SIYANG CAO

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Department of Electrical and Computer Engineering

The University of Arizona

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CHRONOLOGY OF EDUCATION

12/14 Ph.D. **Electrical Engineering**
The Ohio State University (OSU), OH

5/14 M.S. **Electrical Engineering**
The Ohio State University (OSU), OH

7/10 M.S. **Electronics and Information**
South China University of Technology, China

7/07 B.S. **Electronic Information Engineering**
Xidian University, China

CHRONOLOGY OF EMPLOYMENT

8/15 - present **Assistant Professor**
Department of Electrical & Computer Engineering
University of Arizona, Tucson, Arizona

9/14 - 7/15 **Radar System Engineer**
Delphi Active Safety
Kokomo, Indiana

1/11 - 12/14 **Research Assistant**
Department of Electrical Engineering, OSU
Columbus, Ohio

9/10 - 12/10 **Teaching Assistant**
Department of Electrical Engineering, OSU
Columbus, Ohio

3/09 - 3/10 **Software Quality Analyst**
Intel Asia-Pacific Research and Development Ltd.
Shanghai, China

HONORS AND AWARDS

- IEEE Senior Member, August 2020
- Sony Faculty Innovation Award, 2019
- Sony Faculty Innovation Award, 2020
- The Best Paper Award, IEEE Sensors Letters, 2020
- Radar Conference Student Paper Competition, Finalist (One of ten), 2014

SERVICE

Outreach (National/International)

- Reviewer for Panelist
  - National Science Foundation, 2020-2021
  - National Institutes of Health, 2021-2022

- Reviewer for IEEE Senior Member (November, 2021)

- Conferences
  - Track Chair for session, "Mm-wave/THz Radar systems and phenomenology," at 2019 IEEE Radar Conference, Boston, Massachusetts
  - Track Chair for session, "Detection and Estimation Theory (including Array Processing Theory)," at 2019 IEEE Radar Conference, Boston, Massachusetts
  - Session Chair for session, "ATR & Classification of Human Activity," at 2019 IEEE Radar Conference, Boston, Massachusetts

- Committees for Conferences
  - Technical Program Committee, 2019 IEEE Radar Conference, Boston, Massachusetts
  - Technical Program Committee, 2019 IEEE Computing and Communication Workshop and Conference, Las Vegas, Nevada
  - Technical Program Committee, 2018 IEEE Computing and Communication Workshop and Conference, Las Vegas, Nevada
  - Technical Program Committee, 2017 IEEE Computing and Communication Workshop and Conference, Las Vegas, Nevada

- Reviewer for
  - IEEE Transactions on Aerospace and Electronic Systems
  - IEEE Transactions on Geoscience and Remote Sensing
  - IEEE Transactions on Signal Processing
  - IEEE Transactions on Vehicular Technology
  - IEEE Transactions on Cybernetics
  - IEEE Transactions on Microwave Theory and Techniques
  - IEEE Transactions on Instrumentation & Measurement
  - IEEE Access
  - IEEE Sensors Letters
  - IEEE Signal Processing Letters
  - IEEE Geoscience and Remote Sensing Letters
  - IEEE Radar Conference
  - IEEE International Radar Conference
  - IET Electronics Letters
  - Elsevier - Advances in Space Research
  - Measurement: Journal of the International Measurement Confederation

Course Developed/Modernized
- Radar Signal Processing (ECE538) (Course developed)
- Applications of Engineering Mathematics (ECE310) (Course modernized)
- Advanced Linear Systems Theory (ECE501b) (Course modernized)

Course Taught
- ECE538 Radar Signal Processing (Fall 2015, Fall 2016, Fall 2017, Fall 2018)
- ECE310 Applications of Engineering Mathematics (Spring 2016, Spring 2017, Spring 2018)
- ECE501B Advanced Linear Systems Theory (Fall 2019)

Current Graduate Student
- Reydesel Alejandro Cuevas (Ph.D. student)
- Lei Cheng (Ph.D. student)
- Shuting Hu (Ph.D. student)
- Qi Wen (Master student)

Former Graduate Student
- Arindam Sengupta (Ph.D., Joined Spartan Radar Corportation after graduation)
- Nathan Madsen (Ph.D., Continued working in Rincon Research Corporation after graduation)
- Feng Jin (Ph.D., Joined Nvidia Corporation after graduation)
- Renyuan(Leo) Zhang (Ph.D., Joined Lyft Inc. after graduation)

PUBLICATIONS

Refereed Journal Articles:

[1] A. Sengupta° and S. Cao, "mmPose-NLP: A Natural Language Processing Approach to Precise Skeletal Pose Estimation using mmWave Radars," *IEEE Transactions on Neural Networks and Learning Systems*, 2022 (early access), doi: 10.1109/TNNLS.2022.3151101.

[2] A. Sengupta°, A. Yoshizawa and S. Cao, "Automatic Radar-Camera Dataset Generation for Sensor-Fusion Applications," *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 2875-2882, 2022.

[3] N. Madsen and S. Cao, "Modifications to Finite Difference Algorithm for Polynomial Phase Signal Parameter Estimation," *IEEE Transactions on Aerospace and Electronic System*, vol. 58, no.1, pp. 496-507, 2022.

[4] F. Jin and S. Cao, "mmFall: Fall Detection using 4D MmWave Radar and a Hybrid Variational RNN AutoEncoder," *IEEE Transactions on Automation Science and Engineering*, vol. 19, no. 2, pp.1245-1257, 2022.

[5] A. Sengupta, F. Jin, R. Zhang and S. Cao, "mm-Pose: Real-Time Human Skeletal Posture Estimation using mmWave Radars and CNNs," *IEEE Sensor Journal*, vol. 20, no. 17, pp. 10032-10044, 2020.

[6] R. Zhang and S. Cao, "Extending Reliability of mmWave Radar Tracking and Detection via Fusion with Camera," *IEEE Access*, vol. 7, pp. 137065 - 137079, 2019.

[7] N. Madsen and S. Cao, "Finite Difference Algorithm for Polynomial Phase Signal Parameter Estimation," *IEEE Transactions on Aerospace and Electronic System*, vol. 56, no. 1, pp. 57-66, 2020.

[8] F. Jin and S. Cao, "Automotive Radar Interference Mitigation using Adaptive Noise Canceller," *IEEE Transactions on Vehicular Technology*, vol. 68, no. 4, pp. 3747-3754, 2019.

[9] **(Best Paper Award)** R. Zhang and S. Cao, "Real-time Human Behavior Detection via CNN using mmWave Radar," *IEEE Sensors Letters*, vol. 3, no.2, 2019.

[10] S. Tang, X. Shu, J. Hu, R. Zhou, S. Shen, and S. Cao, "Study on RSS/AOA hybrid localization in life detection in huge disaster situation," *Springer Natural Hazards*, DOI: https://doi.org/10.1007/s11069-018-3503-9, 2018

[11] S. Cao, D. Brendel, Y. F. Zheng, and R. L. Ewing, "Transform Sensing Array Based on Wavelets," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 56, no. 4, pp. 2408-2423, 2018.

[12] R. Zhang and S. Cao, "3D Imaging Millimeter Wave Circular Synthetic Aperture Radar," *Sensors*, vol. 17, no. 6, pp. 1419.1-1419.22, 2017.

[13] S. Tang, X. Shu, S. Shen, Z.Li, and S. Cao, "Study of Portable Infrastructure-free Cellphone Detector for Disaster Relief," *Springer Natural Hazards*, vol. 86, no. 1, pp. 453-464, 2017.

[14] X. Zhang, Z. Chen, R. Bhadani, S. Cao, and et al. "NISC: Neural Network-Imputation for Single-Cell RNA Sequencing and Cell Type Clustering", *Frontiers in Genetics*, doi: https://doi.org/10.3389/fgene.2022.847112.

[15] S. Ding, S. Cao, Y. F. Zheng, and R. L. Ewing, "From Image-pair to Computer Generated Hologram for Real-world Scene," *Applied Optics*, vol. 55, no. 27, pp. 7583-7592, 2016.

[16] S. Cao, Y. F. Zheng, and R. L. Ewing, "A Wavelet-Packet-Based Radar Waveform for High Resolution in Range and Velocity Detection," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 53, no. 1, pp. 229-243, January 2015.

[17] S. Cao, Y. F. Zheng, and R. L. Ewing, "Wavelet-Based Waveform for Effective Sidelobe Suppression in Radar Signal," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 50, no. 1, pp. 265-284, January 2014.

[18] S. Cao and Y. F. Zheng, "Recent Developments in Radar Waveforms," *Journal of Radars*, vol. 5, no. 5, pp. 603-621, October 2014.

SCHOLARLY PRESENTATIONS

Conferences/Symposia (Submitted Presentations)

[1] A. Sengupta, F. Jin, and S. Cao, "NLP Based Skeletal Pose Estimation Using mmWave Radar Point-Cloud: A Simulation Approach," in Proc. *IEEE Radar Conference*, September, 2020.

[2] **(Invited Paper)** A. Sengupta, F. Jin, R. A. Cuevas, and S. Cao, "A Review of Recent Advancements Including Machine Learning on Synthetic Aperture Radar Using Millimeter-Wave Radar," in Proc. *IEEE Radar Conference*, September, 2020.

[3] F. Jin, A. Sengupta, S. Cao and Y. Wu, "MmWave Radar Point Cloud Segmentation Using GMM in Multimodal Traffic Monitoring," in Proc. *IEEE International Radar Conference*, April, 2020.

[4] R. Zhang, and S. Cao, "Robust and Adaptive Radar Elliptical Density-Based Spatial Clustering and Labelling for mmWave Radar Point Cloud Data," in *Proc. IEEE Asilomar Conference on Signals, Systems and Computers*, November 2019.

[5] A. Sengupta, F. Jin, and S. Cao, "A DNN-LSTM based Target Tracking Approach using mmWave Radar and Camera Sensor Fusion," in *Proc. IEEE National Aerospace & Electronics Conference*, July 2019.

[6] R. Zhang, and S. Cao, "Non-Synchronized Integration using Multiple Radars via Least Squares Fitting," in *Proc. IEEE National Aerospace & Electronics Conference*, July 2019.

[7] F. Jin, R. Zhang, A. Sengupta, S. Cao, S. Hariri, N. Agarwal, and S. Agarwal, "Multiple Patients Behavior Detection in Real-time using mmWave Radar and Deep CNNs," in *Proc. IEEE Radar Conference*, April 2019.

[8] X. Zhang and S. Cao, "Soil Moisture Estimation using Automotive Radar," in *Proc. American Society of Agricultural and Biological Engineers*, July 2018.

[9] N. Madsen and S. Cao, "Slow-time Waveform Design for MIMO" in *Proc. IEEE Radar Conference*, April 2018.

[10] R. Zhang and S. Cao, "Support Vector Machines for Classification of Automotive Radar Interference," in *Proc. IEEE Radar Conference*, April 2018.

[11] R. Zhang and S. Cao, "Compressed Sensing for Portable Millimeter Wave 3D Imaging Radar," in *Proc. IEEE Radar Conference*, May 2017.

[12] R. Zhang and S. Cao, "Portable Millimeter Wave 3D Imaging Radar," in *Proc. IEEE Radar Conference*, May 2017.

[13] M. Liang, S. Cao, and H. Xin, "Additive Manufactured Millimeter Wave Luneburg Lens Antenna for Automotive Radar Application", in *Proc. International Workshop on Antenna Technology: Small Antennas, Innovative Structures, and Applications*, March 2017.

[14] S. Cao, Y. F. Zheng, and R. L. Ewing, "From Phase Array to Holographic Radar," in *Proc. IEEE Aerospace and Electronics Conference*, June 2015.

[15] S. Ding, S. Cao, Y. Li, Y. F. Zheng, and R. L. Ewing, "Two Viewing Angles for Holographics in Radar and Light," in *Proc. IEEE Aerospace and Electronics Conference*, June 2015.

[16] S. Cao, Y. F. Zheng, and R. L. Ewing, "Transform Sensing of Phased Array Radar," in *Proc. IEEE Aerospace and Electronics Conference*, June 2014.

[17] S. Cao, Y. F. Zheng, and R. L. Ewing, "Wavelet-based Gaussian Waveform for Spotlight Synthetic Aperture Radar," in *Proc. IEEE Aerospace and Electronics Conference*, June 2014.

[18] S. Cao, Y. F. Zheng, and R. L. Ewing, "S-band radar Based on Lyrtech Software Defined Radio," in *Proc. IEEE Aerospace and Electronics Conference*, June 2014.

[19] S. Cao, Y. F. Zheng, and R. L. Ewing, "On the Doppler effect to the wavelet-based radar waveform," in *Proc. IEEE Aerospace and Electronics Conference*, June 2014.

[20] S. Cao, Y. F. Zheng, and R. L. Ewing, "Transform Sensing of Phased Array Radar," in *Proc. IEEE Radar Conference*, May 2014.

[21] A. Sikdar, S. Cao, Y. F. Zheng, and R. L. Ewing, "Radar Depth Association with Vision Detected Vehicles on a Highway," in *Proc. IEEE Radar Conference*, May 2014.

[22] S. Cao, Y. F. Zheng, and R. L. Ewing, "Wavelet-based Radar Waveform for Moving Targets Detection," in *Proc. IEEE Radar Conference*, May 2014.

[23] S. Cao, Y. F. Zheng, and R. L. Ewing, "Wavelet-based Radar Waveform Adaptable for Different Operation Conditions," in *Proc. IEEE European Radar Conference*, October 2013.

[24] S. Cao, Y. F. Zheng, and R. L. Ewing, "Scaling Function Waveform for Effective Side-lobe Suppression in Radar Signal," in *Proc. IEEE Aerospace and Electronics Conference*, July 2011.

UNITED STATES PATENTS

[1] Xin, Hao, Min, Liang, and Siyang Cao, "Novel Automotive Radar Using 3D Printed Lunerburg Lens," PCT/US2017/046998, filed on Aug. 15, 2016.

[2] James, F. Searcy, Alebel Hassen Arage, Stephen W. Alland, and Siyang Cao, "Residue Cancellation for Automated Vehicle MIMO Radar," US9952319B2, filed on Dec. 08, 2015, granted on April. 24, 2018. (Three patents are granted by US, European, and China, respectively)

[3] Robert L. Ewing, Yuan F. Zheng, Siyang Cao and David Brendel, "Robust Feedback Design Methodology for Transform Sensing using RF phase array detection." US20210208268, filed on Dec. 30, 2020.

[4] Siyang Cao and Arindam Sengupta, "Systems and methods of remote extraction of skeletal information using millimeter wave radar," US 20210100451, filed on Oct. 7, 2020.