAccT**) 2022

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**



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

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

**Dr. Scott Davidoff**, Senior Manager  
Human-Centered Design Group  
*NASA Jet Propulsion Lab*  
[scottdavidoff.com](http://scottdavidoff.com)

**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  
Data Sciences and Analytics Group  
*Pacific Northwest National Laboratory*  
[signatures.pnnl.gov/bios/nathan-hodas](http://signatures.pnnl.gov/bios/nathan-hodas)