

Elahe Soltanaghai

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Research Interests

- Wireless Sensing and communication
- Millimeter-wave Networks
- Cyber-Physical Systems
- Intelligent and Autonomous Systems
- Embedded Computing
- Internet of Things

Professional Experience

Assistant Professor 2021-Present
University of Illinois Urbana-Champaign Urbana, IL

Postdoctoral Researcher 2019-2021
Carnegie Mellon University, Advisor: Prof. Anthony Rowe Pittsburgh, PA

Research Intern 2018
Microsoft Research, Supervisor: Dr. Bodhi Priyantha Redmond, WA

Education

University of Virginia Charlottesville, US
Ph.D. in Computer Science - Advisor: Prof. Kamin Whitehouse 2014 - 2019

- Dissertation: Sensing the physical environment using pervasive wireless infrastructure

Sharif University of Technology Tehran, Iran
M.S. in Computer Engineering - Advisor: Prof. Mehdi Kharrazi 2011 - 2013

- Thesis: Botnet command & control channel detection based on DNS traffic analysis

Amirkabir University of Technology Tehran, Iran
B.S. Dual degree in Computer Engineering and Information Technology Engineering - Advisor: Prof. Babak Sadeghyan 2007 - 2011

- Thesis #1: Botnet detection based on Sequential Probability Ratio Test
- Thesis #2: Privacy preserving network-based intrusion detection system

Honors and Awards

- 2023 **Recipient of NCSA Faculty Fellowship**, for our research on scientific visualization of wireless signals.
- 2023 **Best Demo Award Runner-up**, at ACM IPSN'23.
- 2023 **Recipient of Teaching Excellence Award**, for "Smart Cities, Homes, & Beyond" course.
- 2022 **Recipient of Google Research Scholar Award**, Early-career faculty award.
- 2021 **Named one of the 10 Rising Star Women Worldwide in Communication and Networking**, N2Women.
- 2020 **Recipient of ACM SIGMOBILE Dissertation Award**, Runner Up.
- 2019 **Named as 2019 EECS Rising Stars**, hosted by the University of Illinois at Urbana-Champaign.
- 2019 **Winner of Research Pitch Competition**, 2019 EECS Rising Stars workshop.
- 2019 **Awarded N2Women Young Researcher Fellowship**, MobiCom'19.
- 2017 **2nd place winner**, in ACM Student Research Competition (SRC) at MobiCom'17.
- 2017 **Best poster award**, MobiSys'17.
- 2017 **2nd place winner**, Three Minute Thesis (3MT) competition at UVa.
- 2017 **UVA Department of Computer Science Graduate Student Award**, for Outstanding Service.
- 2016 **Best presentation award**, in ACM BuildSys'16.

Publications

Peer Reviewed Conference, Journal, and Workshop Papers

- Enabling Long-range Sub-mm Micro-Displacement Sensing with Passive Tags as Phase Carriers
T. King, J. He, C. Yao, A. Prabhakara, M. Alipour, S. Kumar, A. Rowe, **E. Soltanaghai**
IPSN, 2023. (*Best Demo Award Runner-up*)
- High Resolution Point Clouds from mmWave Radar
A. Prabhakara, T. Jin, A. Das, G. Bhatt, L. Kumari, **E. Soltanaghai**, J. Bilmes, S. Kumar, A. Rowe
IEEE ICRA, 2023.
- Perceiving the World with Pervasive Wireless Communication Infrastructures
E. Soltanaghai (Invited Paper)
COMSNETS, 2022.
- On the Feasibility of Building-Scale Power Line Backscatter Communication
J. Zhang, **E. Soltanaghai**, A. Balanuta, R. Grimsley, S. Kumar, A. Rowe.
NSDI, 2022. (*Features in GetMobile Magazine*)
- Multi-User Augmented Reality with Infrastructure-free Relative Positioning.
J. Miller, **E. Soltanaghai**, R. Duvall, J. Chen, N. Pereira, A. Rowe.
IPSN, 2022.
- Lumos: Detecting and Localizing Unknown IoT Devices in an Untrusted Environment
R. Sharma, **E. Soltanaghai**, V. Sarkar, A. Rowe.
Usenix Security, 2022.
- mmWave Retro-Reflectors for Long Range Localization in Autonomous Driving.
E. Soltanaghai, A. Prabhakara, A. Balanuta, M. Anderson, S. Kumar, A. Rowe.
MobiCom, 2021 (*Acceptance Rate: 16%*). (*1st place winner in ACM Student Research Competition*)
- TagFi: Locating an Ultra-Low Power Tag Using Existing WiFi Infrastructure
E. Soltanaghai, A. Dongare, A. Prabhakara, S. Kumar, A. Rowe, K. Whitehouse.
IMWUT-UbiComp, 2021
- Robust and Practical WiFi Human Sensing Using On-device Learning with a Domain Adaptive Model
E. Soltanaghai, R. Sharma, Z. Wang, A. Chittilappilly, E. Giler, A. Rowe.
BuildSys, 2020 (*Acceptance Rate: 27%*).
- Doorpler: a radar-based system for low power, real-time zone occupancy sensing
A. Kalyanaraman, **E. Soltanaghai**, K. Whitehouse
RTAS, 2019.
- Multipath Triangulation: decimeter-level WiFi localization and orientation with a single unaided receiver
E. Soltanaghai, A. Kalyanaraman, K. Whitehouse
MobiSys, 2018. (*Acceptance Rate: 26%*)
- Peripheral WiFi Vision: exploiting Multipath reflections for more sensitive human sensing
E. Soltanaghai, A. Kalyanaraman, K. Whitehouse
4th International Workshop on Physical Analytics (WPA), 2017.
- FormaTrack: tracking people based on body shape
A. Kalyanaraman, D. Hong, **E. Soltanaghai**, K. Whitehouse
IMWUT-UbiComp, 2017.

- Practical occupancy detection for programmable and smart thermostats
E. Soltanaghaei, K. Whitehouse
Applied Energy, 2017. (*Impact factor: 7.9*)
- WalkSense: classifying home occupancy states using walkway sensing
E. Soltanaghaei, K. Whitehouse
BuildSys, 2016. (*Best Presentation Award*)
- Multi-option, multi-class path scheduling methods for advance reservation systems
E. Soltanaghaei, M. Veeraraghavan
16th International conference on High Performance Switching and Routing (HPSR), 2015.
- Detection of Fast-Flux botnets based on DNS analysis
E. Soltanaghaei, M. Kharrazi
International Journal of Science and Technology (Scientia Iranica), 2014.
- Pattern extraction for high-risk accidents in the construction industry: a data mining approach
M. Amiri, A. Ardeshir, MH. Fazel Zarandi, **E. Soltanaghaei**
International Journal of Injury Control and Safety Promotion, 2014.
- Analysis of high risk occupational accidents in construction industry using data mining methods
M. Amiri, A. Ardeshir, **E. Soltanaghaei**
Journal of Iranian Occupational Health, Tehran university of medical sciences, 2013 [in Persian].

Posters, demos, and Short Papers

- Platypus: Sub-mm Micro-Displacement Sensing with Passive Millimeter-wave Tags As” Phase Carriers”
J. He, T. King, C. Yao, A. Prabhakara, M. Alipour, S. Kumar, A. Rowe, **E. Soltanaghaei**
IPSN, 2023. (*Best Demo Award Runner-up*)
- Characterizing Uncertainties of Wireless Channels in Connected Vehicles
E. Soltanaghaei, M. Elnaggar, K. Kleeman, K. Whitehouse, C. Fleming
MobiCom, 2019. [short paper]
- Object Tracking with Battery-free WiFi-RFID Tags
E. Soltanaghaei, B. Priyantha, K. Whitehouse
NSDI, 2019.
- Improving multipath resolution using MIMO smoothing
E. Soltanaghaei, A. Kalyanaraman, K. Whitehouse
MobiCom, 2017. [short paper] (*2nd place winner in ACM Student Research Competition*)
- Occupancy state detection using WiFi signals: poster
E. Soltanaghaei, A. Kalyanaraman, K. Whitehouse
MobiSys, 2017. (*Best Poster Award*)

Patents

- *Methods, systems, and low power retro-directive rf tags for localization.*
E. Soltanaghaei, A. Prabhakara, A. Balanuta, S. Kumar, A. Rowe. U.S. Patent Application 63/144509, 2022.
- *Unaided localization with a single WiFi receiver.*
E. Soltanaghaei, K. Whitehouse. U.S. Patent Application 62/628526, filed February 2018.

Teaching

CS 437: Topics in Internet of Things

Fall 2023

instructor, University of Illinois Urbana Champaign

- This course explores the foundations of wireless sensing for IoT through hands-on experimentation with real-world smart wireless systems that can sense people, devices, and objects. Students will perform bi-weekly projects in the IoT lab, building, analyzing, and evaluating WiFi-based (first half of the semester) and radar-based (second half of the semester) sensing solutions that are widely used in real-world applications (smart homes, IoT, self-driving cars, health monitoring, metaverse and mixed reality systems).

CS 598: Smart Cities, Phones, and Beyond

Spring'22, Fall'22

instructor, University of Illinois Urbana Champaign (Listed as Teachers Ranked as Excellent)

- This course explores the principles and practice of smart physical places and things (Smart-X), covering state-of-the-art technologies that address various visions of the future platforms supporting Smart-X. It also offers significant hands-on experience through a semester-long project, paper critiques, overview of the commercial landscapes of the topics covered in class, as well as in-class lab sessions to implement an end-to-end smart security camera.

ECE 18-648: Embedded Real-time System

Fall 2020

Co-instructor, Carnegie Mellon University

- Teaching lectures on real-time scheduling and resource sharing, embedded communication, zero-energy platforms, and machine-learning at the edge.

CS 4501: Internet of Things

Fall 2015

Teaching Assistant, University of Virginia

- Developed lab instructions and course materials in the lab sessions.
- Instructed lab sessions that involved programming raspberry Pis for different sensing and control use cases such as voice recognition, temperature/humidity sensor reading and controlling robotic arms.

Invited Talks

Saturday Engineering for Everyone

April 2023

Unleashing the Invisible World of Wireless Signals

UIUC

C-NICE Future of Communications

October 2022

Integrating Sensing and Communication in Pervasive Wireless Infrastructures

UIUC

COMSNETS'22

January 2022

Co-designing Future Wireless Sensing and Networking Infrastructures

Virtual

Invited Seminar Talks on “Sensing the World with Pervasive Wireless Infrastructures”

- *Michigan State University, October 2021*
- *Microsoft Research, April 2021*
- *University of Illinois Urbana-Champaign, April 2021*
- *Arizona State University, April 2021*
- *George Mason University, March 2021*
- *University of Wisconsin - Madison, March 2021*
- *MIT, March 2021*
- *Oregon State University, March 2021*
- *University of Pennsylvania, February 2021*
- *Washington University, February 2021*
- *Northeastern University, January 2021*
- *University of Waterloo, November 2020*
- *ETH Zurich, March 2020*
- *Imperial College London, March 2020*
- *Carnegie Mellon University, May 2019*
- *UC San Diego, April 2019*

ACM BuildSys

November 2020

Robust and Practical WiFi Human Sensing Using On-device Learning with a Domain Adaptive Model

Virtual

CONIX Annual Review Workshop <i>Emerging Applications of Millimeter-wave Wireless Systems</i>	October 2020 Virtual
E-Workshop Series, Semiconductor Research Corporation (SRC) <i>Sensing the Physical World using Pervasive Wireless Infrastructure</i>	April 2020 Virtual
Texas Instrument Kilby Innovation Technology Center <i>Sensing the Physical World using Pervasive Wireless Infrastructure</i>	Nov 2019 Dallas, TX
Microsoft's Immersion day <i>Single-shot Tag Localization</i>	August 2018 Redmond, WA
Sensing and Processing Across Networks Lab, University of Utah <i>Human Sensing with Commodity WiFi</i>	October 2017 Salt Lake City, UT
ACM Student Research Competition, MobiCom <i>MIMO Smoothing for Improving Multipath Resolution</i>	October 2017 Snowbird, UT
ACM Workshop on Physical Analytic, MobiSys <i>Peripheral WiFi Vision: exploiting Multipath reflections for more sensitive human sensing,</i>	June 2017 Niagara Fall, NY
5th Annual Three-Minute Thesis Competition <i>Device-free Human Detection using WiFi</i>	April 2017 Charlottesville, VA
iLab.X Workshop, Technology Entrepreneurship Fellows Program <i>Smart WiFi Access Points (1 of 2 finalists whose research has been selected for commercialization.)</i>	December 2016 Charlottesville, VA
ACM BuildSys, Stanford University <i>WalkSense: classifying home occupancy states using walkway sensing</i>	November 2016 Stanford, CA

Service

- **Technical Program Committee (TPC) member,**
 - MobiCom 2024, 2023, 2022
 - NSDI 2024
 - Sensys 2023
 - IoTDI 2023
 - SIGCOMM 2022
 - WWW 2021
 - IEEE SECON 2020
- **Panelist,**
 - C-NICE Future of Communications 2022
 - NSF NeTS Small 2023
 - N2Women Sensys 2022
 - PhD Forum'22
 - UIUC Illinois Scholars Undergraduate Research (ISUR) Program 2022
 - UIUC Girls Who Code 2022
- **Poster Co-Chair,** IEEE MobiCom'24.
- **Workshop Co-Chair,** IEEE SECON'23.
- **N2Women Co-Chair,** MobiCom'21.
- **Birds-of-Feather (BoF) Panel moderator,** Mobisys, 2020.

- **Workshop Co-Chair**, ACM S3 Workshop 2019 (co-located with MobiCom'19).
- **Expert Panelist**, the environmental science class at Charlottesville High School, Spring 2018.
- **Scribe**, NSF visioning workshop on extreme networking, 2017.
- **Invited Reviewer:**
 - ACM Proceedings on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT)
 - ACM Transaction on Sensor Networks (TOSN)
 - IEEE Journal of Wireless Communication Letters
 - IEEE Sensors Journal
 - International Journal of Sensor Networks
 - EURASIP Journal on Wireless Communications and Networking