Tara Boroushaki

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Research Interests

- Wireless Sensing, Radio Frequency Perception, Multi-Modal Sensing, Sensor Fusion
- Mixed Reality, Robotic Manipulation and Navigation, Computer Vision, Machine Learning

Education

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

Massachusetts Institute of Technology — MA, USA
Master of Sciences, Digital Communication and Multimedia, 5.0/5.0 GPA — *Sep. 2019 – June 2021*
Advisor: Prof. Fadel Adib
Thesis: Robotic Grasping of Fully-Occluded Objects using RF Perception

Sharif University of Technology — Tehran, Iran
B.Sc. in Electrical Engineering, Major: Communications — *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
   Networked Systems Design and Implementation (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,
   The ACM Conference on Embedded Networked Sensor Systems (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 International Conference on Robotics and Automation (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.

Experience

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

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

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

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

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

Academic Service

- Co-Chair of *ACM S* [3] Workshop in Mobile Computing and Networking Conference, 2023
- Shadow PC memeber for *the ACM Conference on Embedded Networked Sensor Systems* (SenSys), 2022
- Reviewer for *IEEE Transactions on Mobile Computing*
- Reviewer for *the IEEE Robotics and Automation Letters (RA-L)*
- Reviewer for *IEEE International Conference on Robotics and Automation (ICRA)*
- Reviewer for *the ACM Transactions on Internet of Things*
- Chair of *Automation: Sensors and Grasping* Session in ICRA'21

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), Socionext 60GHz Radar (SC1220AT2), BladeRF, Ettus USRP N210
  - **Vision Sensors:** Microsoft HoloLens 2, Intel RealSense D415
- **Hardware and Circuit Design:** Ansys Electronics, AVR Microcontrollers, Altium Designer, HSPICE

Press Coverage

- **X-AR:**
  1. **MIT News**, Adam Zewe, "Augmented reality headset enables users to see hidden objects," *Feb 27, 2023*
  2. **Boston Globe Media**, Ross Cristantiello, "MIT researchers create X-ray vision headset," *March 1, 2023*
  3. **Communications of ACM**, Samuel Greengard, "A Focus on X-Ray Vision," *May 11, 2023*
  4. **7 NEWS WHDH**, Andrew Paul, "MIT researchers develop augmented reality headset to help users see hidden objects," *March 2, 2023*
  5. **Popular Science**, Andrew Paul, "This modified AR headset could help you find your lost keys," *Feb 27, 2023*
  6. **The Daily Beast**, Tony Ho Tran, "This Headset Gives You X-Ray Vision to See Through Objects," *Feb 27, 2023*
  7. **Science Daily**, "Augmented reality headset enables users to see hidden objects," *Feb 27, 2023.*
- **FuseBot:**
  1. **MIT News** [**Front Page**], Adam Zewe, "Robot overcomes uncertainty to retrieve buried objects," *June 29, 2022*
  2. **TechCrunch**, Brian Heater, "Warehouse Wars," *June 30, 2022*
  3. **Vision System Design**, Linda Wilson, "MIT Researchers Build Robot That Detects Hidden Items in a Pile," *16 Aug, 2022*
- **RFusion:**
  1. **MIT News** [**Front Page**], Adam Zewe, "A robot that finds lost items," *October 5, 2021*
  2. **World Economic Forum**, Adam Zewe, "This robot looks for lost items," *9 October, 2021*

3. **BBC**, LJ Rich, "Robot arm finds lost items and other tech news stories," *October 8, 2021*
4. **Daily Mail**, Sam Tonkin, "Never misplace your keys again! Scientists develop a robot that can rapidly sift through piles of clutter to locate lost items," *7 October, 2021*
5. **Interesting Engineering**, Chris Young, "A New MIT Smart Home Robot Will Find Your Lost Car Keys," *October 5, 2021*
6. **VoA News Russian**, Andrei Dziarkach, " "Details" with Andrey Derkach ", *October 9, 2021*
7. **GizModo**, Asha Barbaschow, "A Sniffer Dog, But Make It A Robot, And Just An Arm," *October 6, 2021*

- **RF-Grasp:**
  1. **The Wall Street Journal**, Benoit Morenne, "A Robot That Finds Your Lost Stuff and More AI-Enabled Gadgets to Come," *July 2, 2021*
  2. **MIT News**, Daniel Ackerman, "A robot that senses hidden objects," *April 1, 2021*
  3. **RFID Journal**, Claire Swedberg, "MIT Researchers Commercializing RFID and Computer Vision Robotics," *May 14, 2021*
  4. **TechCrunch**, Brian Heater, "Grasping at hidden objects," *April 8, 2021*
  5. **ACM TechNews**, Adopted from MIT News, "Robot Senses Hidden Objects," *April 5, 2021*
  6. **IEEE Spectrum**, Evan Ackerman, "Your weekly selection of awesome robot videos," *April 2, 2021*
  7. **Mashable**, Jordan Aaron, "Researchers made a robot that could find your lost keys — Strictly Robots," *April 2, 2021*
  8. **Engadget**, Igor Bonifacic, "MIT researchers use radio waves to help robots find hidden objects," *April 2, 2021*