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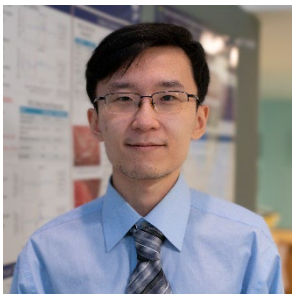
# Embedded Intelligence Towards Smarter, Healthier, and Safer Environments




## Stephen Xia
### UC Berkeley


Wednesday, February 22, 2023
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**Zoom:** https://purdue-edu.zoom.us/j/95911599109 ~ Meeting ID: 959 1159 9109


**Abstract**

We have seen remarkable growth in smart devices and artificial intelligence in all aspects of our lives. Despite the ever-growing amount of AI around us, our environments are still far from truly intelligent. At the touch of a button, we have access to powerful AI that can easily outperform any human in complex tasks, yet our environments still cannot alert us to dangerous approaching vehicles, nor help us find our lost child in a busy grocery store, something all of us do regularly and intuitively. In this talk, I will present two lines of work that bridge the gap between AI and truly intelligent environments.

First, I will introduce my work on embedded acoustic intelligence. I will start by presenting my work on embedding acoustic intelligence into wearables we commonly carry, such as headphones and helmets, to create safer cities. These low-cost and long-lasting wearables leverage novel architectures that utilize a combination of physics-based models and machine learning techniques to alert pedestrians and construction workers of dangers from oncoming vehicles, ultimately acting as a second pair of ears that create a sphere of safety around us. Next, I will discuss how we can take lessons learned from urban safety to realize a generalized selective audio filtering architecture that allows us to embed robust acoustic intelligence into a diverse set of real-time and resource-constrained applications and platforms. This architecture dynamically leverages the physics of audio and a wide range of data-driven machine learning models to allow engineers and developers to enhance and suppress custom sounds in their applications.

Second, I will present my work on creating more configurable, adaptive, and evolving environments, which are three critical characteristics we need to realize to create truly intelligent environments. I will first touch on several works that allow anyone, regardless of their technical background, to easily deploy and configure complex sensing solutions, such as camera networks for indoor occupant tracking, without needing any domain or expert knowledge. Second, I will introduce my work on adaptive smart home systems that jointly consider human preferences and available resources within the environment to improve home automation and greatly reduce the barrier of entry for smart home technologies. Finally, I will present several works where we realize new dormant sensing and compute capabilities in several platforms, such as drones, by only leveraging processes already present, thereby "evolving" new capabilities completely for free.


**Bio**

Stephen Xia is a Postdoctoral Scholar in the Department of Electrical Engineering and Computer Sciences at UC Berkeley, advised by Dr. Prabal Dutta and Dr. Xiaofan (Fred) Jiang. Stephen received his Ph.D. in 2022 from Columbia University and his B.S. in 2016 from Rice University, all in Electrical Engineering. His research lies at the intersection between systems, embedded machine learning, and signal processing, spanning areas in mobile and embedded systems, Internet-of-Things, cyber-physical systems, artificial intelligence, and smart health. His work takes a joint physics-based and data-driven approach to realize truly intelligent and autonomous environments by embedding and dynamically utilizing compute, sensing, actuation, storage, and networking resources all around us. Stephen's research has been highlighted by many popular media outlets, including Mashable, Fast Company, and Gizmodo, and has received various distinctions, including Best Demo Awards at ACM SenSys 2021, ACM/IEEE IPSN 2020, ACM/IEEE IoTDI 2018, and the Best Presentation Award at IEEE VNC 2018.

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