John Krumm, PhD

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I am a researcher in computer science. I enjoy finding principled solutions to complicated problems, often using large, disparate datasets, machine learning, and math. I am an effective communicator, both written and oral, and I am good at organizing a group to achieve a goal. I like working in a collaborative environment where the objective is to find practical, creative, understandable, extensible solutions to technical problems. My research specialties have been computer vision, location, and personal data privacy.

Education

1986–1993 **PhD in Robotics**, *Carnegie Mellon University, School of Computer Science*, Pittsburgh, PA.
Thesis on computer vision

1979–1983 **BA**, *Augustana University*, Sioux Falls, SD.
Majors in computer science, mathematics, and physics

Experience

2023 – now **Computer Science Researcher**, *University of Southern California*, Los Angeles, CA.
GPS trajectory analysis, road traffic, machine learning, AI

1997–2023 **Senior Principal Researcher**, *Microsoft Research*, Redmond, WA.
Computer vision, location, personal data privacy, machine learning, AI

1993–1997 **Principle Member of Technical Staff**, *Sandia National Laboratories*, Albuquerque, NM.
Computer vision for robotics

Computer Skills

Languages: Python, C#, C++

Data: SQL Server, dbForge

General: I learn whatever tool is relevant for the task

Packages: MatLab, PyTorch, OpenAI

Productivity: Visual Studio Code, Visual Studio, Microsoft Office, Overleaf

Awarded Research Publications

See full list of publications at https://www.johnkrumm.net/publications.

2022 **John Krumm**. Sensitivity analysis of personal location disclosure. In *Proceedings of the 23rd IEEE International Conference on Mobile Data Management (MDM 2022)*, 2022.
Best paper award - Shows how location privacy progressively erodes with even small releases of an individual's location data, neural net algorithm.

2022   **John Krumm**. Maximum entropy bridgelets for trajectory completion. In *Proceedings of the 30th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL 2022)*, 2022.
Best paper award - New, principled approach for probabilistic interpolation over gaps in GPS data, learns from data.

2020   Nabil Hossain, **John Krumm**, Michael Gamon, and Henry Kautz. Semeval-2020 task 7: Assessing humor in edited news headlines. 2020.
Best task award - Crowdsourced, humorous news headlines as a basis for a programming contest.

2018   Heba Aly, **John Krumm**, Gireeja Ranade, and Eric Horvitz. On the value of spatiotemporal information: Principles and scenarios. In *Proceedings of the 26th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL 2018)*, 2018.
Best paper award runner-up - Method for assessing the monetary value of GPS data so ordinary people can sell it.

2017   Austin W Smith, Andrew L Kun, and John Krumm. Predicting taxi pickups in cities: Which data sources should we use? In *Proceedings of the 6th International Workshop on Pervasive Urban Applications (PURBA 2017) in conjunction with the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2017)*, 2017.
Best paper award - Automatically choosing best features to use for predicting taxi demand.

2011   **John Krumm** and AJ Bernheim Brush. Learning time-based presence probabilities. In *Proceedings of the 9th International Conference on Pervasive Computing (Pervasive 2011)*, 2011.
Best paper award - Method for predicting a person's location, developed to control home heating.

2011   James Scott, AJ Bernheim Brush, **John Krumm**, Brian Meyers, Michael Hazas, Stephen Hodges, and Nicolas Villar. Preheat: Controlling home heating using occupancy prediction. In *Proceedings of the 13th International Conference on Ubiquitous Computing (UbiComp 2011)*, 2011.
10-year impact award - Efficient control of home heating based on occupancy prediction, tested in actual homes.

2007   **John Krumm**. Inference attacks on location tracks. In *Proceedings of the 5th International Conference on Pervasive Computing (Pervasive 2007)*, 2007.
10-year impact award - Privacy attack algorithm showing that many popular obfuscation techniques for location data do not preserve privacy.

Highly Cited Research Publications

See full list of publications at https://www.johnkrumm.net/publications.

H-index of 75 from Google Scholar.

2009   **John Krumm**. A survey of computational location privacy. *Personal and Ubiquitous Computing*, volume 13, 2009.
869 citations - Overview of research on computational approaches to location privacy.

2009   Paul Newson and **John Krumm**. Hidden markov map matching through noise and sparseness. In *Proceedings of the 17th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL 2009)*, 2009.
1039 citations - Likely the world's most popular method for matching GPS points to roads, used at Microsoft, Apple, Uber.

2009   Lili Cao and John Krumm. From gps traces to a routable road map. In *Proceedings of the 17th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2009)*, 2009.
430 citations - Method for making a routable road map from GPS traces of ordinary drivers, frequently reimplemented by other researchers.

2007   **John Krumm**. Inference attacks on location tracks. In *Proceedings of the 5th International Conference on Pervasive Computing (Pervasive 2007)*, 2007.
835 citations - Privacy attack algorithm showing that many popular obfuscation techniques for location data do not preserve privacy, 10-year impact award.

2006   **John Krumm** and Eric Horvitz. Predestination: Inferring destinations from partial trajectories. In *Proceedings of the 8th International Conference on Ubiquitous Computing (UbiComp 2006)*, 2006.
657 citations - Novel, probabilistic algorithm to predict a driver's destination during the drive.

2005   Yu-Chung Cheng, Yatin Chawathe, Anthony LaMarca, and **John Krumm**. Accuracy characterization for metropolitan-scale wi-fi localization. In *Proceedings of the 3rd International Conference on Mobile Systems, Applications, and Services (MobiSys 2005)*, 2005.
686 citations - Understanding location accuracy of Wi-Fi triangulation.

2004   **John Krumm**, Eric Horvitz, et al. Locadio: Inferring motion and location from wi-fi signal strengths. In *Proceedings of the 1st International Conference on Mobile and Ubiquitous Systems (Mobiquitous 2004)*, 2004.
465 citations - New algorithm for measuring location indoors using Wi-Fi signal strengths and feasible path constraints.

2004   Mike Hazas, James Scott, and **John Krumm**. Location-aware computing comes of age. *IEEE Computer Magazine*, volume 37, 2004.
619 citations - Summary of state of the art in location-aware computing.

2000   **John Krumm**, Steve Harris, Brian Meyers, Barry Brumitt, Michael Hale, and Steve Shafer. Multi-camera multi-person tracking for easyliving. In *Proceedings of the 3rd IEEE International Workshop on Visual Surveillance*, 2000.
1113 citations - Algorithm for tracking multiple people with multiple cameras in a smart room.

2000   Barry Brumitt, Brian Meyers, **John Krumm**, Amanda Kern, and Steven Shafer. Easyliving: Technologies for intelligent environments. In *Proceedings of the 2nd International Symposium on Handheld and Ubiquitous Computing (HUC 2000)*, 2000.
1365 citations - Overview of smart room project at Microsoft Research.

1999   Kentaro Toyama, **John Krumm**, Barry Brumitt, and Brian Meyers. Wallflower: Principles and practice of background maintenance. In *Proceedings of the Seventh IEEE International Conference on Computer Vision (ICCV 1999)*, 1999.
2620 citations - Fundamental problems of background subtraction in computer vision, including a taxonomy of typical challenges, a novel algorithm, and a popular test set of representative images.

Highly Cited U.S. Patents

See full list of 82 U.S. patents at https://www.johnkrumm.net/patents.

2020   **John C. Krumm**, Eric J. Horvitz. Methods for predicting destinations from partial trajectories employing open- and closed-world modeling methods. U.S. patent number US 10746561 B2, 2020.
171 patent citations - Predict the destination of a vehicle as it drives.

2018 **John C. Krumm**, Eric J. Horvitz, Ramaswamy Hariharan. Integration of location logs, GPS signals, and spatial resources for identifying user activities, goals, and context. U.S. patent number US 9904709 B2, 2018.
347 patent citations - Compute a person's activity, goals, and overall context based on their location.

2015 Alice Jane Bernheim Brush, **John Charles Krumm**, Shahriyar Amini, Amy Karlson, Jaime Teevan, Nissanka Arachchige Bodhi Priyantha. Mobile search based on predicted location. U.S. patent number US 9134137 B2, 2015.
108 patent citations - Local search based on predicted location, so search results are ahead of you rather than behind you.

2014 Julia M. Letchner, **John C. Krumm**, Eric J. Horvitz. Collaborative route planning for generating personalized and context-sensitive routing recommendations. U.S. patent number US 8718925 B2, 2014.
119 patent citations - Compute routes based on drivers like you.

2013 **John C. Krumm**, Lakshmi N. Mummidi. Discovering points of interest from users map annotations. U.S. patent number US 8401771 B2, 2013.
106 patent citations - Crowdsourcing to find popular places to go.

2010 Matthew Man Chung Cheung, **John C. Krumm**, Chandrasekhar Thota, Steve J. Lombardi, Anurag Sharma. Positioning service utilizing existing radio base stations. U.S. patent number US 7738884 B2, 2010.
157 patent citations - Compute location of a device from signal strengths, including WiFi, AM, FM, TV, any electromagnetic, any acoustic.

2009 Mohammad Shabbir Alam, Warren Vincent Barkley, Timothy M. Moore, Geoffrey E. Pease, Steven A. N. Shafer, Florin Teodorescu, Yinghua Yao, Madhurima Pawar, **John C. Krumm**. Architecture and system for location awareness. U.S. patent number US 7536695 B2, 2009.
134 patent citations - Design to allow different types of location-based service providers to operate with a single service.

2009 **John C. Krumm**, Kenneth P. Hinckley. Proximity detection using wireless signal strengths. U.S. patent number US 7509131 B2, 2009.
302 patent citations - Measure proximity to objects and people from self-learning database of WiFi signal strengths.

2006 **John Krumm**. Object recognition system and process for identifying people and objects in an image of a scene. U.S. patent number US 7092566 B2, 2006.
129 patent citations - Object recognition with computer vision using color histograms.

2006 **John C. Krumm**, Eric J. Horvitz. System and methods for determining the location dynamics of a portable computing device. U.S. patent number US 7053830 B2, 2006.
319 patent citations - Algoirthm for computing a person's location from wireless signal strengths, including stop detection, feasible speeds, and feasible routes.

Mentoring/Teaching

Teaching

2017 - 2018 **Volunteer Teacher for Two Full Semesters of High School Computer Science**, 30 students/semester, Lake Washington High School, Kirkland, WA.

University Student Research Project Mentoring

2022 - 2023 **Mentor for University of Michigan School of Information Capstone Project**, Professor Abigail Jacobs, Five students.
"Web Advertising Targeted to Sensitive Groups"

2021 - 2022 **Co-Mentor for University of Michigan School of Information Capstone Project**, Professor Abigail Jacobs, Five students.
"Researching Public Attitudes Towards Social Media Data Privacy"

2020 **Mentor for University of New Hampshire Electrical and Computer Engineering Project Course** , Professor Andrew Kun.
"Speed Anomalies and Safe Departure Times from Uber Movement Data" resulting in a published workshop paper

2017 **Mentor for University of New Hampshire Electrical and Computer Engineering Project Course** , Professor Andrew Kun.
"Predicting Taxi Pickups in Cities: Which Data Sources Should We Use?" resulting in a published workshop paper and best workshop paper award

2017 **Mentor for University of New Hampshire Electrical and Computer Engineering Project Course** , Professor Andrew Kun.
"TweetCount: Urban Insights by Counting Tweets" resulting in a published workshop paper

PhD Committees (14)

2023 **Kyle Crighton**, Engineering and Public Policy, Carnegie Mellon University.
"Tracking User Web Browsing Behavior: Privacy Harms and Security Benefits"

2023 **Mashaal Musleh**, Computer Science and Engineering, University of Minnesota.
"Towards Highly Accurate Map Services"

2023 **Shrey Gupta**, Computer Science, Emory University.
"Transfer and Integration of Knowledge for Complex Real-World Datasets"

2021 **Kien Nguyen**, Computer Science, University of Southern California.
"Privacy-Aware Geo-Marketplaces"

2020 **Nabil Hossain**, Computer Science, University of Rochester.
"Creative Natural Language Generation: Humor and Beyond"

2017 **Mengwen Xu**, Institute of Interdisciplinary Information Sciences, Tsinghua University, PhD thesis reviewer.
"Destination Prediction, POI Visitation Inference and Store Site Selection by Prediction on Massive Spatial-temporal Data"

2017 **Radu Mariescu-Istodor**, Computer Science, University of Eastern Finland, PhD thesis reviewer.
"Efficient Management and Search of GPS Routes"

2015 **Abdeltawab Hendawi**, Computer Science and Engineering, University of Minnesota.
"Scalable Predictive Query Processing for Moving Objects"

2014 **Yuheng Hu**, Computer Science and Engineering, Arizona State University.
"Event Analytics on Social Media: Challenges and Solutions"

2014 **James Biagioni**, Computer Science, University of Illinois at Chicago.
"Sensing and Navigation of Public Transportation Systems"

2014 **Senaka Buthpitiya**, Electrical and Computer Engineering, Carnegie Mellon University.
"Modeling Mobile User Behavior for Anomaly Detection"

2012 **Young-Woo Seo**, Robotics Institute, Carnegie Mellon University.
"A Self-Supervised Machine Learning Framework for Augmenting Cartographic Resources"

2011 **Ling Xu**, Robotics Institute, Carnegie Mellon University.
"Planning for Effective Environmental Coverage"

2008 **William Tse-Yun Niu**, School of Information Technologies, University of Sydney, PhD examiner.
"Ontological Reasoning about Location for Indoor Pervasive Computing Environments"

Professional Service

Leadership

2017 - now **Executive Committee**, ACM SIGSPATIAL, Treasurer, Secretary, current Chair.

2019 **Workshops Co-Chair**, ACM SIGSPATIAL Conference.

2018 **Workshops Co-Chair**, ACM SIGSPATIAL Conference.

2017 **Workshops Co-Chair**, ACM SIGSPATIAL Conference.

2014 **Program Committee Co-Chair**, ACM SIGSPATIAL Conference.

2013 **Program Committee Co-Chair**, ACM SIGSPATIAL Conference.

2009 **Program Committee Co-Chair**, UbiComp Conference.

2006 **Workshops Co-Chair, UbiComp Conference**, UbiComp Conference.

2006 **Program Committee Co-Chair**, Pervasive Computing Conference.

Advising

2022 - now **Scientific Advisory Committee**, Geospatial Science and Human Security, National Security Sciences Directorate, Oak Ridge National Laboratory.

Diversity, Equity, and Inclusion

2022 **Lead**, ACM SIGSPATIAL Student Travel Grant.
Oversaw approximate doubling of student travel grants to our main academic conference with special emphasis on applicants with a demonstrated commitment to diversity at their schools.

2019 - 2021 **Lead**, Microsoft Research Faculty Fellowship.
Diversified set of eligible candidate schools and helped compose statement encouraging diversity of applicants.

2019 - 2021 **Member**, Microsoft Research Diversity Working Group.
Regular meetings to exchange ideas and practices to ensure a diverse workplace and a diverse pipeline of new researchers.

Editing

2020 - now **Editorial Board**, IEEE Pervasive Computing.

2017 - now **Associate Editor**, ACM Transactions on Spatial Algorithms and Systems.

2023 **Book Co-Editor**, *Spatial Gems Volume 2* (to appear).

2022 **Book Co-Editor**, *Spatial Gems Volume 1*.

2012 - 2014 **Co-Editor in Chief**, Journal of Location Based Services.

2010 **Book Co-Editor**, *Ubiquitous Computing Fundamentals*.

2006 - 2009 **Editorial Board**, IEEE Pervasive Computing.

2008 **Lead Guest Editor**, IEEE Pervasive Computing.

Workshops

2022 **Co-Organizer**, ACM SIGSPATIAL Spatial Gems Workshop.

2021 **Co-Organizer**, ACM SIGSPATIAL Spatial Gems Workshop.

2020 **Co-Organizer**, ACM SIGSPATIAL Spatial Gems Workshop.

2019 **Co-Organizer**, ACM SIGSPATIAL Spatial Gems Workshop.

2003 **Co-Organizer**, Workshop on Location-Aware Computing.

2003 **Co-Organizer**, IEEE Workshop on Multi-Object Tracking.

2001 **Co-Organizer**, IEEE Workshop on Multi-Object Tracking.

Program Committees

2023 **Vice Program Committee Chair**, ACM SIGSPATIAL Conference.

2020 **Senior Program Committee**, ACM SIGSPATIAL Conference.

2019 **Senior Program Committee**, ACM SIGSPATIAL Conference.

2018 **Senior Program Committee**, ACM SIGSPATIAL Conference.

2017 **Senior Program Committee**, ACM SIGSPATIAL Conference.

2017 **Program Committee**, Automotive User Interface and Interactive Vehicle Applications.

2016 **Senior Program Committee**, ACM SIGSPATIAL Conference.

2016 **Program Chair**, Workshop on Mobile Entity Localization, Tracking, and Analysis.

2015 **Senior Program Committee**, ACM SIGSPATIAL Conference.

2012 **Program Committee**, Pervasive Computing Conference.

2011 **Program Committee**, UbiComp Conference.

2011 **Program Committee**, Pervasive Computing Conference.

2011 **Program Committee**, IEEE Symposium on Computational Intelligence in Vehicles and Transportation Systems.

2011 **Program Committee**, International Conference on Automotive User Interfaces and Interactive Vehicular Applications.

2010 **Program Committee**, UbiComp Conference.

2010 **Program Committee**, ACM SIGSPATIAL International Workshop on GeoStreaming.

2010 **Program Committee**, Automotive User Interfaces and Interactive Vehicular Applications.

2010 **Program Committee**, ACM SIGSPATIAL International Workshop on GeoStreaming.

2009 **Program Committee**, UbiComp Conference.

2009 **Program Committee**, Symposium on Location and Context Awareness.

2009 **Program Committee**, Forum on the Application and Management of Personal Electronic Information.

2009 **Program Committee**, Conference on Automotive User Interfaces and Interactive Vehicular Applications.

2008 **Program Committee**, UbiComp Conference.

2008 **Program Committee**, Pervasive Computing Conference.

2008 **Program Committee**, International Workshop on Intelligent Vehicle Control Systems.

2007 **Program Committee**, Pervasive Computing Conference.

2007 **Program Committee**, Workshop on Privacy-Aware Location-based Mobile Services.

2007 **Program Committee**, Symposium on Location- and Context-Awareness.

2007 **Program Committee**, Artificial Intelligence Techniques for Ambient Intelligence.

2006 **Program Committee**, UbiComp Conference.

2006 **Program Committee**, Pervasive Computing Conference.

2006 **Program Committee**, Symposium on Location- and Context-Awareness.

2005 **Program Committee**, Workshop on Wireless Mobile Applications and Services on WLAN Hotspots.

2005 **Program Committee**, UbiComp Conference.

2005 **Program Committee**, Pervasive Computing Conference.

2005 **Program Committee**, Symposium on Location- and Context-Awareness.

2004 **Program Committee**, Workshop on Location-Aware Computing.

2004 **Program Committee**, Workshop on Wireless Mobile Applications and Services on WLAN Hotspots.

Other

2020 **Social Media Chair**, ACM UbiComp Conference.

2017 **Social Media Chair**, ACM UbiComp Conference.

2009 **Local Arrangements Chair**, ACM SIGSPATIAL Conference.

2008 **Tutorials Co-Chair**, Pervasive Computing Conference.

2007 **Tutorials Co-Chair**, Pervasive Computing Conference.