

# Xin Liu

RESEARCH SCIENTIST

Google Consumer Health Research Team

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## Summary

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My research interests lie in the intersection of machine learning, ubiquitous computing and health. I have published 20+ peer-reviewed papers on top venues in machine learning (NeurIPS, ICLR, CHIL, CVPR, WACV), mobile and ubiquitous computing (CHI, IMWUT/UbiComp), and health & biomedical engineering (TBME, JBHI, EMBC, PLOS). My research have gained significant attention from both academia and industry and been featured as oral presentations at NeurIPS and ICLR as well as on various public media including IEEE Spectrum, ACM TechNews, GeekWire, ZDNet, UW news.

## Education

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### University of Washington, Seattle

Seattle, WA, USA

#### PH.D. IN COMPUTER SCIENCE

Sep 2018 - March 2023

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

### University of Massachusetts, Amherst

Amherst, MA, USA

#### B.S. IN COMPUTER SCIENCE

Sep 2014 - June 2018

- Graduated with Honors + Outstanding Undergraduate Achievement Award + 21st Century Leaders Award
- Research Area: Mobile & Ubiquitous Computing, Mobile Health, Rehabilitation Technology
- Advisor: Sunghoon Ivan Lee

## Professional Experience

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|-----------|---|
| 2023-Now  | <b>Google + Consumer Health Research</b> , Full-time Research Scientist                       |
| 2018-2023 | <b>University of Washington + Ubiquitous Computing Lab</b> , Graduate Research Assistant      |
| 2021-2023 | <b>Google + Consumer Health Research</b> , Research Intern                                    |
| 2021      | <b>Microsoft Research + Human Understanding and Empathy Team</b> , Research Intern (June-Sep) |
| 2020-2021 | <b>OctoML + Machine Learning System Team</b> , Research Intern (Nov - June)                   |
| 2019      | <b>Allen Institute for Artificial Intelligence (AI2)</b> , Research Intern (June-Sep)         |
| 2016-2018 | <b>UMass Amherst + Advanced Human Health Analytics Lab</b> , Undergraduate Research Assistant |

## Awards

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|------|---|
| 2023 | <b>Distinguished Paper Award</b> , IMWUT/UbiComp 2023 [16]  |
| 2023 | <b>Oral, Notable Top 5%</b> , ICLR 2023 [21]  |
| 2022 | <b>Google PhD Fellowship</b> , Three-year full support, 1 out of 72 worldwide recipients, Google AI |
| 2022 | <b>Oral, Top 1%</b> , NeurIPS 2022 [19]   |
| 2020 | <b>Oral, Top 1%</b> , NeurIPS 2020 [5]  |
| 2019 | <b>Cover Article Nominee</b> , IEEE JBHI [1]  |
| 2018 | <b>Glerum Family Endowed Fellowship</b> , University of Washington                                  |
|      | <b>21st Century Leaders Award</b> , Top 10 most exceptional graduates out of 5500, UMass Amherst    |
|      | <b>Outstanding Undergraduate Achievement Award</b> , 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

## Publications

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### UNDER REVIEW/REVISION

- [6] Zachary Enghardt, 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," *SenSys 2023*
- [5] Akshay Paruchuri, **Xin Liu**, Yulu Pan, Shwetak Patel, Daniel McDuff, Soumyadip Sengupta, "Motion Matters: Neural Motion Transfer for Better Camera Physiological Sensing," *WACV 2023*
- [4] 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," *WACV 2023* (\* **senior author**)
- [2] Brian Hill, **Xin Liu**, Daniel McDuff, "Learning Higher-Order Dynamics in Video-Based Cardiac Measurement," *IEEE Transactions on Biomedical Engineering (TBME)*
- [1] **Xin Liu**, Shwetak Patel, Daniel McDuff, "Camera-Based Physiological Sensing: Challenges and Future Directions," *Arxiv*

### PUBLISHED

- [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, **Xin Liu\***, Yuntao Wang\* , "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* (\* **senior author**)
- [23] Jiankai Tang, Kequan Chen, Yuntao Wang, Yuanchun Shi, Shwetak Patel, Daniel McDuff, **Xin Liu\***, "MMPD: Multi-Domain Mobile Video Physiology Dataset," *EMBC 2023* (\* **senior author**)
- [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, Top 0.1% Review Score & Notable Top 5% Submission]
- [20] Yang 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%]

- [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 Physiological Sensing," *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**, Yang 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

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

## Mentoring

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2020-Now	<b>Mentor at GIX Access Computing Program</b> , University of Washington & Tsinghua University	Seattle, WA
2022-Now	<b>Yujia Liu</b> , UW ECE M.S., (Now PhD Student at UCSD)	Seattle, WA
2022-Now	<b>Yuxuan Ou</b> , BUPT, China (Now MS student at University of Cambridge)	Seattle, WA
2021-2022	<b>Xiaoyu Zhang</b> , Tsinghua University, BS, (Now PhD Student at Tsinghua CS)	Seattle, WA
2020-2022	<b>Sinan Xie</b> , Tsinghua University, BS, (Now PhD Student at UCSD ECE)	Seattle, WA
2020-2021	<b>Tess Despres</b> , University of Washington, ECE, (Now PhD Student at UC Berkeley EECS)	Seattle, WA
2020-2021	<b>Haojia Nie</b> , University of Waterloo, CS, (Intern at ByteDance + Meta)	Seattle, WA
2019-2020	<b>Yuang Li</b> , BUPT, China (Now MS student at University of Cambridge)	Seattle, WA
2019-2020	<b>Yongjoon Oh</b> , University of Washington, CSE (Now at Microsoft)	Seattle, WA

## Academic Service & Outreach

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### OUTREACH

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

### ACADEMIC SERVICE

2020	<b>IEEE Journal of Biomedical and Health Informatics</b> , Reviewer
2020	<b>ACM CHI</b> , Reviewer
2020-2021	<b>ACM IWMUT/UbiComp</b> , Reviewer
2021	<b>IEEE CVPR</b> , Reviewer
2021	<b>NeurIPS</b> , Reviewer
2021	<b>ICLR</b> , Reviewer
2021	<b>UIST</b> , Reviewer
2021	<b>ACII</b> , Reviewer
2021	<b>IEEE Transaction of Mobile Computing</b> , Reviewer