Xin Liu

SENIOR RESEARCH SCIENTIST

Google Research

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Summary

I lead Google's efforts in building AI systems for time-series sensor data and personal health. I directed the research and development behind Google's frontier models in personal health, including the Large Sensor Model, Personal Health LLM, SensorLM, and the Personal Health Agent (`https://health.google/ai-models/`). I am also a core contributor to Gemini 2.5's tabular reasoning and data science reasoning.

My research interests lie at the intersection of large-scale machine learning, AI for health and science, and language model reasoning. I have published over 60 peer-reviewed papers in top venues spanning machine learning (NeurIPS, ICLR, ACL, EMNLP), mobile and ubiquitous computing (CHI, IMWUT/Ubicomp), and health (Nature Medicine, Nature Communications). My work has been featured in oral presentations at NeurIPS, ICLR, and EMNLP, as well as in public media outlets including The Verge, CNET, Google Keyword, IEEE Spectrum, ACM TechNews, and GeekWire.

Education

University of Washington, Seattle   *Seattle, WA, USA*

PH.D. IN COMPUTER SCIENCE   *Sep 2018 - March 2023*

- Google PhD Fellow
- Research Areas: Machine Learning, Mobile Computing, Health AI
- Advisors: Shwetak Patel & Daniel McDuff

University of Massachusetts, Amherst   *Amherst, MA, USA*

B.S. IN COMPUTER SCIENCE   *Sep 2014 - June 2018*

- Graduated with Highest Honor (0.01%)
- Research Area: Mobile & Ubiquitous Computing, Mobile Health, Rehabilitation Technology
- Advisor: Sunghoon Ivan Lee

Professional Experience

2023-Now	**Google Research**, Senior Research Scientist, Research & Tech Lead
2021-2023	**Google Research**, Research Intern
2021	**Microsoft Research**, Research Intern (June-Sep)
2020-2021	**OctoML Machine Learning System Team** , Research Intern (Nov - June)
2019	**Allen Institute for Artificial Intelligence (AI2)**, Research Intern (June-Sep)

Awards

2025	**Emerging Rockstar**, IEEE Pervasive Computing
2023	**Oral, Top 2.6%**, WACV 2024 [29]
2023	**Distinguished Paper Award**, IMWUT/Ubicomp 2023 [16]
2023	**Oral, Notable Top 5%**, ICLR 2023 [21]
2022	**Google PhD Fellowship**, Three-year full support, 1 out 0f 72 worldwide recipients, Google AI
2022	**Oral, Top 1%**, NeurIPS 2022 [19]
2020	**Oral, Top 1%**, NeurIPS 2020 [5]
2019	**Cover Article Nominee**, IEEE JBHI [1]
2018	**Glerum Family Endowed Fellowship**, University of Washington
	21st Century Leaders Award, Top 10 most exceptional graduates out of 5500, UMass Amherst
	Outstanding Undergraduate Achievement Award, UMass Amherst
2017	**Rising Researcher Award**, Highest honor for undergraduate research, UMass Amherst
	Outstanding Undergraduate Course Assistant Award, UMass Amherst
	NSF Student Travel Award, National Science Foundation
	Honors College Research Assistant Fellowship, UMass Amherst
2014-2018	**University Merit Director's Scholarship**, UMass Amherst

Selected Publication

FOUNDATION MODELS FOR TIME-SERIES SENSOR DATA

[6] Yuwei Zhang #, Kumar Ayush #, Siyuan Qiao, A. Ali Heydari, Girish Narayanswamy, Maxwell A. Xu, Ahmed A. Metwally, Shawn Xu, Jake Garrison, Xuhai Xu, Tim Althoff, Yun Liu, Pushmeet Kohli, Jiening Zhan, Mark Malhotra, Shwetak Patel, Cecilia Mascolo, **Xin Liu $**, Daniel McDuff $, Yuzhe Yang $, "SensorLM: Learning the Language of Wearable Sensors," **NeurIPS**, 2025 $ Co-senior Author, Core Contributor, Co-host of the first author.

[5] Maxwell A. Xu #, Girish Narayanswamy #, Kumar Ayush, Dimitris Spathis, Shun Liao, Shyam A. Tailor, Ahmed Metwally, A. Ali Heydari, Yuwei Zhang, Jake Garrison, Samy Abdel-Ghaffar, Xuhai Xu, Ken Gu, Jacob Sunshine, Ming-Zher Poh, Yun Liu, Tim Althoff, Shrikanth Narayanan, Pushmeet Kohli, Mark Malhotra, Shwetak Patel, Yuzhe Yang, James M. Rehg, **Xin Liu $**, Daniel McDuff $, "LSM-2: Learning from Incomplete Wearable Sensor Data," **Under Submission at ICLR**, 2026 $ Equal Leadership, Corresponding Author # Equal Contribution, Primary host of the first authors.

[4] Girish Narayanswamy #, **Xin Liu #$**, Kumar Ayush, Yuzhe Yang, Xuhai Xu, Shun Liao, Jake Garrison, Shyam Tailor, Jake Sunshine, Yun Liu, Tim Althoff, Shrikanth Narayanan, Pushmeet Kohli, Jiening Zhan, Mark Malhotra, Shwetak Patel, Samy Abdel-Ghaffar, Daniel McDuff†$, "Scaling Wearable Foundation Models," **ICLR**, 2025 $ Equal Leadership, Corresponding Author # Equal Contribution, Primary host of the first author.

[3] Yuzhe Yang, **Xin Liu**, Jiang Wu, Silviu Borac, Dina Katabi, Ming-Zher Poh, Daniel McDuff, "SimPer: Simple Self-Supervised Learning of Periodic Targets," **ICLR 2023** [Oral, Ranked Top 5 among 4922 Submissions, & Notable Top 5% Submission]

[2] Xuhai Xu, **Xin Liu**, Han Zhang, Weichen Wang, Subigya Kumar Nepal, Kevin S. Kuehn, Jeremy F Huckins, Margaret E Morris, Paula S. Nurius, Eve Ann Riskin, Shwetak Patel, Tim Althoff, Andrew Campbell, Anind K. Dey, Jennifer Mankoff , "Cross-Dataset Generalization of Longitudinal Human Behavior Modeling," **Ubicomp/IMWUT 2023** Distinguished Paper Award

[1] **Xin Liu**, Josh Fromm , Shwetak Patel, Daniel McDuff, "Multi-Task Temporal Shift Attention Networks for On-Device Contactless Vitals Measurement," **Conference on Neural Information Processing Systems (NeurIPS 2020)** [Oral, Top 1%, 105 out of 9454 Submissions]

AI FOR HEALTH

[5] A. Ali Heydari#, Ken Gu#, Vidya Srinivas#, Hong Yu#, Zhihan Zhang, Yuwei Zhang, Akshay Paruchuri, Qian He, Hamid Palangi, Nova Hammerquist, Ahmed A. Metwally, Brent Winslow, Yubin Kim, Kumar Ayush, Yuzhe Yang, Girish Narayanswamy, Maxwell A. Xu, Jake Garrison, Amy Aremnto Lee, Jenny Vafeiadou, Ben Graef, Isaac R. Galatzer-Levy, Erik Schenck, Andrew Barakat, Javier Perez, Jacqueline Shreibati, John Hernandez, Anthony Z. Faranesh, Javier L. Prieto, Connor Heneghan, Yun Liu, Jiening Zhan, Mark Malhotra, Shwetak Patel, Tim Althoff, **Xin Liu$**, Daniel McDuff$, Xuhai Xu$, "The Anatomy of a Personal Health Agent," **To be submitted at Nature**, 2025 $ Equal Leadership, Corresponding Author # Equal Contribution

[4] Justin Khasentino#, Anastasiya Belyaeva#$, **Xin Liu #$**, Zhun Yang#, Nicholas A. Furlotte#, Chace Lee, Erik Schenck, Yojan Patel, Jian Cui, Logan Douglas Schneider, Robby Bryant, Ryan G. Gomes, Allen Jiang, Roy Lee, Yun Liu, Javier Perez, Jameson K. Rogers, Cathy Speed, Shyam Tailor, Megan Walker, Jeffrey Yu, Tim Althoff, Conor Heneghan, John Hernandez, Mark Malhotra, Leor Stern, Yossi Matias, Greg S. Corrado, Shwetak Patel, Shravya Shetty, Jiening Zhan, Shruthi Prabhakara, Daniel McDuff$, Cory Y. McLean$, "A Personal Health Large Language Model for Sleep and Fitness Coaching," **Nature Medicine**, 2025 # Equal Contribution $ Corresponding Author

[3] Mike A. Merrill #, Akshay Paruchuri #, Naghmeh Rezaei, Geza Kovacs, Javier Perez, Yun Liu, Erik Schenck, Nova Hammerquist, Jake Sunshine, Shyam Tailor, Kumar Ayush, Hao-Wei Su, Qian He, Cory Y. McLean, Mark Malhotra, Shwetak Patel, Jiening Zhan, Tim Althoff $, Daniel McDuff $, **Xin Liu $**, "Transforming Wearable Data into Health Insights Using Large Language Model Agents," **Nature Communications (Conditionally accepted)**, 2025 $ Equal Leadership, Corresponding Author # Equal Contribution, Primary host of the first authors. Used in Google Products.

[2] Shun Liao #, Paolo Di Achille #, Jiang Wu #, Silviu Borac #, Jonathan Wang #, **Xin Liu #**, Eric Teasley #, Lawrence Cai, Yun Liu, Daniel McDuff, Hao-Wei Su, Brent Winslow, Anupam Pathak, Shwetak Patel, Jameson K. Rogers, Ming-Zher Poh, "Passive Heart Rate Monitoring During Smartphone Use in Everyday Life," **Under Major Revision at Nature**, 2025 # Equal Contribution. Based on my PhD research. Google Product.

[1] Yuzhe Yang, Yujia Liu, **Xin Liu**, Avanti Gulhane, Domenico Mastrodicasa, Wei Wu, Edward J. Wang, Dushyant W. Sahani, Shwetak Patel, "Demographic Bias of Expert-Level Vision-Language Foundation Models in Medical Imaging," **Science Advances**, 2024

Language Model Reasoning

[4] Gheorghe Comanici, Eric Bieber, Mike Schaekermann, Ice Pasupat, Noveen Sachdeva, Inderjit Dhillon, Marcel Blistein, Ori Ram, Dan Zhang, Evan Rosen, ...**Xin Liu**,.... "Gemini 2.5: Pushing the Frontier with Advanced Reasoning, Multimodality, Long Context, and Next Generation Agentic Capabilities," **Tech Report**, 2025 Core contributor of tabular reasoning, cognitive skill reasoning.

[3] Ken Gu, Zhihan Zhang, Kate Lin, Yuwei Zhang, Akshay Paruchuri, Hong Yu, Mehran Kazemi, Kumar Ayush, A Ali Heydari, Maxwell A Xu, Girish Narayanswamy, Yun Liu, Ming-Zher Poh, Yuzhe Yang, Mark Malhotra, Shwetak Patel, Hamid Palangi, Xuhai Xu, Daniel McDuff, Tim Althoff, **Xin Liu**, "RADAR: Benchmarking Language Models on Imperfect Tabular Data," **NeurIPS**, 2025 Used in Gemini evaluation and post-training. Primary host of the first author.

[2] Mehran Kazemi, Bahare Fatemi, Hritik Bansal, John Palowitch, Chrysovalantis Anastasiou, Sanket Vaibhav Mehta, Lalit K. Jain, Virginia Aglietti, Disha Jindal, Peter Chen, Nishanth Dikkala, Gladys Tyen, **Xin Liu**, Uri Shalit, Silvia Chiappa, Kate Olszewska, Yi Tay, Vinh Q. Tran, Quoc V. Le, Orhan Firat, "Big-Bench Extra Hard," **ACL (Main)**, 2025 Used in Gemini evaluation and post-training. Core contributor of tabular reasoning.

[1] Akshay Paruchuri, Jake Garrison, Shun Liao, John Hernandez, Jacob Sunshine, Tim Althoff, **Xin Liu $**, Daniel McDuff $, "What Are the Odds? Language Models Are Capable of Probabilistic Reasoning," **EMNLP (Main)**, 2024 $ Equal Leadership, Corresponding Author. Primary host of the first author.

Mentoring

2024-2025	**Ken Gu**, Google, First author of NeurIPS Submission	*Seattle, WA*
2024-2025	**Max Xu**, Google, First author of NeurIPS Submission	*Seattle, WA*
2024	**Akshay Paruchuri**, Google, First author of EMNLP / Nature Communications	*Seattle, WA*
2023-2024	**Mike Merrill**, Google, First author of Nature Communications	*Seattle, WA*
2020-2023	**Mentor at GIX Access Computing Program**, University of Washington & Tsinghua University	*Seattle, WA*
2022-Now	**Yujia Liu**, UW ECE M.S., (Now PhD Student at UCSD)	*Seattle, WA*
2022-Now	**Yuxuan Ou**, BUPT, China (Now MS student at University of Cambridge)	*Seattle, WA*
2021-2022	**Xiaoyu Zhang**, Tsinghua University, BS, (Now PhD Student at Tsinghua CS)	*Seattle, WA*
2020-2022	**Sinan Xie**, Tsinghua University, BS, (Now PhD Student at UCSD ECE)	*Seattle, WA*
2020-2021	**Tess Despres**, University of Washington, ECE, (Now PhD Student at UC Berkeley EECS)	*Seattle, WA*
2020-2021	**Haojia Nie**, University of Waterloo, CS, (Intern at ByteDance + Meta)	*Seattle, WA*
2019-2020	**Yuang Li**, BUPT, China (Now MS student at University of Cambridge)	*Seattle, WA*
2019-2020	**Yongjoon Oh**, University of Washington, CSE (Now at Microsoft)	*Seattle, WA*

Full Publication List

[68] A. Ali Heydari#, Ken Gu#, Vidya Srinivas#, Hong Yu#, Zhihan Zhang, Yuwei Zhang, Akshay Paruchuri, Qian He, Hamid Palangi, Nova Hammerquist, Ahmed A. Metwally, Brent Winslow, Yubin Kim, Kumar Ayush, Yuzhe Yang, Girish Narayanswamy, Maxwell A. Xu, Jake Garrison, Amy Aremnto Lee, Jenny Vafeiadou, Ben Graef, Isaac R. Galatzer-Levy, Erik Schenck, Andrew Barakat, Javier Perez, Jacqueline Shreibati, John Hernandez, Anthony Z. Faranesh, Javier L. Prieto, Connor Heneghan, Yun Liu, Jiening Zhan, Mark Malhotra, Shwetak Patel, Tim Althoff, **Xin Liu$**, Daniel McDuff$, Xuhai Xu$, "The Anatomy of a Personal Health Agent," *Under Review at Nature*, 2025
$ Equal Leadership, Corresponding Author # Equal Contribution

[67] Akshay Paruchuri, Sinan Hersek, Lavisha Aggarwal, Qiao Yang, **Xin Liu**, Achin Kulshrestha, Andrea Colaco, Henry Fuchs, Ishan Chatterjee, "EgoTrigger: Toward Audio-Driven Image Capture for Human Memory Enhancement in All-Day Energy-Efficient Smart Glasses," *ISMAR 2025 (TVCG Journal Paper)*, 2025

[66] Mihir Parmar, **Xin Liu**, Palash Goyal, Yiwen Song, Mingyang Ling, Chitta Baral, Hamid Palangi, Tomas Pfister, "PLAN-TUNING: Post-Training Language Models to Learn Step-by-Step Planning for Complex Problem Solving," *EMNLP 2025*, 2025

[65] Justin Khasentino#, Anastasiya Belyaeva#$, **Xin Liu #$**, Zhun Yang#, Nicholas A. Furlotte#, Chace Lee, Erik Schenck, Yojan Patel, Jian Cui, Logan Douglas Schneider, Robby Bryant, Ryan G. Gomes, Allen Jiang, Roy Lee, Yun Liu, Javier Perez, Jameson K. Rogers, Cathy Speed, Shyam Tailor, Megan Walker, Jeffrey Yu, Tim Althoff, Conor Heneghan, John Hernandez, Mark Malhotra, Leor Stern, Yossi Matias, Greg S. Corrado, Shwetak Patel, Shravya Shetty, Jiening Zhan, Shruthi Prabhakara, Daniel McDuff$, Cory Y. McLean$, "A Personal Health Large Language Model for Sleep and Fitness Coaching," *Nature Medicine*, 2025
 # Equal Contribution $ Corresponding Author

[64] Akshay Paruchuri, Maryam Aziz, Rohit Vartak, Ayman Ali, Best Uchehara, **Xin Liu**, Ishan Chatterjee, Monica Agrawal, ""What's Up, Doc?" Analyzing How Users Seek Health Information in Large-Scale Conversational AI Datasets," *EMNLP 2025*, 2025

[63] Gheorghe Comanici, Eric Bieber, Mike Schaekermann, Ice Pasupat, Noveen Sachdeva, Inderjit Dhillon, Marcel Blistein, Ori Ram, Dan Zhang, Evan Rosen, ...**Xin Liu**,.... "Gemini 2.5: Pushing the Frontier with Advanced Reasoning, Multi-modality, Long Context, and Next Generation Agentic Capabilities," *arXiv:2507.06261*, 2025

[62] Yubin Kim, Taehan Kim, Wonjune Kang, Eugene Park, Joonsik Yoon, Dongjae Lee, **Xin Liu**, Daniel McDuff, Hyeonhoon Lee, Cynthia Breazeal, "VocalAgent: Large Language Models for Vocal Health Diagnostics with Safety-Aware Evaluation," *Interspeech 2025*, 2025

[61] Yubin Kim, Zhiyuan Hu, Hyewon Jeong, Eugene Park, Shuyue Stella Li, Chanwoo Park, Shiyun Xiong, MingYu Lu, Hyeonhoon Lee, **Xin Liu**, "BehaviorSFT: Behavioral Token Conditioning for Clinical Agents Across the Proactivity Spectrum," *EMNLP 2025*, 2025

[60] Xulin Ma, Jiankai Tang, Zhang Jiang, Songqin Cheng, Yuanchun Shi, Dong Li, **Xin Liu**, Daniel McDuff, Xiaojing Liu, Yuntao Wang, "Non-Contact Health Monitoring During Daily Personal Care Routines," *IEEE BSN 2025*, 2025

[59] Yubin Kim, Hyewon Jeong, Chanwoo Park, Eugene Park, Haipeng Zhang, **Xin Liu**, Hyeonhoon Lee, Daniel McDuff, Marzyeh Ghassemi, Cynthia Breazeal, "Tiered Agentic Oversight: A Hierarchical Multi-Agent System for AI Safety in Healthcare," *arXiv:2506.12482*, 2025

[58] Yuwei Zhang #, Kumar Ayush #, Siyuan Qiao, A. Ali Heydari, Girish Narayanswamy, Maxwell A. Xu, Ahmed A. Metwally, Shawn Xu, Jake Garrison, Xuhai Xu, Tim Althoff, Yun Liu, Pushmeet Kohli, Jiening Zhan, Mark Malhotra, Shwetak Patel, Cecilia Mascolo, **Xin Liu ***, Daniel McDuff*, Yuzhe Yang*, "SensorLM: Learning the Language of Wearable Sensors," *arXiv:2508.01234*, 2025

[57] Ken Gu, Zhihan Zhang, Kate Lin, Yuwei Zhang, Akshay Paruchuri, Hong Yu, Mehran Kazemi, Kumar Ayush, A. Ali Heydari, Maxwell A. Xu, **Xin Liu**, "RADAR: Benchmarking Language Models on Imperfect Tabular Data," *Under Review at NeurIPS*, 2025

[56] Maxwell A. Xu #, Girish Narayanswamy #, Kumar Ayush, Dimitris Spathis, Shun Liao, Shyam A. Tailor, Ahmed Metwally, A. Ali Heydari, Yuwei Zhang, Jake Garrison, Samy Abdel-Ghaffar, Xuhai Xu, Ken Gu, Jacob Sunshine, Ming-Zher Poh, Yun Liu, Tim Althoff, Shrikanth Narayanan, Pushmeet Kohli, Mark Malhotra, Shwetak Patel, Yuzhe Yang, James M. Rehg, **Xin Liu $**, Daniel McDuff $, "LSM-2: Learning from Incomplete Wearable Sensor Data," *Under Review at NeurIPS*, 2025 *$ Equal Leadership, Corresponding Author # Equal Contribution*

[55] Yubin Kim, Hyewon Jeong, Shan Chen, Shuyue Stella Li, Mingyu Lu, Kumail Alhamoud, Jimin Mun, Cristina Grau, Minseok Jung, Rodrigo Gameiro, Lizhou Fan, Eugene Park, Tristan Lin, Joonsik Yoon, Wonjin Yoon, Maarten Sap, Yulia Tsvetkov, Paul Liang, Xuhai Xu, **Xin Liu**, Daniel McDuff, Hyeonhoon Lee, Hae Won Park, Samir Tulebaev, Cynthia Breazeal, "Medical Hallucinations in Foundation Models and Their Impact on Healthcare," *Under Review at Nature Medicine*, 2025

[54] Hitesh Goel, Yoobin Park, Jin Liou, Darwin A. Guevarra, Peggy Callahan, Jolene Smith, Bingsheng Yao, Dakuo Wang, **Xin Liu**, Daniel McDuff, Noemie Elhadad, Emiliana Simon-Thomas, Elissa Epel, Xuhai Xu, "Promoting Prosociality via Micro-acts of Joy: A Large-Scale Well-Being Intervention Study," *ACM CHI*, 2025

[53] Neil Mallinar, A. Ali Heydari, **Xin Liu**, Anthony Z. Faranesh, Brent Winslow, Nova Hammerquist, Benjamin Graef, Cathy Speed, Mark Malhotra, Shwetak Patel, Javier L. Prieto, Daniel McDuff, Ahmed A. Metwally, "A Scalable Framework for Evaluating Health Language Models," *Under Minor Revision at npj Digital Medicine*, 2025

[52] Vidya Srinivas, Xuhai Xu, **Xin Liu**, Kumar Ayush, Isaac Galatzer-Levy, Shwetak Patel, Daniel McDuff, Tim Althoff, "Substance over Style: Evaluating Proactive Conversational Coaching Agents," *ACL 2025 (Main)*, 2025

[51] Shun Liao*, Paolo Di Achille*, Jiang Wu*, Silviu Borac*, Jonathan Wang*, **Xin Liu***, Eric Teasley*, Lawrence Cai, Yun Liu, Daniel McDuff, Hao-Wei Su, Brent Winslow, Anupam Pathak, Shwetak Patel, Jameson K. Rogers, Ming-Zher Poh, "Passive Heart Rate Monitoring During Smartphone Use in Everyday Life," *Under Major Revision at Nature*, 2025

[50] Jiankai Tang, **Xin Liu**, Daniel McDuff, Zhang Jiang, Hongming Hu, Luxi Zhou, Nodoka Suzuki, Yuki Nagahama, Wei Li, Yuntao Wang, "Camera Measurement of Blood Oxygen Saturation," *Under Review at IEEE JBHI*, 2025

[49] Theodore Curran*, Chengqian Ma*, **Xin Liu***, Daniel McDuff*, Girish Narayanswamy, George Stergiou, Shwetak Patel, Eugene Yang, "Estimating Blood Pressure with a Camera: An Exploratory Study of Ambulatory Patients with Cardiovascular Disease," *arXiv:2503.00890*, 2025

[48] Mehran Kazemi, Bahare Fatemi, Hritik Bansal, John Palowitch, Chrysovalantis Anastasiou, Sanket Vaibhav Mehta, Lalit K. Jain, Virginia Aglietti, Disha Jindal, Peter Chen, Nishanth Dikkala, Gladys Tyen, **Xin Liu**, Uri Shalit, Silvia Chiappa, Kate Olszewska, Yi Tay, Vinh Q. Tran, Quoc V. Le, Orhan Firat, "Big-Bench Extra Hard," *ACL 2025 (Main)*, 2025

[47] Mihir Parmar, **Xin Liu**, Palash Goyal, Yanfei Chen, Long Le, Swaroop Mishra, Hossein Mobahi, Jindong Gu, Zifeng Wang, Hootan Nakhost, Hamid Palangi, Tomas Pfister, "PlanGEN: A Multi-Agent Framework for Generating Planning and Reasoning Trajectories for Complex Problem Solving," *EMNLP 2025*, 2025

[46] Kegang Wang, Jiankai Tang, Yantao Wei, Mingxuan Liu, **Xin Liu**, Yuntao Wang, "A Plug-and-Play Temporal Normalization Module for Robust Remote Photoplethysmography," *arXiv:2411.15283*, 2024

[45] Girish Narayanswamy #, **Xin Liu #$**, Kumar Ayush, Yuzhe Yang, Xuhai Xu, Shun Liao, Jake Garrison, Shyam Tailor, Jake Sunshine, Yun Liu, Tim Althoff, Shrikanth Narayanan, Pushmeet Kohli, Jiening Zhan, Mark Malhotra, Shwetak Patel, Samy Abdel-Ghaffar, Daniel McDuff†$, "Scaling Wearable Foundation Models," *ICLR*, 2025 *$ Equal Leadership, Corresponding Author # Equal Contribution*

[44] Isaac R. Galatzer-Levy, Jed McGiffin, David Munday, **Xin Liu**, Danny Karmon, Ilia Labzovsky, Rivka Moroshko, Amir Zait, Daniel McDuff, "Evidence of Cognitive Deficits and Developmental Advances in Generative AI: A Clock Drawing Test Analysis," *arXiv:2410.11756*, 2024

[43] Isaac R. Galatzer-Levy, David Munday, Jed McGiffin, **Xin Liu**, Danny Karmon, Ilia Labzovsky, Rivka Moroshko, Amir Zait, Daniel McDuff, "The Cognitive Capabilities of Generative AI: A Comparative Analysis with Human Benchmarks," *arXiv:2410.07391*, 2024

[42] Daniel McDuff, David Munday, **Xin Liu**, Isaac Galatzer-Levy, "Cognitive Assessment of Language Models," *ICML 2024 Workshop on LLMs and Cognition*, 2024

[41] Daniel McDuff, Isaac Galatzer-Levy, Seamus Thomson, Andrew Barakat, Conor Heneghan, Samy Abdel-Ghaffar, Jake Sunshine, Ming Zher-Poh, Lindsey Sunden, John Hernandez, **Xin Liu**, "Evidence of Differences in Diurnal Electrodermal, Temperature, and Heart Rate Patterns by Mental Health Status in Free-Living Data," *BMJ Mental Health*, 2024

[40] Xuhai Xu, **Xin Liu**, Han Zhang, Weichen Wang, Subigya Nepal, Yasaman S. Sefidgar, Woosuk Seo, Kevin S. Kuehn, Jeremy F. Huckins, Margaret E. Morris, "GLOBEM: Cross-Dataset Generalization of Longitudinal Human Behavior Modeling," *GetMobile: Mobile Computing and Communications*, 28(2):23–30, 2024

[38] Chengqian Ma, Zhanxiang Hua, Alexandra Anderson-Frey, Vikram Iyer, **Xin Liu**, Lianhui Qin, "WeatherQA: Can Multimodal Language Models Reason About Severe Weather?," *arXiv:2406.11217*, 2024

[37] Akshay Paruchuri, Jake Garrison, Shun Liao, John Hernandez, Jacob Sunshine, Tim Althoff, **Xin Liu $**, Daniel McDuff $, "What Are the Odds? Language Models Are Capable of Probabilistic Reasoning," *EMNLP 2024 (Main)*, 2024 *$ Equal Leadership, Corresponding Author*

[36] Mike A. Merrill #, Akshay Paruchuri #, Naghmeh Rezaei, Geza Kovacs, Javier Perez, Yun Liu, Erik Schenck, Nova Hammerquist, Jake Sunshine, Shyam Tailor, Kumar Ayush, Hao-Wei Su, Qian He, Cory Y. McLean, Mark Malhotra, Shwetak Patel, Jiening Zhan, Tim Althoff $, Daniel McDuff $, **Xin Liu $**, "Transforming Wearable Data into Health Insights Using Large Language Model Agents," *Nature Communications (Conditionally accepted)*, 2025 *$ Equal Leadership, Corresponding Author # Equal Contribution*

[35] Zachary Englhardt, Chengqian Ma, Margaret E. Morris, Chun-Cheng Chang, Xuhai "Orson" Xu, Lianhui Qin, Daniel Mc-Duff, **Xin Liu**, Shwetak Patel, Vikram Iyer, "From Classification to Clinical Insights: Towards Analyzing and Reasoning About Mobile and Behavioral Health Data with Large Language Models," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT)*, 8(2):1–25, 2024

[34] Hyewon Jeong, Sarah Jabbour, Yuzhe Yang, Rahul Thapta, Hussein Mozannar, William Jongwon Han, Nikita Mehandru, Michael Wornow, Vladislav Lialin, **Xin Liu**, "Recent Advances, Applications, and Open Challenges in Machine Learning for Health: Reflections from Research Roundtables at ML4H 2023 Symposium," *arXiv:2403.01628*, 2024

[33] Yuzhe Yang, Yujia Liu, **Xin Liu**, Avanti Gulhane, Domenico Mastrodicasa, Wei Wu, Edward J. Wang, Dushyant W. Sahani, Shwetak Patel, "Demographic Bias of Expert-Level Vision-Language Foundation Models in Medical Imaging," *Science Advances*, 2024

[32] Zachary Englhardt, Richard Li, Dilini Nissanka, Zhihan Zhang, Girish Narayanswamy, Joseph Breda, **Xin Liu***, Shwetak Patel*, Vikram Iyer*, "Exploring and Characterizing Large Language Models For Embedded System Development and Debugging," *ACM CHI 2023*

[31] Zachary Englhardt, Chengqian Ma, Margaret E Morris, Xuhai Xu, Chun-Cheng Chang, Lianhui Qin, **Xin Liu***, Shwetak Patel*, Vikram Iyer*, "From Classification to Clinical Insights: Towards Analyzing and Reasoning About Mobile and Behavioral Health Data With Large Language Models," *IMWUT/Ubicomp 2023*

[30] **Xin Liu**, Daniel McDuff, Geza Kovacs, Isaac Galatzer-Levy, Jacob Sunshine, Jiening Zhan, Ming-Zher Poh, Shun Liao, Paolo Di Achille, Shwetak Patel, "Large Language Models are Few-Shot Health Learners," *White Paper*

[29] Akshay Paruchuri, **Xin Liu**, Yulu Pan, Shwetak Patel, Daniel McDuff, Soumyadip Sengupta, "Motion Matters: Neural Motion Transfer for Better Camera Physiological Sensing," *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV) 2024* **[Oral, Oral, Top 2.6%, 53 out of 2042 Submissions]**

[28] Girish Narayanswamy, Yujia Liu, Yuzhe Yang, Chengqian Ma, **Xin Liu**∗, Daniel McDuff∗, Shwetak Patel∗, "BigSmall: Efficient Multi-Task Learning for Disparate Spatial and Temporal Physiological Measurements," *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV) 2024*

[27] **Xin Liu**, Girish Narayanswamy, Akshay Paruchuri, Xiaoyu Zhang, Jiankai Tang, Yuzhe Zhang, Yuntao Wang, Soumyadip Sengupta, Shwetak Patel, and Daniel McDuff, "rPPG-Toolbox: Deep Remote PPG Toolbox," *NeurIPS 2023*

[26] Theodore Curran, **Xin Liu**, Daniel Mcduff, Chengqian Ma, Girish Narayanswamy, Shwetak Patel, Eugene Yang, "Camera-Based Remote Photoplethysmography to Predict Blood Pressure in Clinic Patients with Cardiovascular Disease," *Journal of Hypertension, 2023*

[25] Theodore Curran, Daniel McDuff, **Xin Liu**, Girish Narayanswamy, Chengqian Ma, Shwetak Patel, Eugene Yang, "Camera-based Remote Photoplethysmography for Blood Pressure Measurement: Current Evidence, Clinical Perspectives, and Future Applications," *Connected Health And Telemedicine 2023*

[24] Ziqi Gao, Jianguo Chen, Junliang Xing, Shwetak Patel, Yuanchun Shi, **Xin Liu**∗, Yuntao Wang∗ , "MMTSA: Multimodal Temporal Segment Attention Network for Efficient Human Activity Recognition," *IMWUT/Ubicomp 2023*

[23] Jiankai Tang, Kequan Chen, Yuntao Wang, Yuanchun Shi, Shwetak Patel*, Daniel McDuff*, **Xin Liu**∗, "MMPD: Multi-Domain Mobile Video Physiology Dataset," *EMBC 2023*

[22] Theodore Curran, Xin Liu, Daniel McDuff, Shwetak Patel, Eugene Yang, "Camera-based remote photoplethysmography to measure heart rate and blood pressure in ambulatory patients with cardiovascular disease: preliminary analysis," *Journal of the American College of Cardiology*

[21] Yuzhe Yang, **Xin Liu**, Jiang Wu, Silviu Borac, Dina Katabi, Ming-Zher Poh, Daniel McDuff, "SimPer: Simple Self-Supervised Learning of Periodic Targets," *ICLR 2023* **[Oral, Ranked Top 5 among 4922 Submissions, & Notable Top 5% Submission]**

[20] Yuang Li, Yuntao Wang*, **Xin Liu***, Yuanchun Shi, Shao-Fu Shih, "Enabling Real-time On-chip Audio Super-Resolution for Bone Conduction Microphones," *Sensors*

[19] Xuhai Xu, Han Zhang, Yasaman Sefidgar, Yiyi Ren, **Xin Liu**, Woosuk Seo, Jennifer Brown, Kevin Kuehn, Mike Merrill, Paula Nurius, Shwetak Patel, Tim Althoff, Margaret E. Morris, Eve Riskin, Jennifer Mankoff, Anind K. Dey, "GLOBEM: Multi-Year Datasets for Longitudinal Human Behavior Modeling Generalization," *NeurIPS 2022 - Benchmark and Dataset Track*

[18] Daniel McDuff, Miah Wander, **Xin Liu**, Brian Hill, Javier Hernandez, Jonathan Lester, Tadas Baltrusaitis "SCAMPS: Synthetics for Camera Measurement of Physiological Signals," *NeurIPS 2022 - Benchmark and Dataset Track* **[Oral, Top 1.8%, 183 out of 10411 submissions]**

[17] **Xin Liu**, Brian Hill, Ziheng Jiang, Shwetak Patel, Daniel McDuff, "EfficientPhys: Enabling Simple, Fast, and Accurate Camera-Based Vitals Measurement," *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV 2023)*

[16] Xuhai Xu, **Xin Liu**, Han Zhang, Weichen Wang, Subigya Kumar Nepal, Kevin S. Kuehn, Jeremy F Huckins, Margaret E Morris, Paula S. Nurius, Eve Ann Riskin, Shwetak Patel, Tim Althoff, Andrew Campbell, Anind K. Dey, Jennifer Mankoff , "Cross-Dataset Generalization of Longitudinal Human Behavior Modeling," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT/Ubicomp 2023)* **Distinguished Paper Award**

[15] **Xin Liu**, Ziheng Jiang, Shwetak Patel, Daniel McDuff, "Federated Remote Physiological Measurement with Imperfect Data," *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshop, 2022*

[14] **Xin Liu**, Yuntao Wang, Sinan Xie, Daniel McDuff, Shwetak Patel, "MobilePhys: Personalized Mobile Camera-Based Contactless Physiological Sensing," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT/Ubicomp 2021)*

[13] Daniel McDuff, Javier Hernandez, **Xin Liu**, Erroll Wood, Tadas Baltrusaitis, "Using High-Fidelity Avatars to Advance Camera-based Cardiac Pulse Measurement," *IEEE Transactions on Biomedical Engineering (TBME) 2022*

[12] Brian Hill, **Xin Liu**, Daniel McDuff, "Beat-to-beat cardiac pulse rate measurement from video," *IEEE/CVF International Conference on Computer Vision Conference Workshop*

[11] Daniel McDuff, **Xin Liu**, Javier Hernandez, Erroll Wood, Tadas Baltrusaitis, "Synthetic Data for Multi-Parameter Camera-Based PhysiologicalSensing," *IEEE Engineering in Medicine and Biology Conference (EMBC 2021)*

[10] Chunjong Park, Morelle Arian, **Xin Liu**, Alex Mariakakis, Leon Sasson, Shwetak Patel, Tim Althoff, "Job Performance in Athletes and Salespeople: An Observational Study of Performance, Sleep, and Mobile App Usage," *The Web Conference (WWW 2021),*

[9] **Xin Liu**, Ziheng Jiang , Josh Fromm, Xuhai Xu, Shwetak Patel, Daniel McDuff, "MetaPhys: Few-Shot Adaptation for Non-Contact Physiological Measurement," *ACM Conference on Health, Inference, and Learning (ACM-CHIL 2021)* **Selected Media Coverage:** [UW News], [ACM TechNews Headline], [IEEE Spectrum], [GeekWire]

[8] **Xin Liu**, Yuang Li, Josh Fromm, Ziheng Jiang, Yuntao Wang, Alex Mariakakis, Shwetak Patel, "SplitSR: An End-to-End Approach to Super-Resolution on Mobile Devices," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT/Ubicomp 2021)*

[7] Xuhai Xu, Jiahao Li, Tianyi Yuan, Liang He, **Xin Liu**, Yukang Yan, Yuntao Wang, Yuanchuan Shi, Jennifer Mankoff, Anind Dey, "HulaMove: Using Commodity IMU for Waist Interaction," *ACM CHI Conference on Human Factors in Computing Systems (CHI 2021)*

[6] Kathrin Zürcher, Carl Morrow, Julien Riou, Marie Ballif, Anastasia Sideris Koch, Simon Bertschinger, **Xin Liu**, Manuja Sharma, Keren Middelkoop, Digby Warner, Robin Wood, Matthias Egger, Lukas Fenner "Novel approach to estimate tuberculosis transmission in primary care clinics in sub-Saharan Africa: protocol of a prospective study," *BMJ Open 2020)*

[5] **Xin Liu**, Josh Fromm , Shwetak Patel, Daniel McDuff, "Multi-Task Temporal Shift Attention Networks for On-Device Contactless Vitals Measurement," *Conference on Neural Information Processing Systems, (NeurIPS 2020)* **[Oral, Top 1%, 105 out of 9454 Submissions] Selected Media Coverage:** [Microsoft Research Webinar], [Microsoft Blog], [ZDNet]

[4] Young Lee, **Xin Liu**, Jeremy Gummeson, Sunghoon Ivan Lee, "Towards the Ambulatory Assessment of Movement Quality in Stroke Survivors using a Wrist-worn Inertial Sensor," *IEEE International Conference on Biomedical and Health Informatics (IEEE BHI 2019)*

[3] Sunghoon Ivan Lee, **Xin Liu**, Smita Rajan, Nathan Ramasarma, Paolo Bonato, "A Novel Upper-Limb Function Measure Derived from Finger-Worn Sensor Data Collected in a Free-Living Setting," *PLOS ONE, vol. 14, no. 3, 2019*

[2] **Xin Liu**, Smita Rajan, Nathan Ramasarma, Paolo Bonato, Sunghoon Ivan Lee, "Finger-Worn Sensors for Accurate Functional Assessment of the Upper Limbs in Real-World Settings," *IEEE Engineering in Medicine and Biology Conference (IEEE EMBC 2018)*

[1] **Xin Liu**, Smita Rajan, Nathan Ramasarma, Paolo Bonato, Sunghoon Ivan Lee, "Finger-Worn Sensors for Accurate Functional Assessment of the Upper Limbs in Real-World Settings," *IEEE Journal of Biomedical and Health Informatics (J-BHI), vol.23, no.2, 2019)* **[Cover Article Nominee]**

Teaching Experience

Winter 2021/2022	**TECHIN 513 Managing Data and Signal Processing**, Teaching Assistant	*University of Washington*
Fall 2017	**CS328: Mobile Health & Sensing**, Teaching Assistant (*Outstanding Course Assistant Award*)	*UMass Amherst*

Academic Service & Outreach

OUTREACH

2019-2020	**UW Allen School PhD Visit Day** , Co-Organizer
2019-2020	**UW College of Engineering K-12 Discovery Day**, Volunteer
2018	**UMass Women in Engineering and Computing Career Day for High School Girls**, Volunteer

ACADEMIC SERVICE

2020	**IEEE Journal of Biomedical and Health Informatics**, Reviwer
2020-2023	**ACM CHI**, Reviwer
2020-2023	**ACM IWMUT/Ubicomp**, Reviwer
2021-2023	**IEEE CVPR**, Reviwer
2022-2023	**ICML**, Reviwer
2021-2023	**NeurIPS**, Reviwer
2021-2023	**ICLR**, Reviwer
2021	**UIST**, Reviwer
2021	**ACII**, Reviwer
2021	**IEEE Transaction of Mobile Computing**, Reviwer