

# XIAOLU ZENG

## Postdoc Research Associate

Department of Electrical & Computer Engineering University of Maryland, College Park, MD, USA.

## Principal Scientist

Origin Wireless AI Inc., Greenbelt, MD, USA.

✉ [xlzeng09@umd.edu](mailto:xlzeng09@umd.edu) 🌐 <https://xiaolu1263.github.io/>

## Research Interests

Massive MIMO, 5G millimeter wave (mmWave), Target Tracking and Localization, Wireless AI, Internet of Things, Health Sensing, Intelligent Recognition and Classification, Advanced Driver Assistance Systems (ADAS)...

## Education

### Harbin Institute of Technology, China

B.S. in Electronic Information Engineering

Aug. 2010 - Jun. 2014

### Xidian University, China

Ph.D. in Information and Communication Engineering

Aug. 2014 - Jun. 2020

### University of Maryland College Park, USA

Joint Ph.D. student in Electric and Computer Engineering

Sep. 2017 - Jun. 2020

## Academic & Industry Experience

### Department of Electrical & Computer Engineering, University of Maryland, College Park, MD, USA

- Postdoc Research Associate (*Advisor: Prof. K. J. Ray Liu*) Jul. 2020 - Present
- Research Scholar (*Advisor: Prof. K. J. Ray Liu*) Sep. 2017 - Jun. 2020
  - Time Reversal Based High Accuracy Localization and Tracking (see 🖱️)

### Origin Wireless Inc, (A Wireless AI Company) Greenbelt, MD, USA

- Principle Scientist Dec. 2019. - Present
  - Wireless AI for wireless sensing and localization using ambient radio signals (see 🖱️)

### Harbin Institute of Technology, China

- Research Assistant Mar. 2013. - Jun. 2014
  - Phased Array Techniques & Automation Systems

## Publications [\[GoogleScholar\]](#)

### Journal Papers (\* indicates manuscripts under revision/review/to submit)

- [J1] **X. Zeng**, M. Yang, B. Chen and Y. Jin, "Estimation of Direction of Arrival by Time Reversal for Low-Angle Targets," in *IEEE Transactions on Aerospace and Electronic Systems (IEEE TAES)*, vol. 54, no. 6, pp. 2675-2694, Dec. 2018. (**JCR: Q1, IF: 3.672**)
- [J2] **X. Zeng**, F. Zhang, B. Wang and K. J. R. Liu, "Radio Frequency Based Direction Sensing Using Massive MIMO," in *IEEE Access*, vol. 8, pp. 26827-26838, Jan. 2020. (**JCR: Q1, IF: 3.745**)
- [J3] **X. Zeng**, F. Zhang, B. Wang and K. J. R. Liu, "Massive MIMO for High-Accuracy Target Localization and Tracking," in *IEEE Internet of Things Journal (IEEE IoTJ)*, Jan. 2021 (Early Access). (**JCR: Q1, IF: 9.936**)
- [J4] F. Wang, **X. Zeng**, C. Wu, B. Wang, and K. J. Ray Liu, "mmHRV: Contactless Heart Rate Variability Monitoring using Millimeter-Wave Radio," *IEEE Internet of Things Journal (IEEE IoTJ)*, Feb. 2021. (**JCR: Q1, IF: 9.936**)
- [J5\*] F. Wang, **X. Zeng**, C. Wu, B. Wang, and K. J. Ray Liu, "Driver Vital Signs Monitoring using Millimeter Wave Radio," *IEEE Internet of Things Journal (IEEE IoTJ)*, Jul. 2021. (**JCR: Q1, IF: 9.936**) ([Major Revision](#))

- [J6\*] **X. Zeng**, B. Wang, C. Wu, S. D. Regani and K. J. Ray Liu, “WiCPD: Wireless Child Presence Detection System for Smart Car,” (Submitted to) IEEE Journal on Selected Areas in Communications (IEEE J-SAC), Jul. 2021. (**JCR: Q1, IF: 9.13**)
- [J7\*] **X. Zeng**, B. Wang, C. Wu, F. Wang and K. J. Ray Liu, “WiHome: Smart Home Monitoring System Using Internet of Things,” (Submitted to) IEEE Internet of Things Journal (IEEE IoTJ), Jul. 2021. (**JCR: Q1, IF: 9.936**)

### Conference Papers

- [C1] **X. Zeng**, F. Zhang, B. Wang and K. J. Ray Liu, “High Accuracy Tracking of Targets Using Massive MIMO,” 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Toronto Canada, Jun. 2021.
- [C2] F. Wang, **X. Zeng**, C. Wu, B. Wang and K. J. Ray Liu, “Radio Frequency Based Heart Rate Variability Monitoring,” 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Toronto Canada, Jun. 2021.
- [C3] **X. Zeng**, B. Wang and K. J. Ray Liu, “Driver Arrival Sensing for Smart Car using WiFi Fine Time Measurements,” 2020 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC), Auckland, New Zealand, Dec. 2020.
- [C4] **X. Zeng**, B. Chen and M. Yang, “DOA estimation for low angle targets using time reversal in frequency domain model,” 2018 IEEE Radar Conference (RadarConf18), Oklahoma City, OK, Apr. 2018.
- [C5] **X. Zeng**, M. Yang, B. Chen and Y. Jin, “Low angle direction of arrival estimation by time reversal,” 2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), New Orleans, LA, Mar. 2017.
- [C6] **X. Zeng**, B. Chen, Y. Zhao and M. Yang, “Design and implementation of a T/R module automatic test system,” 2016 CIE International Conference on Radar (RADAR), Guangzhou, Oct. 2016.

### Patents

- [P1] **Xiaolu Zeng**, Feng Zhang, Beibei Wang, KJ Ray Liu, Oscar Chi-Lim Au, Chenshu Wu, “Method, apparatus, and system for outdoor target tracking,” (US Patent No.: 16790627).
- [P2] Chenshu Wu, Feng Zhang, Beibei Wang, Yuqian HU, K. J. Ray Liu, Oscar Chi-Lim Au, **Xiaolu Zeng**, etc. “Method, Apparatus, and System for Wireless Gait Recognition,” (Europe Patent No.:3695783).
- [P3] Baixiao Chen, **Xiaolu Zeng**, Minglei Yang, “DOA Estimation Based on Time Reversal Techniques,” (China Patent No.: ZL201610702654.8 [P]).
- [P4] Minglei Yang, Baixiao Chen, Jing Wang, **Xiaolu Zeng**, “DOA Estimation by Using Nested Minimum-redundancy Arrays,” (China Patent No.: ZL201510725142.9 [P]).
- [P5] Minglei Yang, Baixiao Chen, Lei Sun, **Xiaolu Zeng**, “Sub-nested Minimum-redundancy Arrays for DOA estimation,” (China Patent No.: ZL201610236372.3 [P]).
- [P6] Baixiao Chen, **Xiaolu Zeng**, Minglei Yang, “Design and implementation of a T/R module automatic test system,” (China Patent No.: ZL201510566320.8 [P]).

### Selected Honors and Awards

- 1st-Class Ph.D. Student Scholarship at Xidian University, *2015, 2016, 2017, 2018, 2019*
- Chinese Scholarship Council for Joint Ph.D students *2017-2019*
- Outstanding Doctoral Candidate, Xidian University (1/37) *2015-2016*
- 1st-class Undergraduate Student Scholarship, Harbin Institute of Technology *2011*
- 3rd-Award, The Undergraduate Electronic Design Contest, Harbin Institute of Technology *2013*

### Projects & Researches

#### Time Reversal Based DOA Estimations for Low-angle Targets

- An accurate DOA Estimation for low-angle targets with serious multipath distortions based on [Time Reversal](#) theory, which turns the detrimental multipath from enemy to friend and thus improves the accuracy. [J1] [C4] [C5] [P3]

### **mmWave and 5G Massive MIMO for Localization and Tracking**

- An accurate Localization and Tracking System based on [Time Reversal](#) and Massive MIMO techniques, which smartly leverages the unavoidable multipath distortions and thus improving the accuracy and robustness while enlarging the deployment scalability greatly. [J2] [J3] [P1].

### **mmWave-Based Vital Signs Monitoring**

- An accurate Millimeter Wave (mmWave) based Vital Sign Monitoring System by using off-the-shelf [mmWave Radar](#), which has been implemented and invited to demo for Qualcomm. Commercial version is coming soon... [J4] [C2].

### **mmWave-Based Driver Monitoring**

- An novel Millimeter Wave (mmWave) based Driver Monitoring System which works robustly in practical driving scenarios where driving motion is a serious problem for most of the related researches. The system has been implemented on [TI IWR1843 Radar](#) and tested in MD route 200/495/270... [J5].

### **Joint Signal Decompositions over Multiple Channels**

- An accurate signal decomposition method which can extract the intrinsic signal components over multiple channels simultaneously without need of the prior information about the number of the signal components.

### **DNN Based DOA Estimations**

- Design a DNN model based on TensorFlow to learn the feature of background perturbations and thus make the system work robustly in both static and dynamic environments.

### **RF-based Indoor Tracking System**

- Two calibration-free Indoor Tracking Systems with decimeter-accuracy by exploring the statistical properties of the received signals, which facilitates three ongoing products including Cart-tracking in supermarkets, Fall-detector and Gait-recognition with partly invited for demo to Apple, HP, Qualcomm, Verizon, Marvell [P2].

### **Wireless Driver Arrival Sensing for Smart Car**

- An accurate driver's arrival time sensing using WiFi-FTM (IEEE 802.11mc, 2016), which makes the car more smart in multiple-service management than the existing driver's presence sensing only system. [C3].

### **Wireless Child Presence Detection (CPD) System**

- A highly accurate and calibration-free wireless CPD detection system which can cover the whole car and integrate with current on car WiFi system seamlessly. The system has been implemented and invited to demo to many famous car manufactures such as BMW, Mercedes-Benz Ford... [J6]

### **Wireless Home Monitoring System**

- First-of-its-kind wireless home monitoring system based on the household router and IoT devices, which sheds light on many interesting applications such as home security, smart health, elderly care... [J7]

### **Wireless Vital Signs Detection System**

- An device-free Sleep Monitoring System for Remote Patient Monitoring using commercial WiFi devices, which won the [CES 2021 Best of Innovation Award](#).

### **Device-free Home Security Surveillance System**

- A highly accurate and calibration-free wireless motion detector with large through-the-wall coverage for home security by using Channel Station Information (CSI) related techniques, which won the [CES 2020 Innovation Award](#).

## **[Grants & Proposals](#)**

Time Reversal Based Target Detection under Complex Terrains, The National Natural Science Foundation (NSF), China, 2015, Main student investigator.

## Academic Services

### Reviewer for

- IEEE Signal Processing Letters, IEEE Internet of Things Journal, IET Radar, Sonar & Navigation, IEEE Access, IET Microwaves, Antennas and Propagation, IEEE ICASSP, The CIE International Conference on Radar

### Teaching Experience

- Teaching Assistant: Radar System and Analysis, 2016.

## Presentation/Poster/Invited Talk

- International Workshop on Signal Information Intelligent Learning and Processing, Xian, China, Jul. 2021
- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Toronto Canada, Jun. 2021
- Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC), Auckland, New Zealand, Dec. 2020
- IEEE Radar Conference (RadarConf18), Oklahoma City, OK, Apr. 2018
- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), New Orleans, LA, Mar. 2017
- CIE International Conference on Radar, Guangzhou, China, Oct. 2016

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