Changhao Xu

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Education

California Institute of Technology, Pasadena 09/2018 – 01/2024
Ph.D. major in Medical Engineering, advisor: Wei Gao
Ph.D. minor in Computer Science, advisor: Yisong Yue
M.S. in Medical Engineering in 2020, Amazon AI4Science Fellow, GPA 4.1/4.0

Fudan University, Shanghai 09/2014 – 06/2018
B.S. in Materials Science, GPA 3.83/4.0, ranking 1/66
Advisor: Yongfeng Mei

University of California, Los Angeles 07/2017 – 09/2017
Summer research in Cross-disciplinary Scholars in Science and Technology (CSST) Program
Advisor: Xiangfeng Duan

University of California, Los Angeles 09/2016 – 12/2016
Exchange student in Physics

Research Interests

My research interests are in the intersections of machine learning, electronic skin, robotics and personalized health, spanning the spectrum from wearable sensors development, algorithm design, to applications in robotics and medicine. To that end, my research has three goals: (1) develop robust sensors for continuous long-term monitoring; (2) bridge sensor data with robotics and health information through an autonomous machine learning pipeline; and (3) advance robotic control and health assessment with intelligent systems.

Publications

(* equal contributions. For the up-to-date list, please visit my Google Scholar page.)

1. **Changhao Xu**, et al. Learning human performance using a multimodal adaptive electronic skin, to be submitted.
2. **Changhao Xu**, et al. A physicochemical-sensing electronic skin for stress response monitoring, *Nature Electronics*, 10.1038/s41928-023-01116-6 (2023).
3. **Changhao Xu**, et al. Artificial intelligence-powered electronic skin, *Nature Machine Intelligence*, 5, 1344–1355 (2023).
4. Ehsan Shirzaei Sani*, **Changhao Xu***, et al. A stretchable wireless wearable bioelectronic system for multiplexed monitoring and combination treatment of infected chronic wounds, *Science Advances*, 9, eadf7388 (2023).
5. Jihong Min*, Jiaobing Tu*, **Changhao Xu***, Heather Lukas*, et al. Skin-Interfaced Wearable Sweat Sensors for Precision Medicine, *Chemical Reviews*, 8, 5049–5138 (2023).
6. Cui Ye, Minqiang Wang, Jihong Min, Roland Yingjie Tay, Heather Lukas, Juliane R Sempionatto, Jiahong Li, **Changhao Xu**, et al. A wearable aptamer nanobiosensor for non-invasive female hormone monitoring, *Nature Nanotechnology*, 10.1038/s41565-023-01513-0 (2023).
7. Yu Song, Roland Yingjie Tay, Jiahong Li, **Changhao Xu**, et al. 3D-printed epifluidic electronic skin for machine learning–powered multimodal health surveillance, *Science Advances*, 9, eadi6492 (2023).
8. Jihong Min, Stepan Demchyshyn, Juliane R Sempionatto, Yu Song, Bekele Hailegnaw, **Changhao Xu**, et al. An autonomous wearable biosensor powered by a perovskite solar cell, *Nature Electronics*, 6, 630–641 (2023).
9. Jiaobing Tu, Jihong Min, Yu Song, **Changhao Xu**, et al. A wireless patch for the monitoring of C-reactive protein in sweat, *Nature Biomedical Engineering*, 7, 1293–1306 (2023).
10. Minqiang Wang, Yiran Yang, Jihong Min, Yu Song, Jiaobing Tu, Daniel Mukasa, Cui Ye, **Changhao Xu**, et al. A wearable electrochemical biosensor for the monitoring of metabolites and nutrients, *Nature Biomedical Engineering*, 6, 1225–1235 (2022).

11. You Yu, Jiahong Li, Samuel A Solomon, Jihong Min, Jiaobing Tu, Wei Guo, **Changhao Xu**, et al. All-printed soft human-machine interface for robotic physicochemical sensing, *Science Robotics*, 7, eabn0495 (2022).
12. Heather Lukas, **Changhao Xu**, et al. Emerging telemedicine tools for remote COVID-19 diagnosis, monitoring, and management, *ACS Nano*, 14, 16180-16193 (2020).
13. Rebeca M. Torrente-Rodríguez, Heather Lukas, Jiaobing Tu, Jihong Min, Yiran Yang, **Changhao Xu**, et al. SARS-CoV-2 RapidPlex: A Graphene-based Multiplexed Telemedicine Platform for Rapid and Low-Cost COVID-19 Diagnosis and Monitoring, *Matter*, 3, 1981-1998 (2020).
14. You Yu, Joanna Nassar, **Changhao Xu**, et al. Biofuel-powered Soft Electronic Skin with Multiplexed and Wireless Sensing for Human-Machine Interfaces, *Science Robotics*, 5, eaaz7946 (2020).
15. **Changhao Xu**, et al. Skin-interfaced Sensors in Digital Medicine: from Materials to Applications, *Matter*, 2, 1414-1445 (2020).
16. **Changhao Xu**, et al. Motile Microelectronics with Wireless Power, *Nature Electronics*, 3, 139-140 (2020).
17. Rebeca M. Torrente-Rodríguez, Jiaobing Tu, Yiran Yang, Jihong Min, Minqiang Wang, Yu Song, You Yu, **Changhao Xu**, et al. Investigation of Cortisol Dynamics in Human Sweat Using a Graphene-Based Wireless mHealth System, *Matter*, 2, 921-937 (2020).
18. **Changhao Xu**, et al. Ultrathin Silicon Nanomembrane in a Tubular Geometry for Enhanced Photodetection, *Advanced Optical Materials*, 7, 1900823 (2019).
19. **Changhao Xu**, et al. Rolled-up Nanotechnology: Materials Issue and Geometry Capability, *Advanced Materials Technologies*, 4, 1800486 (2019).
20. Jian Guo, Yuan Liu, Yue Ma, Enbo Zhu, Shannon Lee, Zixuan Lu, Zipeng Zhao, **Changhao Xu**, et al. Few-layer GeAs field effect transistors and infrared photodetectors, *Advanced Materials*, 30, 1705934 (2018).

HONORS AND AWARDS

Amazon AI4Science Fellow	2023
Caltech KNI cleanroom resident expert	2019
UCLA CSST Scholar	2017
Samsung scholarship	2016
Fudan Wangdao Scholar (Highest honor of Undergraduate Research Program)	2015
Xu Zengshou Scholarship (1 out of 64)	2015

TEACHING EXPERIENCES

Teaching assistant for MedE 201: Principles and Design of Medical Devices	2020 and 2021
Guest lecturer for MedE 202: Sensors in Medicine	2023

ADVISING AND MENTORSHIP

Alison Lao (from UCSD Nanoengineering), Caltech SURF. Next: Ph.D. at Rice.	2020
Xin Hui Ooi (from Caltech ME), Caltech SURF. Next: Ph.D. at Umich.	2021
Rinni Bhansali (from Stanford EE), Caltech Amgen Fellow.	2022
Ashwitha Surabhi (from Caltech CNS), Caltech SURF.	2023
Ruixiao Liu, Ph.D. student at Caltech.	2023
Lauren Wang and Aayan Khan (from San Marino High School)	2023

DIVERSITY, EQUITY AND INCLUSION

Mentor of the Caltech MedE first-year mentorship program
Volunteer teacher (2023.9 -) at San Marino High School