

# Haekyu Park

CS PhD student at Georgia Tech

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I'm a Ph.D. student in Computer Science at Georgia Tech, working with Dr. Polo Chau. My research goal is to enhance **machine learning interpretability**, to promote trust in machine learning models and broaden access for the technologies. My research thrusts are:

- Scalable visual discovery for trustworthy and interpretable machine learning
- Actionable insights to protect and troubleshoot models
- Broader machine learning access and education opportunities

Specifically, I design and develop interactive visual interfaces which help people easily interact with machine learning models. I am a member of the Polo Club of Data Science at Georgia Tech. I have been fortunate to work with amazing researchers, engineers, and scientists at  **NVIDIA** and  **intel**.

## Education

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### Georgia Institute of Technology

Ph.D., Computer Science

Advisor: Dr. Polo Chau

Aug 2018 - Present

### Seoul National University

B.S., Computer Science and Engineering

Graduated with honors (Cum Laude)

Mar 2012 - Aug 2017

## Research Experience

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### Research Intern

Jun 2021 - Aug 2021

Microsoft Research, Seattle, WA

Mentor: Gonzalo Ramos

### AI Infrastructure Software Intern

May 2020 - Jul 2020

NVIDIA, Santa Clara, CA

Mentor: Joe Eaton, Brad Rees, Bartley Richardson

Developed a visual graph analytics, allowing for interactively running multiple graph algorithms in real-time on large graphs.

Leveraged GPU acceleration for both data analysis and rendering side

### Data Science Intern

May 2019 - Aug 2019

NVIDIA, Austin, TX

Mentor: Bartley Richardson, Brad Rees, Joe Eaton

Internship results are integrated into NVIDIA RAPIDS team's KDD 2019 NVIDIA RAPIDS tutorial

### Graduate Research Assistant

Aug 2018 - Present

Georgia Institute of Technology, Atlanta, GA

## Honors and Awards

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**J.P.Morgan PhD Fellowship** 2021  
For my PhD Work "Human-centered AI: Interactive Scalable Interfaces for Trustworthy and Safe AI"

**"Thank a Teacher" Award** 2019  
Center of Teaching & Learning (CTL), Georgia Institute of Technology

**Moon-Jung Chung Scholarship** 2019  
KOCSEA (The Korean Computer Scientists and Engineers Association in America)

**National Scholarship for Science and Engineering** 2015  
National Scholarship for Science and Engineering

## Grants and Funding

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**WiML Travel Funding** 2019  
\$550 Travel Funding  
Women in Machine Learning Workshop, co-located with NeurIPS

**Amazon AWS Research Grant** 2018  
Funded \$5,000 in AWS cloud credits  
Co-PIs: Nilaksh Das, Scott Freitas, Duen Horng Chau

## Publications

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**RECAST: Enabling User Recourse and Interpretability of Toxicity Detection Models with Interactive Visualization**  
Austin P. Wright, Omar Shaikh, [Haekyu Park](#), Will Epperson, Muhammed Ahmed, Stephane Pinel, Duen Horng Chau, Diyi Yang  
24th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW), 2021.

📄 Paper

**SkeletonVis: Interactive Visualization for Understanding Adversarial Attacks on Human Action Recognition Models**  
[Haekyu Park](#), Zijie J. Wang, Nilaksh Das, Anindya S. Paul, Pruthvi Perumalla, Zhiyan Zhou, Duen Horng Chau  
AAAI, Demo, Virtual, 2021.  
▶ Demo 📄 Paper

**Bluff: Interactively Deciphering Adversarial Attacks on Deep Neural Networks**  
Nilaksh Das\*, [Haekyu Park](#)\*, Zijie J. Wang, Fred Hohman, Robert Firstman, Emily Rogers, Duen Horng Chau  
IEEE Visualization Conference, (VIS), Salt Lake City, UT, USA, 2020.  
\* Authors contributed equally.  
▶ Demo 📄 Paper

**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 Chau  
IEEE Conference on Visual Analytics Science and Technology, (VAST), Salt Lake City, UT, USA, 2020.  
▶ Demo 📄 Paper

**A Comparative Analysis of Industry Human-AI Interaction Guidelines**

Austin P. Wright, Zijie J. Wang, [Haekyu Park](#), Grace Guo, Fabian Sperrle, Mennatallah El-Assady, Alex Endert, Daniel Keim, Duen Horng Chau

*IEEE Visualization Conference, Workshop on Trust and Expertise in Visual Analytics (TREX), Salt Lake City, UT, USA, 2020.*

[Paper](#)

### **Argo Lite: Open-Source Interactive Graph Exploration and Visualization in Browsers**

Siwei Li, Zhiyan Zhou, Anish Upadhyay, Omar Shaikh, Scott Freitas, [Haekyu Park](#), Zijie J. Wang, Susanta Routray, Matthew Hull, Duen Horng Chau

*ACM International Conference on Information and Knowledge Management, (CIKM), Resource Track, Online, 2020.*

[▶ Demo](#) [Paper](#)

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

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

*ACM CHI Conference on Human Factors in Computing Systems (CHI), Late-Breaking Works, Honolulu, Hawaii, USA, 2020.*

\* Authors contributed equally.

[Paper](#)

### **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 Chau

*ACM CHI Conference on Human Factors in Computing Systems (CHI), Late-Breaking Works, Honolulu, Hawaii, USA, 2020.*

[Paper](#)

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

Fred Hohman, [Haekyu Park](#), Caleb Robinson, Duen Horng Chau

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

[▶ Demo](#) [Paper](#)

### **Visual Analytics for Interpretability on Deep Neural Networks**

[Haekyu Park](#), Fred Hohman, Nilaksh Das, Caleb Robinson, Duen Horng Chau

*Women in Machine Learning Workshop (WiML), co-located with NeurIPS 2019, Vancouver, BC, Canada, 2019.*

### **MLsploit: A Framework for Interactive Experimentation with Adversarial Machine Learning Research**

Nilaksh Das, Siwei Li, Chanil Jeon, Jinho Jung, Shang-Tse Chen, Carter Yagemann, Evan Downing, [Haekyu Park](#), Evan Yang, Li Chen, Michael Kounavis, Ravi Sahita, David Durham, Scott Buck, Duen Horng Chau, Taesoo Kim, Wenke Lee

*ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), KDD Project, Anchorage, Alaska, USA, 2019.*

[▶ Demo](#) [Paper](#)

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

[Haekyu Park](#), Fred Hohman, Duen Horng Chau

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

[▶ Demo](#) [Paper](#)

### **SIDE: Representation Learning in Signed Directed Networks**

Junghwan Kim, [Haekyu Park](#), Ji-Eun Lee, U Kang

*The Web Conference (Previously known as WWW, World Wide Web Conference), Lyon, France, 2018.*

[🌐 Webpage](#) [Paper](#)

### **A Comparative Study of Matrix Factorization and Random Walk with Restart in Recommender Systems**

[Haekyu Park](#), Jinhong Jung, U Kang

*IEEE International Conference on Big Data (BigData), Boston, MA, USA, 2017.*

[🌐 Webpage](#) [Paper](#)

## **Open-Source Research Projects**

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

2020

Keywords: Deep Learning Education, Interactive Visualization, Interactive Animation

Interactive visual system for learning Convolutional Neural Networks.

It was published at IEEE VIS (VAST, TVCG), 2020.

Zijie Jay Wang, Robert Turko, Omar Shaikh, [Haekyu Park](#), Nilaksh Das, Fred Hohman, Minsuk Kahng, Duen Horng (Polo) Chau

► Demo ⚙ Top of Github Trending ★ 4,905 Github stars (as of Oct 2020)

### Bluff: Interactively Deciphering Adversarial Attacks on Deep Neural Networks

2020

Keywords: Adversarial Attacks, Neural Network Interpretability, Activation Pathways, Interactive Visual Analytics  
Interactive system for visualizing, characterizing, and deciphering adversarial attacks on vision-based neural networks.  
It was published at IEEE VIS, 2020.

Nilaksh Das\*, Haekyu Park\*, Zijie Jay Wang, Fred Hohman, Robert Firstman, Emily Rogers, Duen Horng Chau  
(\* Equal Contribution)

► Demo

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

2019

Keywords: Neural Network Interpretability, Attribution Graph, Interactive Visual Analytics  
Interactive visualization that scalably summarizes what features a deep learning model has learned and how those features interact to make predictions.

It was published at IEEE VIS (VAST, TVCG), 2019.

Fred Hohman, Haekyu Park, Caleb Robinson, Duen Horng Chau

► Demo

### MLsploit: A Framework for Interactive Experimentation with Adversarial Machine Learning Research

2019

Keywords: Adversarial Attacks and Defenses for Machine Learning Models, Interactive Experimentation  
User-friendly, cloud-based system that enables researchers and practitioners to rapidly evaluate and compare state-of-the-art adversarial attacks and defenses for machine learning (ML) models.

It was published at a KDD 2019 Project Showcase.

► Demo

### SIDE: Representation Learning in Signed Directed Networks

2018

Keywords: Network Embedding, Signed Weighted Directed Graph

General network embedding method that represents both sign and direction of edges in the embedding space.

It was published at the Web Conference (WWW), 2018.

🌐 Webpage

### A Comparative Study of Matrix Factorization and Random Walk with Restart in Recommender Systems

2017

Keywords: Recommender System, Matrix Factorization (MF), Random Walk with Restart (RWR)

We provide a comparative study of MF and RWR, which are the most representative methods for recommender systems.

It was published at IEEE Big Data, 2017.

🌐 Webpage

## Other Projects

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### Accelerated Data Science Teaching Kit for Educators

2021

Keywords: GPU-accelerated Data Science, RAPIDS, NVIDIA Teaching Kits

The first version of its GPU Accelerated Data Science Teaching Kit for educators.

Presented at NVIDIA's Graphics Technology Conference (GTC) 2021: Bridging Data Analytics and Machine Learning Skill Gaps with RAPIDS and the New Accelerated Data Science Teaching Kit for University Educators [S31763]

🌐 Data Science Teaching Kit 🌐 Blog

### DARPA Guaranteeing AI Robustness against Deception (GARD)

2020-2021

Keywords: Defenses for Adversarial Examples, Robustness, Defense using Semantic Coherence

We develop defenses for adversarial attacks on object detector for both RGB images and single-camera video. We augment this object detector to support spatial, temporal, semantic coherence in videos.

### RAPIDS and Cybersecurity: A Network Use Case

2019

Keywords: RAPIDS, NVIDIA, GPU-acceleration, Graph, Personalized Page Rank

We showcase an approach to flagging anomalous network communications in a large graph using a combination of structural graph features and graph analytics, running end-to-end in RAPIDS.

Presented at cybersecurity use case notebook.

### **Recommender System for Videos on Oksusu Application**

2017

Keywords: Deep Learning, Sequence/Word Embedding, Approx. k-NN, Heterogeneous Features

Our system recommends videos to users of Oksusu application, handling massive data on users' behaviors and heterogeneous information of videos.

SK Telecom, Seoul, Republic of Korea

### **A Fast Data Compression with Shared Virtual Memory in Heterogeneous System Architecture**

2017

Keywords: OpenCL, GPGPU, SVM, HSA

I used general purpose computing on graphics processing units (GPGPU) and Shared Virtual Memory (SVM) in Heterogeneous System Architecture (HSA) for fast data deduplication methods. GPGPU and HSA provide a powerful basis for parallel computing in an easy programmable and efficient way.

Undergraduate thesis

### **Personalized Recommendation for Credit Card Rewards**

2016

Keywords: Coupled Matrix Factorization, Time Series Data

We provide personalized recommendations for credit card rewards to customers using various side information of users and items. The main algorithm is TCMF (Time Coupled Matrix Factorization).

Hyundai Card, Seoul, Republic of Korea

 News article (in Korean)

## **Talks**

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### **SkeletonVis: Interactive Visualization for Understanding Adversarial Attacks on Human Action Recognition Models**

Haekyu Park, Zijie Jay Wang, Nilaksh Das, Anindya S. Paul, Pruthvi Perumalla, Zhiyan Zhou, Duen Horng Chau

Feb 2021, Poster Presentation, AAAI

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

Nilaksh Das\*, Haekyu Park\*, Zijie Jay Wang, Fred Hohman, Robert Firstman, Emily Rogers, Duen Horng Chau

(\* Equal Contribution)

Oct 2020, Oral Presentation, IEEE VIS

Oct 2020, Presentation, Michigan Institute for Data Science (MIDAS) Consortium for researchers in Training

### **Accelerated Data Science in the Classroom: Teaching Analytics and Machine Learning with RAPIDS**

Polo Chau and Haekyu Park

Mar 2020, Talk, NVIDIA's GPU Technology Conference (GTC)

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

Apr 2019, Poster Presentation, PacificVis

### **A Comparative Study of Matrix Factorization and Random Walk with Restart in Recommender Systems**

Dec 2017, Oral Presentation, IEEE Big Data

## **Tutorial**

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### **RAPIDS and Cybersecurity: A Network Use Case**

Keywords: RAPIDS, NVIDIA, GPU-acceleration, Graph, Personalized Page Rank

## Teaching

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### Graduate Teaching Assistant

Georgia Institute of Technology, Atlanta, GA  
Data and Visual Analytics (CSE 6242)  
Instructor: Polo Chau

## Mentoring

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### Aiswarya Bhagavatula

M.S. in Computational Science and Engineering, Georgia Institute of Technology  
GPU accelerated data science teaching kit  
AI Robustness against Adversarial Attacks

2021

### Sushanto Praharaj

M.S. in Computational Science and Engineering, Georgia Institute of Technology  
AI Robustness against Adversarial Attacks  
Received Marshall D. Williamson Fellowship award

2021

### Jon Saad-Falcon

B.S./M.S. in Computer Science, Georgia Institute of Technology  
GPU accelerated data science teaching kit  
Received Donald V. Jackson Fellowship award

2021

### Kevin Li

B.S. in Computer Science, Georgia Institute of Technology  
GPU accelerated data science teaching kit

2021

### Zhiyan Zhou

B.S. in Computer Science, Georgia Institute of Technology  
AI Robustness against Adversarial Attacks

2021

### Megan Dass

B.S. in Computer Science, Georgia Institute of Technology  
AI Robustness against Adversarial Attacks  
Received Outstanding Freshman Award

2021

### Omar Shaikh

B.S. in Computer Science, Georgia Institute of Technology  
Visualization for natural language processing  
Received Outstanding Freshman Award  
Received Sigma Xi Best Undergraduate Research Award

2019-2020

### Rob Firstman

B.S. in Computer Science, Georgia Institute of Technology  
Visualization for deep learning interpretability

2019-2020

### Robert Turko

2019-2020

B.S. in Computer Science, Georgia Institute of Technology  
Visualization for machine learning education  
Received Outstanding Senior Award

## Licenses and Certifications

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### Licenses and Certifications

NVIDIA DLI Certificate – DLI Platform Course for Instructors, NVIDIA Deep Learning Institute  
NVIDIA DLI Certificate – Fundamentals of Deep Learning for Computer Vision, NVIDIA Deep Learning Institute

## Professional Service

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### Reviewer

ECML/PKDD 2021  
IEEE Computer Graphics and Applications 2021  
CIKM 2020  
VIS 2020  
WiML 2019  
KDD 2019  
ICML 2019

### Professional Membership

The Institute of Electrical and Electronics Engineers (IEEE). Since 2019.

## Technical Skills

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### Programming Languages

Python, JavaScript, HTML, R, Matlab, Java, C, C++, Ocaml, Scheme

### Machine Learning / Deep Learning / Data Science

TensorFlow, PyTorch, Keras, scikit-learn, OpenCV, Numpy, Pandas, SciPy, NetworkX

### GPU-accelerated Data Science

cuGraph, cuDF, cuML, BlazingSQL, OpenCL

### Data Visualization

D3.js, Three.js, WebGL, HoloViews, Matplotlib, WebGL, ggplot