Minsuk Kahng

Georgia Institute of Technology
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Research Interests

Human-centered AI, data visualization, databases, data mining, machine learning, and human-computer interaction

Education

2013–2019 (expected) **Georgia Institute of Technology**, Atlanta, GA, USA
Ph.D. Candidate in Computer Science
Thesis: *Human-Centered AI through Scalable Visual Data Analytics*
Committee: Polo Chau (Advisor), Sham Navathe, Alex Endert, Martin Wattenberg & Fernanda Viégas

2009–2011 **Seoul National University**, Seoul, South Korea
M.S. in Computer Science and Engineering
Thesis: *Context-Aware Recommendation using Learning-to-Rank*

2005–2009 **Seoul National University**, Seoul, South Korea
B.S. in Electrical and Computer Engineering

Awards & Honors

2018–2019 **Google PhD Fellowship**, Google
Selected as one of the 27 outstanding Ph.D. students in U.S. universities

2018 **Graduate Teaching Assistant of the Year**, Center for Teaching and Learning, Georgia Tech
Selected as the best graduate teaching assistant in computer science

2014–2017 **NSF Graduate Research Fellowship**, National Science Foundation

2016 **Student Travel Award**, HILDA Workshop at SIGMOD Conference

2011 **Best Paper Award**, Ph.D. Workshop at CIKM Conference

2005–2009 **National Scholarship** for Science and Engineering, Korea Student Aid Foundation
Merit-based full tuition support by Korean government

Employment

Summer 2017 **Google**, Cambridge, MA, USA
Software Engineering Intern, People+AI Research Group (part of Google Brain)
Created interactive visualizations for non-experts and students to learn deep learning [30].

Summer 2016 **Facebook**, Menlo Park, CA, USA
Research Intern, Applied Machine Learning Research Group
Designed and developed a visualization system for interpreting deep learning models [29].

Summer 2015 **Facebook**, Menlo Park, CA, USA
Research Intern, Applied Machine Learning Research Group
Created a data exploration tool for analyzing machine learning results by slicing and dicing [15].

2013 - 2019 **Georgia Institute of Technology**, Atlanta, GA, USA
PhD Student and Graduate Research Assistant, College of Computing
Created interactive exploration methods for analyzing machine learning models and large datasets.

2011 - 2012 **Seoul National University**, Seoul, South Korea
Researcher, Institute of Computer Technology
Conducted research on entity search and recommender systems for heterogeneous graph data.

2009 - 2011 **Seoul National University**, Seoul, South Korea
Master's Student and Research Assistant, Intelligent Data Systems Lab
Conducted research on context-aware recommender systems, text and graph mining, and web.

Publications

Refereed Conference papers

[30] **Minsuk Kahng**, Nikhil Thorat, Duen Horng (Polo) Chau, Fernanda Viégas, and Martin Wattenberg. "GAN Lab: Understanding Complex Deep Generative Models using Interactive Visual Experimentation." *IEEE Transactions on Visualization and Computer Graphics*, 25(1) (***VAST**'18*), Berlin, Germany, Oct. 2018. [25.0% acceptance rate] Open-sourced with Google AI.

[29] **Minsuk Kahng**, Pierre Y. Andrews, Aditya Kalro, and Duen Horng (Polo) Chau. "ActiVis: Visual Exploration of Industry-Scale Deep Neural Network Models." *IEEE Transactions on Visualization and Computer Graphics*, 24(1) (***VAST**'17*), Phoenix, AZ, Oct. 2017. [21.4% acceptance rate] Deployed by Facebook.

[28] Robert Pienta, **Minsuk Kahng**, Zhiyuan Lin, Jilles Vreeken, Partha Talukdar, James Abello, Ganesh Parameswaran, and Duen Horng (Polo) Chau. "FACETS: Adaptive Local Exploration of Large Graphs." *SIAM International Conference on Data Mining (**SDM**'17)*, Houston, TX, Apr 2017. [26.0% acceptance rate]

[27] **Minsuk Kahng**, Shamkant B. Navathe, John T. Stasko, and Duen Horng (Polo) Chau. "[ETable] Interactive Browsing and Navigation in Relational Databases." *Proceedings of the VLDB Endowment*, 9(12) (***VLDB**'16*), New Delhi, India, Sept. 2016. [15.6% acceptance rate]

[26] Hugo Gualdron, Robson Cordeiro, Jose Rodrigues Jr., Duen Horng (Polo) Chau, **Minsuk Kahng**, and U Kang. "M-Flash: Fast Billion-scale Graph Computation Using a Bimodal Block Processing Model." *European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD'16)*, Riva del Garda, Italy, Sept. 2016. [28.3% acceptance rate]

[25] Charles D. Stolper, **Minsuk Kahng**, Zhiyuan Lin, Florian Foerster, Aakash Goel, John Stasko, and Duen Horng (Polo) Chau. "GLO-STIX: Graph-Level Operations for Specifying Techniques and Interactive eXploration." *IEEE Transactions on Visualization and Computer Graphics*, 20(12) (***InfoVis**'14*), Paris, France, Nov. 2014. [23.0% acceptance rate]

[24] Zhiyuan Lin, **Minsuk Kahng**, Kaeser Md. Sabrin, Duen Horng (Polo) Chau, Ho Lee, and U Kang.

"MMap: Fast Billion-Scale Graph Computation on a PC via Memory Mappping." *IEEE International Conference on Big Data (BigData'14)*, Washington, D.C., Oct. 2014. [39.4% acceptance rate]

[23] Sangkeun Lee, Sungchan Park, **Minsuk Kahng**, and Sang-goo Lee. "PathRank: A Novel Node Ranking Measure on a Heterogeneous Graph for Recommender Systems." *ACM Conference on Information and Knowledge Management (**CIKM**'12)*, Maui, HI, Oct. 2012. [27.8% acceptance rate]

[22] Sangkeun Lee, Sang-il Song, **Minsuk Kahng**, Dongjoo Lee, and Sang-goo Lee. "Random Walk based Entity Ranking on Graph for Multidimensional Recommendation." *ACM Conference on Recommender Systems (RecSys'11)*, Chicago, IL, Oct. 2011. [20.0% acceptance rate]

Journal articles

[21] Fred Hohman, **Minsuk Kahng**, Robert Pienta, and Duen Horng (Polo) Chau. "Visual Analytics in Deep Learning: An Interrogative Survey for the Next Frontiers." *IEEE Transactions on Visualization and Computer Graphics* (Early Access), 2018.

[20] Peter J. Polack Jr., Shang-Tse Chen, **Minsuk Kahng**, Kaya De Barbaro, Rahul Basole, Moushumi Sharmin, and Duen Horng (Polo) Chau. "Chronodes: Interactive Multifocus Exploration of Event Sequences." *ACM Transactions on Interactive Intelligent Systems*, 8(1), 2018.

[19] Rahul C. Basole, Mark Braunstein, Vikas Kumar, Hyunwoo Park, **Minsuk Kahng**, Duen Horng (Polo) Chau, Acar Tamersoy, Daniel A. Hirsh, Nicoleta Serban, James Bost, Burton Lesnick, Beth L. Schissel, and Michael Thompson. "Understanding Variations in Pediatric Asthma Care Processes in the Emergency Department using Visual Analytics." *Journal of the American Medical Informatics Association (JAMIA)*, 22(2), 2015.

[18] Sangkeun Lee, **Minsuk Kahng**, and Sang-goo Lee. "Constructing Compact and Effective Graphs for Recommender Systems via Node and Edge Aggregations." *Expert Systems with Applications*, 42(7), 2015.

Refereed Workshop, Poster, and Demo papers

[17] **Minsuk Kahng**, Pierre Y. Andrews, Aditya Kalro, and Duen Horng (Polo) Chau. "Designing a Visual Analytics System for Industry-Scale Deep Neural Network Models." *IEEE **VIS** Workshop on Visual Analytics for Deep Learning*, Phoenix, AZ, Oct. 2017.

[16] Dezhi Fang, Fred Hohman, Peter Polack, Hillol Sarker, **Minsuk Kahng**, Moushumi Sharmin, Mustafa al'Absi, and Duen Horng (Polo) Chau. "mHealth Visual Discovery Dashboard." *ACM International Joint Conference on Pervasive and Ubiquitous Computing (**UbiComp**'17)*, Maui, HI, Sept. 2017.

[15] **Minsuk Kahng**, Dezhi Fang, and Duen Horng (Polo) Chau. "[MLCube] Visual Exploration of Machine Learning Results using Data Cube Analysis." *Workshop on Human-In-the-Loop Data Analytics (HILDA at **SIGMOD**'16)*, San Francisco, CA, June 2016. Deployed by Facebook.

[14] Robert Pienta, Leilei Xiong, Santiago Grijalva, Duen Horng (Polo) Chau, and **Minsuk Kahng**. "STEPS: A Spatio-temporal Electric Power Systems Visualization." *ACM International Conference on Intelligent User Interfaces (**IUI**'16)*, Sonona, CA, Mar. 2016.

[13] Peter J. Polack Jr., Shang-Tse Chen, **Minsuk Kahng**, Moushumi Sharmin, and Duen Horng (Polo)

Chau. "TimeStitch: Interactive Multi-focus Cohort Discovery and Comparison." *IEEE Conference on Visual Analytics Science and Technology (**VAST**'15)* (Poster), Chicago, IL, Oct. 2015.

[12] Robert Pienta, Zhiyuan Lin, **Minsuk Kahng**, Jilles Vreeken, Partha P Talukdar, James Abello, Ganesh Parameswaran, Duen Horng (Polo) Chau "AdaptiveNav: Adaptive Discovery of Interesting and Surprising Nodes in Large Graphs" *IEEE **VIS*** (Poster), Chicago, IL, Oct. 2015.

[11] Rahul C. Basole, Hyunwoo Park, Mayank Gupta, Mark Braunstein, Duen Horng (Polo) Chau, Michael Thompson, Vikas Kumar, Robert Pienta, and **Minsuk Kahng**. "A Visual Analytics Approach to Understanding Care Process Variation and Conformance." *IEEE **VIS** Workshop on Visual Analytics in Healthcare*, Chicago, IL, Oct. 2015.

[10] Rahul C. Basole, Hyunwoo Park, Vikas Kumar, Mark Braunstein, James Bost, Duen Horng (Polo) Chau, and **Minsuk Kahng**. "Bicentric Visualization of Pediatric Asthma Care Process Activities." *IEEE **VIS** Workshop on Visualizing Electronic Health Record Data*, Paris, France, Nov. 2014.

[9] Yiqi Chen, Zhiyuan Lin, Robert Pienta, **Minsuk Kahng**, and Duen Horng (Polo) Chau. "Towards Scalable Graph Computation on Mobile Devices." *IEEE BigData Workshop on Scalable Machine Learning: Theory and Applications*, Washington, D.C., Oct. 2014.

[8] Vikas Kumar, Hyunwoo Park, Rahul C. Basole, Mark Braunstein, **Minsuk Kahng**, Duen Horng (Polo) Chau, Acar Tamersoy, Daniel A. Hirsh, Nicoleta Serban, James Bost, Burton Lesnick, Beth Schissel, and Michael Thompson. "Exploring Clinical Care Processes Using Visual and Data Analytics: Challenges and Opportunities." ***KDD** Workshop on Data Science for Social Good*, New York, NY, Aug. 2014.

[7] Charles D. Stolper, Florian Foerster, **Minsuk Kahng**, Zhiyuan Lin, Aakash Goel, John Stasko, and Duen Horng (Polo) Chau. "GLOs: Graph-Level Operations for Exploratory Network Visualization." *ACM SIGCHI Conference on Human Factors in Computing Systems (**CHI**'14)* (Poster), Toronto, Canada, Apr. 2014.

[6] **Minsuk Kahng** and Sang-goo Lee. "Exploiting Paths for Entity Search in RDF Graphs." *ACM SIGIR Conference on Research and Development in Information Retrieval (**SIGIR**'12)* (Poster), Portland, OR, Aug. 2012.

[5] **Minsuk Kahng**, Sangkeun Lee, and Sang-goo Lee. "Ranking Objects by Following Paths in Entity-Relationship Graphs." *ACM Workshop for Ph.D. Students in Information and Knowledge Management (at **CIKM**'11)*, Glasgow, UK, Oct. 2011. Best Paper Award.

[4] **Minsuk Kahng**, Sangkeun Lee, and Sang-goo Lee. "Ranking in Context-Aware Recommender Systems." *International Conference on World Wide Web (**WWW**'11)* (Poster), Hyderabad, India, Mar. 2011.

[3] Inbeom Hwang, **Minsuk Kahng**, Sung Eun Park, Jinwook Seo, and Sang-goo Lee. "Si-Fi: Interactive Similar Item Finder." *ACM SIGIR Conference on Research and Development in Information Retrieval (**SIGIR**'10)* (Demo), Geneva, Switzerland, Aug. 2010.

Book Chapters

[2] Peter J. Polack Jr., Moushumi Sharmin, Kaya de Barbaro, **Minsuk Kahng**, Shang-Tse Chen, and Duen Horng (Polo) Chau. "Exploratory Visual Analytics of Mobile Health Data: Sensemaking Challenges and Opportunities." *Mobile Health: Sensors, Analytic Methods, and Applications.*

Springer, 2017.

[1] Dongjoo Lee, Sung Eun Park, **Minsuk Kahng**, Sangkeun Lee, and Sang-goo Lee. "Exploiting Contextual Information from Event Logs for Personalized Recommendation." *Computer and Information Science 2010, Studies in Computational Intelligence.* Springer, 2010.

Teaching Experience

Instructor

Fall 2012 **Databases for Statistics**
(45 undergraduate statistics students)
Sookmyung Women's University, Seoul, South Korea
Introductory database course

Teaching Assistant

Fall 2017 **CS6400: Database Systems Concepts and Design**
Instructor: Sham Navathe (56 students)
Georgia Institute of Technology, Atlanta, GA, USA
Graduate-level database course

Fall 2014 **CSE6242/CX4242: Data and Visual Analytics**
Instructor: Polo Chau (118 students)
Georgia Institute of Technology, Atlanta, GA, USA
Graduate-level course on analyzing and visualizing big data

Guest Lecturer

Fall 2017 **Data Management Challenges in Practical Machine Learning**
Georgia Institute of Technology, Atlanta, GA, USA
Lectured on feature engineering and data transformation.

May 2012 **State-of-the-Art Methods and Trends in Information Retrieval**
Seoul National University, Seoul, Korea
Lectured on information retrieval research that integrates recent machine learning techniques.

Student Advising & Mentoring

2018–present Alex Cabrera, B.S. in Computer Science, Georgia Tech
2016–2017 Dezhi Fang, B.S. in Computer Science, Georgia Tech
2013–2016 Zhiyuan Lin, B.S. in Computer Science, Georgia Tech (now a PhD Student at Stanford)
2015–2016 Peter Polack, M.S. in Computer Science, Georgia Tech (now a PhD Student at UCLA)
2014–2015 Mayank Gupta, M.S. in Computer Science, Georgia Tech
2014 Yiqi Chen, B.S. in Computer Science, Georgia Tech
2013 Ganesh Parameswaran, M.S. in Computer Science, Georgia Tech

Invited Talks

ActiVis: Visual Exploration of Industry-Scale Deep Neural Network Models
Aug. 2018 ACM SIGGRAPH, Vancouver, Canada
June 2018 Human-in-the-Loop Data Analytics Workshop at ACM SIGMOD, Houston, TX, USA
Sept. 2017 HotCSE Seminar, Georgia Tech, Atlanta, GA, USA

Interactive Visual Analytics for Understanding Machine Learning
May 2018 KAIST Interaction Lab, Daejeon, South Korea

Scalable Graph Exploration and Visualization: Sensemaking Challenges and Opportunities
Feb. 2015 International Conference on Big Data and Smart Computing, Jeju, South Korea

Discovering Semantics in Heterogeneous Data Graphs
May 2012 Data Science Meetup in Seoul, NexR, Seoul, South Korea

Fellowships & Funding

Graduate Fellowships

2018–2019 **Google PhD Fellowship**. Full Tuition + US$35,000 for 2 years.

2014–2017 **NSF Graduate Research Fellowship**. Full Tuition + US$34,000 for 3 years.

2013 Offered **University of Michigan, EECS, Full Fellowship**. Full Tuition + US$30,664 for 1 year.

Grant Proposal Writing

2018 **NSF Proposal** on Machine Learning Fairness (under review).
Contributed visualization and discovery of unfair groups.

2018 **Google Faculty Research Proposal** on Interactive Model Debugging (under review).
Contributed insight discovery for model debugging.

2016 **NSF IIS** #15638163 (III: Medium: Collaborative Research: Human-computer Graph Exploration and Tele-discovery). Total funded: US$1,200,000.
Contributed graph visualization tools and techniques.

2015 **Google Faculty Research Award**. Total funded: US$52,000.
Contributed visual exploration for recommender systems.

PI Meeting Presentation

Mar. 2015 **GLO-STIX: Graph Visualization Legos**
DARPA PI Meeting, Arlington, VA, USA
Represented Georgia Tech for the 2nd phase of the *Anomaly Detection at Multiple Scales* program.

Professional Service

Workshop Co-organizer

KDD 2018 Workshop on Interactive Data Exploration and Analytics (IDEA'18)

Program Committee

ACM International Conference on Intelligent User Interfaces (IUI'19)
Symposium on Visualization in Data Science (at VIS'18)
Workshop on Visualization for AI Explainability (at VIS'18)
KDD Workshop on Interactive Data Exploration and Analytics (IDEA'16–17)
Workshop on Visual Analytics for Deep Learning (at VIS'17)

Paper Reviewer

CHI 2014, 2017–2019
VAST 2018
InfoVis 2018
EuroVis 2018
ACM Transactions on Computer-Human Interaction (2015, 2018)
SDM 2014, 2016–2017
Visualization in Data Science 2017
KDD 2014–2016
IUI 2016
RecSys 2016
Expert Systems with Applications (2015)
SIGMOD 2013
DASFAA 2011

Webmaster and Web Designer

9th ACM International Conference on Web Search and Data Mining (WSDM'16)

Open-Sourced & Deployed Software

Open-sourced Contributions

GAN Lab: A Visual Experimentation Tool for Generative Adversarial Networks [30]
Lead author. https://github.com/poloclub/ganlab

TensorFlow.js: A WebGL-accelerated JavaScript Library for Deep Learning Models
Contributor. https://github.com/tensorflow/tfjs

GLO: Graph-Level Operations for Interactive Visualization [25]
Contributor. https://github.com/chadstolper/glo

South Korea Map: Geodata for Administrative Divisions of South Korea for Visualization
Contributor. https://github.com/southkorea/southkorea-maps

Deployed Systems

ActiVis: Visualization of Deep Learning Models at Facebook [29]
Lead author. Deployed on FBLearner Flow, Facebook's machine learning platform

MLCube: Visual Exploration of Machine Learning Results [15]
Lead author. Deployed on FBLearner, Facebook's machine learning platform

References

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Shamkant B. Navathe
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Martin Wattenberg
Senior Staff Research Scientist
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Fernanda B. Viégas
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viegas@google.com

Alex Endert
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Last updated: December 8, 2018