

# 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. My research is supported by JPMorgan AI PhD Fellowship. I have been fortunate to work with amazing researchers, engineers, and scientists at  Microsoft,  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

Microsoft Research, Redmond, WA

Mentor: Gonzalo Ramos

Jun 2021 - Aug 2021

### AI Infrastructure Software Intern

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

May 2020 - Jul 2020

### Data Science Intern

NVIDIA, Austin, TX

Mentor: Bartley Richardson, Brad Rees, Joe Eaton

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

May 2019 - Aug 2019

**Graduate Research Assistant**  
Georgia Institute of Technology, Atlanta, GA

Aug 2018 - Present

**Undergraduate Research Assistant**  
Seoul National University, Seoul, Republic of Korea

Jun 2016 - Aug 2017

## Honors and Awards

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**J.P.Morgan PhD Fellowship**

For my PhD Work "Human-centered AI: Interactive Scalable Interfaces for Trustworthy and Safe AI"

2021

**"Thank a Teacher" Award**

Center of Teaching & Learning (CTL), Georgia Institute of Technology

2019

**Moon-Jung Chung Scholarship**

KOCSEA (The Korean Computer Scientists and Engineers Association in America)

2019

**National Scholarship for Science and Engineering**

National Scholarship for Science and Engineering

2015

## Grants and Funding

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**WiML Travel Funding**

\$550 Travel Funding

Women in Machine Learning Workshop, co-located with NeurIPS

2019

**Amazon AWS Research Grant**

Funded \$5,000 in AWS cloud credits

Co-PIs: Nilaksh Das, Scott Freitas, Duen Horng Chau

2018

## Publications

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**DetectorDetective: Investigating the Effects of Adversarial Examples on Object Detectors**

Sivapriya Vellaichamy, Matthew Hull, Zijie J. Wang, Nilaksh Das, Sheng-Yun Peng, Haekyu Park, Duen Horng Chau  
*Conference on Computer Vision and Pattern Recognition (CVPR), Demo, 2022*

► Demo

**MisVis: Explaining Web Misinformation Connections via Visual Summary**

Seongmin Lee, Sadia Afroz, Haekyu Park, Zijie J. Wang, Omar Shaikh, Vibhor Sehgal, Ankit Peshin, Duen Horng Chau  
*CHI Conference on Human Factors in Computing Systems Extended Abstracts, 2022*

► Demo

📄 Paper

**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 Chau  
*IEEE Visualization Conference (VIS), Virtual, 2021*

► Demo

📄 Paper

**RECAST: Enabling User Recourse and Interpretability of Toxicity Detection Models with Interactive Visualization**

📄 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**

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

2021

Keywords: Deep Learning Interpretability, Visualization, Human Interpretable Concepts Learned by a Model, Concept Cascade  
Interactive visual system that scalably summarizes and visualizes concepts learned by neural networks.

It was published at IEEE Visualization Conference (VIS), 2021.

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

► Demo

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

2021

Keywords: Adversarial Attacks, Human Action Recognition

Interactive visual system for understanding vulnerability of human action recognition model.

It was published at AAAI Demo, 2021.

[Haekyu Park](#), Zijie J. Wang, Nilaksh Das, Anindya S. Paul, Pruthvi Perumalla, Zhiyan Zhou, Duen Horng Chau

► Demo

## **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.

### 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.

### 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.

### 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.

## 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]

### 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

2016

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

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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### **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 Chau

Oct 2021, IEEE Visualization Conference (VIS)

### **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

Presented at KDD 2019 NVIDIA RAPIDS tutorial with the cybersecurity use case notebook

## **Teaching**

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**Graduate Teaching Assistant**

Georgia Institute of Technology, Atlanta, GA

Data and Visual Analytics (CSE 6242)

Fall 2019, Fall 2021

Instructor: Polo Chau

## Mentoring

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**Aiswarya Bhagavatula**

2021

M.S. in Computational Science and Engineering, Georgia Institute of Technology

GPU accelerated data science teaching kit

AI Robustness against Adversarial Attacks

**Sushanto Praharaj**

2021

M.S. in Computational Science and Engineering, Georgia Institute of Technology

AI Robustness against Adversarial Attacks

Received Marshall D. Williamson Fellowship award

**Jon Saad-Falcon**

2021

B.S./M.S. in Computer Science, Georgia Institute of Technology

GPU accelerated data science teaching kit

Received Donald V. Jackson Fellowship award

**Kevin Li**

2021

B.S. in Computer Science, Georgia Institute of Technology

GPU accelerated data science teaching kit

**Zhiyan Zhou**

2021

B.S. in Computer Science, Georgia Institute of Technology

AI Robustness against Adversarial Attacks

**Megan Dass**

2021

B.S. in Computer Science, Georgia Institute of Technology

AI Robustness against Adversarial Attacks

Received Outstanding Freshman Award

**Omar Shaikh**

2019-2020

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

**Rob Firstman**

2019-2020

B.S. in Computer Science, Georgia Institute of Technology

Visualization for deep learning interpretability

**Robert Turko**

2019-2020

B.S. in Computer Science, Georgia Institute of Technology

## 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

## Technical Skills

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### Programming Languages

Python, JavaScript, TypeScript, 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

### Interface / Data Visualization

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