Tara Boroushaki

tarab@mit.edu | tara-boroushaki.com

Research Interests

My research interests lie in sensing and mobile technologies with applications in wireless networking, wireless sensing, cyber-physical systems (including robotics), and cyber-human systems. I develop algorithms and build systems for multi-modal sensing to connect, perceive, and interact with the environment in novel ways to enable more efficient, robust, and capable mobile, cyber-physical, and cyber-human systems.

Education

Massachusetts Institute of Technology — MA, USA
Doctor of Philosophy — *June 2021 – Present*
Advisor: Prof. Fadel Adib

Massachusetts Institute of Technology — MA, USA
Master of Sciences, Digital Communication and Multimedia — *Sep. 2019 – June 2021*
Thesis: Robotic Grasping of Fully-Occluded Objects using RF Perception

Sharif University of Technology — Tehran, Iran
B.Sc. in Electrical Engineering — *June 2019*

Awards & Honors

- Microsoft Research PhD Fellow — 2022-2024
- IEEE RFID '23 Best Paper Award — 2023
- Meta Research PhD Fellowship (declined in favor of Microsoft fellowship) — 2022-2024
- RFusion in "103 Ways MIT is Making the World Better" — 2022
- ACM SenSys '21 Best Paper Award Finalist — 2021
- Neekeyfard Fund Award — 2022

Publications

1. Demo: Real-time X-Ray Vision via Augmented Reality with RF Sensing
   Tara Boroushaki, Maisy Lam, Weitung Chen, Laura Dodds, Aline Eid, and Fadel Adib
   ACM SIGCOMM, September 2023
2. Exploiting Synergies between AR and RFIDs for Item Localization and Retrieval
   Tara Boroushaki, Maisy Lam, Weitung Chen, Laura Dodds, Aline Eid, and Fadel Adib
   IEEE RFID, June 2023, **Best Paper Award**
3. Augmenting Augmented Reality with Non-Line-of-Sight Perception
   Tara Boroushaki, Maisy Lam, Laura Dodds, Aline Eid, and Fadel Adib
   USENIX NSDI, April 2023
4. FuseBot: Mechanical Search of Rigid and Deformable Objects via Multi-Modal Perception
   Tara Boroushaki, Laura Dodds, Nazish Naeem, and Fadel Adib
   Autonomous Robots, September 2023
5. FuseBot: RF-Visual Mechanical Search
   Tara Boroushaki, Laura Dodds, Nazish Naeem, and Fadel Adib
   Robotics: Science and Systems (RSS), June 2022
6. RFusion: Robotic Grasping via RF-Visual Sensing and Learning
   Tara Boroushaki, Isaac Perper, Mergen Nachin, Alberto Rodriguez, and Fadel Adib,
   ACM SenSys, November 2021, **Best Paper Finalist**

7. Robotic Grasping of Fully Occluded Objects using RF Perception
Tara Boroushaki, Junshan Leng, Ian Clester, Alberto Rodriguez, and Fadel Adib,
IEEE ICRA, May 2021

Patents

1. Tara Boroushaki, Fadel Adib, and Junshan Leng, "System and Method for Location Determination and Robot Control," US Patent Application No. 17530603, Filed November 2021.
2. Tara Boroushaki, Isaac Perper, and Fadel Adib, "Methods and Apparatus for Robotic Grasping via RF-Visual Sensing and Learning," US Patent Application No. 17819685, Filed August 2022.
3. Tara Boroushaki, Maisy Lam, Laura Dodds, Aline Eid, and Fadel Adib, "Augmenting Augmented Reality with non-line-of-sight Perception," US Provisional Patent Application No. 63408240, Filed September 2022.

Impact

Cartesian Systems (start-up) is currently using my research on multi-modal perception, localization, and mapping. They have deployed my reseach to solve problems in retail and supply chain.

Funding

Co-authored the following proposal with Prof. Fadel Adib and Prof. Yasaman Ghasempour:

- Collaborative Research: CPS: Medium: Robotic Perception and Manipulation via Full-Spectral Wireless Sensing, NSF award, *1.2 million dollars*

Experience

Research Intern June 2022 – Sep 2022
Microsoft Research, Redmond, WA, USA

- Worked on next generation Mixed Reality Headsets in the Microsoft Networking Research Group and Mixed Reality with Dr. Jouya Jadidian and Dr. Bodhi Priyantha.

Research Assistant July 2018 – Jan. 2019
Computer Vision and Geometry Group, ETH Zurich, Switzerland

- Worked on disparity estimation from a stereo pair of images under the supervision of Prof. Marc Pollefeys

Teaching Experience

- Teaching Assistant, How To Wirelessly Sense Almost Anything, MIT, Fall 2022
- Guest Lecturer, Computer Networks, MIT, Fall 2023
- Teaching Assistant, Principles of Electrical Engineering, Sharif University of Technology, Fall 2016 & 2017

Mentoring Experience

I have had the opportunity to mentor many students at MIT:

- Graduate students: Laura Dodds, Maisy Lam, Nazish Naeem, Weitung Chen, Isaac Perper
- Undergraduate students: Toya Takahashi, Natalie Tang, Ian Limarta, Monica Liu, Suleman Thaniana

Academic Service

- Co-Chair of *ACM* S^3 Workshop in Mobile Computing and Networking Conference, 2023
- Shadow PC member for *the ACM Conference on Embedded Networked Sensor Systems* (SenSys), 2022
- Reviewer for *IEEE Transactions on Mobile Computing* and *the ACM Transactions on Internet of Things*
- External Reviewer for the *ACM Mobicom, SIGCOMM, Mobisys*, and the *USENIX NSDI*
- Reviewer for *the IEEE Robotics and Automation Letters (RA-L), and ICRA*
- Chair of *Automation: Sensors and Grasping* Session in ICRA'21

Invited Talks & Conference Presentations

- **Exploiting Synergies between AR and RFIDs for Item Localization and Retrieval**
  IEEE RFID, June 2023
- **Giving Humans and Robots X-Ray Vision**
  TEDx MIT, April 2023
- **Augmenting Augmented Reality with Non-Line-of-Sight Perception**
  Networked Systems Design and Implementation (NSDI), April 2023
- **FuseBot: RF-Visual Mechanical Search**
  Robotics: Science and Systems (RSS), June 2022
- **Super-Human Perception with Radio Frequencies**
  MAS Research Talks, MIT Media Lab, May 2022
- **Robotic Grasping via RF-Visual Sensing and Learning**
  Harvard School of Engineering and Applied Sciences (SEAS), December 2021
- **RFusion: Robotic Grasping via RF-Visual Sensing and Learning**
  The ACM Conference on Embedded Networked Sensor Systems (SenSys), November 2021
- **Robotic Grasping of Fully Occluded Objects using RF Perception**
  IEEE International Conference on Robotics and Automation (ICRA), June 2021
- **Superhuman Robot Senses: Using Radio Frequencies to See Hidden Objects**
  MIT Horizon, June 2021

Technical Skills

- **Programming:** C/C++, Python (including TensorFlow, Pytorch), MATLAB, R, Java
- **Robotics:** ROS, Simulation (e.g. CoppeliaSim, Gazebo, and Pybullet), Universal Robots UR5e, Robotiq 2f-85 gripper
- **Sensing Systems:**
  - **Radars and Software-Defined Radios:** TI 77GHz Radar (AWR1642), Infineon's 24GHz radar (BGT24MTR12), Socionext 60GHz Radar (SC1220AT2), BladeRF, Ettus USRP N210
  - **Vision Sensors:** Microsoft HoloLens 2, Intel RealSense D415, Himax (hm01b0) image sensor
- **Hardware and Circuit Design:** Ansys Electronics, AVR Microcontrollers, Altium Designer, HSPICE

Selected Press Coverage

- **X-AR:** MIT News, Boston Globe Media, Communications of ACM,7 NEWS WHDH, Popular Science, etc.
- **FuseBot:** MIT News[Front Page], Vision System Design, TechCrunch, etc.
- **RFusion:** MIT News [Front Page], BBC, World Economic Forum, Daily Mail, VoA News Russian, etc.
- **RF-Grasp:** The Wall Street Journal, MIT News, ACM TechNews, IEEE Spectrum, Mashable, etc.