Zijing Zhang

zijingzhang1997.github.io/ ✉ zz587@cornell.edu github.com/zijingzhang1997

Education

Cornell University, Ithaca, NY *Aug. 2019 – (Expected) Aug. 2024*
Ph.D. student, Electrical and Computer Engineering (GPA: 3.87)
Thesis Advisor: Edwin C. Kan

Huazhong University of Science and Technology, Wuhan, China *Sep. 2015- Jun. 2019*
Bachelor of Engineering, Optoelectronic Information Science and Engineering (GPA: 3.91/4.0)

Publications

[1] **Z. Zhang**, P. Sharma, T. B. Conroy, V. Phongtankuel and E. C. Kan, "Objective scoring of physiologically induced dyspnea with non-invasive RF respiratory sensors", *IEEE Transactions on Biomedical Engineering*, doi: 10.1109/TBME.2021.3096462.
[2] **Z. Zhang,** P. Sharma, J. Zhou, X. Hui and E. C. Kan, "Furniture-integrated respiration sensors by notched transmission lines," *IEEE Sensors Journal*, vol. 21, no. 4, pp. 5303-5311, 2021, doi: 10.1109/JSEN.2020.3028970.
[3] X. Hui, J. Zhou, P. Sharma, T. B. Conroy, **Z. Zhang** and E. C. Kan **"**Wearable RF near-field cough monitoring by frequency-time deep learning", *IEEE Transactions on Biomedical Circuits and Systems*, doi: 10.1109/TBCAS.2021.3099865.
[4] **Z. Zhang**, et al., "Wideband and continuously-tunable fractional photonic Hilbert transformer based on a single high-birefringence planar Bragg grating," *Optics Express*, vol. 26, pp. 20450-20458, 2018.
[5] **Z. Zhang**, et al., "Design of a broadband achromatic dielectric meta-lens for linear polarization in the near-infrared spectrum," *OSA Continuum*, vol. 1, pp. 882-890, 2018.
[6] **Z. Zhang**, et al., "Micro-machining for TE/TM mode phase matching in high-birefringence planar waveguide and implementation in continuously-tunable fractional Hilbert transform," *Intl. Photonics & Optoelectronics Mtg., OSA Tech. Dig.*, OT4A.2, 2018.
[7] H. Sun, W. Zhou, **Z. Zhang** and Z. Wan. "A MEMS variable optical attenuator with ultra-low wavelength-dependent loss and polarization-dependent loss," *Micromachines*, vol. 9, no. 12, p. 632, 2018.

Research Interests

- Non-invasive sensing of physiological signals including respiratory efforts, heartbeat dynamics, blood pressures, and viscoelastic tissue properties and other biological signals
- Remote medical diagnosis platform based on digital wearable sensors
- Machine learning and neural network algorithm development

Research Experiences

1. Respiratory pattern monitoring with RF near-field coherent sensing (NCS) *Cornell Univ., Jan. 2020-present*
   - Developed a non-invasive respiration sensor integrated into furniture that can be invisible to the user to enhance comfort and convenience.
   - Captured the cardiopulmonary waveforms and derived the breath rate and heart rate with variations in positions.
   - Implemented the sensor to detect simulated respiratory disorders including central and obstructive sleep apnea.
   - Performed a human study (N=10) that confirmed the validity of the sensing system and signal processing.

2. Objective scoring of dyspnea with touchless wearable RF sensors *Cornell Univ., Sept. 2020-present*
   - Designed a testing protocol to perform human study (N=32) on simulated dyspnea by the exertion and facemasks.
   - Implemented algorithms to identify various features embedded in breathing waveforms to predict the objective dyspnea score in comparison with the self-report scores.
   - Designed a learning model of decision tree and random forest to evaluate the objective dyspnea score.

3. 3D imaging by ambient radio signals using the inverse method and machine learning *Cornell Univ., Oct. 2019-present*
   - Employed ambient low-cost passive RFID tags for the shape and size of human body and feet in a closet-like space.
   - Developed a CNN model that can reconstruct the 3D image of an object by the simulation of CST Microwave Studio.

4. Sleep Apnea Detection and Prediction based on Bed-integrated RF sensor
   Cornell Univ. &Cornell Weill medical sleep center, Summer 2020-present
   - Performed clinical study (N=32) in Weill sleep center and collected overnight recording data using bed-integrated sensor which is invisible to the user.

- Developed machine-learning algorithm that can automatically detect and predict sleep disorder on real patients with high fidelity.
- demonstrated the capability to prognosticate sleep apnea around 60 seconds earlier.

5. Precise Vertebral Segmentation with CT images *Cornell Univ., Mar.-May 2021*
   - Developed an automatic computer system that segments individual vertebrae from CT images utilizing template registration algorithm

Internship Experience

Signal Processing and Machine Learning Intern in Digital Healthcare Group *Analog Devices, Wilmington, MA May –Aug. 2021*

1. Developed non-invasive core body temperature sensor
   - Simulated the physical model of the sensor interacting with human tissue.
   - Developed and validated Machine Learning algorithm for estimating core body temperature.

Awards

CSC Scholarship (Chinese Government Scholarships) for outstanding undergraduate students *Sept. 2017*
Meritorious Prize (First Prize) in Mathematical Contest in Modeling of America *Feb. 2018*
Excellent Graduation Thesis in Huazhong University of Science and Technology *Jun. 2019*

Skills

Programming and tools: MATLAB; Python; PyTorch; C, C++; CST Microwave Studio; LabVIEW; COMSOL