CURRICULUM VITAE

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CONTACT INFORMATION

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RESEARCH INTERESTS

My research interests include human-centered intelligent perception and natural human-machine interaction, especially computer vision-based human vital sign monitoring, electromagnetic inverse scattering, and multi-source human-machine interaction.

EDUCATION

- 2005.9–2010.7, Ph.D. Computational Mathematics, Department of Mathematics, Zhejiang University, China.
- 2001.9–2005.7, B.S. Computational Mathematics, College of Mathematics, Jilin University, China.

ACADEMIC & WORK EXPERIENCE

- 2017.5–present, Associate Professor, Department of Biomedical Engineering, Hefei University of Technology, Hefei, China.
- 2013.1–2017.4, Principal Scientist, Sensor Physics, Halliburton Far East Pte Ltd, Singapore.
- 2010.7–2012.12, Research Fellow, Department of Electrical and Computer Engineering, National University of Singapore, Singapore.

PUBLICATIONS

*Journal Articles (*Corresponding author):*

***A**: Vision-based human vital sign monitoring (sort by date):*

1. **Song, R.**, H. Wang, H. Xia, J. Cheng, C. Li, and X. Chen, Uncertainty quantification for deep learning-based remote photoplethysmography. IEEE Transactions on Instrumentation and Measurement, 2023, accepted.
2. **Song, R.**, C. Ren, J. Cheng, C. Li, and X. Yang, Non-contact human respiratory rate measurement based on two-level fusions of video and fmcw radar information. Measurement, 2023: p. 113604.
3. Han, X., X. Yang, S. Fang, **R. Song**, L. Li, and J. Zhang, Non-contact blood pressure estimation using BP-related cardiovascular knowledge: an uncalibrated method based on consumer-level camera. IEEE Transactions on Instrumentation and Measurement, 2023.

4. Cheng, J., B. Yue, **R. Song***, Y. Liu, C. Li, and X. Chen, Motion-robust anteriorposterior imaging ballistocardiography for non-contact heart rate measurements. Biomedical Signal Processing and Control, 2023. 86: p. 105307.

5. Cheng, J., R. Liu, J. Li, **R. Song***, Y. Liu, and X. Chen, Motion-Robust Respiratory Rate Estimation from Camera Videos via Fusing Pixel Movement and Pixel Intensity Information. IEEE Transactions on Instrumentation and Measurement, 2023.

6. **Song, R.**, X. Sun, J. Cheng, X. Yang, and X. Chen, Video-Based Heart Rate Measurement Against Uneven Illuminations Using Multivariate Singular Spectrum Analysis. IEEE Signal Processing Letters, 2022. 29: p. 2223-2227.

7. Liu, X., X. Yang, **R. Song**, J. Zhang, and L. Li, VideoCAD: an uncertainty-driven neural network for coronary artery disease screening from facial videos. IEEE Transactions on Instrumentation and Measurement, 2022. 72: p. 1-12.

8. Liu, X., X. Yang, **R. Song**, D. Wang, and L. Li, PFDNet: A Pulse Feature Disentanglement Network for Atrial Fibrillation Screening From Facial Videos. IEEE Journal of Biomedical and Health Informatics, 2022(10.1109/JBHI.2022.3220656): p. 1 - 12.

9. Xie, Y., **R. Song***, D. Yang, H. Yu, C. Sun, Q. Xie, and R.X. Xu, Motion robust ICG measurements using a two-step spectrum denoising method. Physiological measurement, 2021. 42(9): p. 095004.

10. **Song, R.**, G. Wang, J. Cheng, A. Liu, C. Li, and X. Chen, Constrained independent vector extraction of quasi-periodic signals from multiple data sets. Signal Processing, 2021. 189: p. 108296.

11. **Song, R.**, J. Li, M. Wang, J. Cheng, C. Li, and X. Chen, Remote photoplethysmography with an EEMD-MCCA method robust against spatially uneven illuminations. IEEE Sensors Journal, 2021. 21(12): p. 13484-13494.

12. **Song, R.**, H. Chen, J. Cheng, C. Li, Y. Liu, and X. Chen, PulseGAN: Learning to generate realistic pulse waveforms in remote photoplethysmography. IEEE Journal of Biomedical and Health Informatics, 2021. 25(5): p. 1373-1384.

13. Cheng, J., Y. Xu, **R. Song***, Y. Liu, C. Li, and X. Chen, Prediction of arterial blood pressure waveforms from photoplethysmogram signals via fully convolutional neural networks. Computers in Biology and Medicine, 2021. 138: p. 104877.

14. **Song, R.**, S. Zhang, C. Li, Y. Zhang, J. Cheng, and X. Chen, Heart rate estimation from facial videos using a spatiotemporal representation with convolutional neural networks. IEEE Transactions on Instrumentation and Measurement, 2020. 69(10): p. 7411-7421.

15. **Song, R.**, S. Zhang, J. Cheng, C. Li, and X. Chen, New insights on super-high resolution for video-based heart rate estimation with a semi-blind source separation method. Computers in biology and medicine, 2020. 116: p. 103535.

16. **Song, R.**, J. Li, J. Cheng, C. Li, Y. Liu, and X. Chen, Motion robust imaging ballistocardiography through a two-step canonical correlation analysis. IEEE Transactions on Instrumentation and Measurement, 2020. 70: p. 1-10.

17. Cheng, J., X. Wang, **R. Song***, Y. Liu, C. Li, and X. Chen, Exploring the feasibility of seamless remote heart rate measurement using multiple synchronized cameras. Multimedia Tools and Applications, 2020.

18. Cheng, J., P. Wang, **R. Song***, Y. Liu, C. Li, Y. Liu, and X. Chen, Remote heart rate measurement from near-infrared videos based on joint blind source separation with delay-coordinate transformation. IEEE Transactions on Instrumentation and Measurement, 2020. 70: p. 1-13.

19. Chen, X., J. Cheng, **R. Song**, Y. Liu, R. Ward, and Z.J. Wang, Video-based heart rate measurement: Recent advances and future prospects. IEEE Transactions on Instrumentation and Measurement, 2018. 68(10): p. 3600-3615.

***B**: EM modeling and inverse scattering (sort by date):*

1. Xu, K., Z. Qian, **R. Song***, X. Ye, N. Xu, X.-M. Pan, P. Zhao, S. Chen, G. Wang, and W. Li, Physically Unrolling Network under Contraction Integral Equation for Limited-Aperture Inverse Scattering Problem. IEEE Transactions on Antennas and Propagation, 2023.
2. Wang, Y., Z. Zong, S. He, **R. Song**, and Z. Wei, Push the Generalization Limitation of Learning Approaches by Multi-Domain Weight-Sharing for Full-Wave Inverse Scattering. IEEE Transactions on Geoscience and Remote Sensing, 2023.
3. Wang, J., N. Du, T. Yin, **R. Song**, K. Xu, S. Sun, and X. Ye, A Machine Learning-Assisted Inversion Method for Solving Biomedical Imaging Based on Semi-Experimental Data. Electronics, 2023. 12(12): p. 2623.
4. Ye, X., N. Du, D. Yang, X. Yuan, **R. Song**, S. Sun, and D. Fang, Application of generative adversarial network-based inversion algorithm in imaging 2-D lossy biaxial anisotropic scatterer. IEEE Transactions on Antennas and Propagation, 2022. 70(9): p. 8262-8275.
5. **R. Song**, M. Li, K. Xu, C. Li, and X. Chen, Electromagnetic Inverse Scattering With an Untrained SOM-Net. IEEE Transactions on Microwave Theory and Techniques, 2022. 70(11): p. 4980-4990.
6. **R. Song**, Y. Huang, X. Ye, K. Xu, C. Li, and X. Chen, Learning-based inversion method for solving electromagnetic inverse scattering with mixed boundary conditions. IEEE Transactions on Antennas and Propagation, 2022. 70(8): p. 6218-6228.
7. Liu, Y., H. Zhao, **R. Song***, X. Chen, C. Li, and X. Chen, SOM-net: Unrolling the subspace-based optimization for solving full-wave inverse scattering problems. IEEE Transactions on Geoscience and Remote Sensing, 2022. 60: p. 1-15.
8. Xu, K., C. Zhang, X. Ye, and **R. Song***, Fast full-wave electromagnetic inverse scattering based on scalable cascaded convolutional neural networks. IEEE Transactions on Geoscience and Remote Sensing, 2021. 60: p. 1-11.
9. **R. Song**, Q. Zhou, Y. Liu, C. Li, and X. Chen, A Convolutional Sparsity Regularization for Solving Inverse Scattering Problems. IEEE Antennas and Wireless Propagation Letters, 2021. 20(12): p. 2285-2289.
10. **R. Song**, Y. Huang, K. Xu, X. Ye, C. Li, and X. Chen, Electromagnetic inverse scattering with perceptual generative adversarial networks. IEEE Transactions on Computational Imaging, 2021. 7: p. 689-699.
11. **R. Song**, H. Chen, J. Cheng, C. Li, Y. Liu, and X. Chen, PulseGAN: Learning to generate realistic pulse waveforms in remote photoplethysmography. IEEE Journal of Biomedical and Health Informatics, 2021. 25(5): p. 1373-1384.
12. Li, C., C. Sui, **R. Song**, J. Cheng, Y. Liu, and X. Chen, Superpixel-Based Noise-Robust Sparse Unmixing of Hyperspectral Image. IEEE Geoscience and Remote Sensing Letters, 2021. 19: p. 1-5.
13. Zhang, L., K. Xu, **R. Song**, X. Ye, G. Wang, and X. Chen, Learning-based quantitative microwave imaging with a hybrid input scheme. IEEE Sensors Journal, 2020. 20(24): p. 15007-15013.

14. Ye, X., Y. Bai, **R. Song**, K. Xu, and J. An, An inhomogeneous background imaging method based on generative adversarial network. IEEE Transactions on Microwave Theory and Techniques, 2020. 68(11): p. 4684-4693.

15. Ma, Z., K. Xu, **R. Song***, C.-F. Wang, and X. Chen, Learning-based fast electromagnetic scattering solver through generative adversarial network. IEEE Transactions on Antennas and Propagation, 2020. 69(4): p. 2194-2208.

16. Li, C., Y. Liu, J. Cheng, **R. Song**, J. Ma, C. Sui, and X. Chen, Sparse unmixing of hyperspectral data with bandwise model. Information sciences, 2020. 512: p. 1424-1441.

17. Huang, Y., **R. Song***, K. Xu, X. Ye, C. Li, and X. Chen, Deep learning-based inverse scattering with structural similarity loss functions. IEEE Sensors Journal, 2020. 21(4): p. 4900-4907.

18. Li, C., Y. Liu, J. Cheng, **R. Song**, H. Peng, Q. Chen, and X. Chen, Hyperspectral unmixing with bandwise generalized bilinear model. Remote Sensing, 2018. 10(10): p. 1600.

19. **R. Song**, X. Ye, and X. Chen, Reconstruction of scatterers with four different boundary conditions by T-matrix method. Inverse Problems in Science and Engineering, 2015. 23(4): p. 601-616.

20. Ye, X., **R. Song**, and X. Chen, Application of T-matrix method in solving mixed boundary separable obstacle problem. Optics Express, 2014. 22(13): p. 1627316281.

21. Xu, K., Y. Zhong, **R. Song**, X. Chen, and L. Ran, Multiplicative-Regularized FFT Twofold Subspace-Based Optimization Method for Inverse Scattering Problems. IEEE Transactions on Geoscience and Remote Sensing, 2014(99): p. 1-10.

22. Ye, X., X. Chen, Y. Zhong, and **R. Song**, Simultaneous reconstruction of dielectric and perfectly conducting scatterers via T-matrix method. IEEE Transactions on Antennas and Propagation, 2013(99): p. 1-1.

23. Agarwal, K., **R. Song**, M. D'Urso, and X. Chen, Improving the Performances of the Contrast Source Extended Born Inversion Method by Subspace Techniques. IEEE Geoscience and Remote Sensing Letters, 2013(99): p. 1-5.

24. Ye, X., **R. Song**, K. Agarwal, and X. Chen, Electromagnetic imaging of separable obstacle problem. Optics express, 2012. 20(3): p. 2206-2219.

25. **R. Song**, Y. Zhong, and X. Chen, A multi-dimensional sampling method for locating small scatterers. Inverse problems, 2012. 28(11): p. 115004.

26. **R. Song**, X. Chen, and Y. Zhong, Imaging small three-dimensional elastic inclusions by an enhanced multiple signal classification method. The Journal of the Acoustical Society of America, 2012. 132(4): p. 2420-2426.

27. R. Song and X. Chen, Analysis of cutoff wavelength of elliptical waveguide by regularized meshless method. International Journal of Numerical Modelling: Electronic Networks, Devices and Fields, 2012. 25(5-6): p. 417-427.

28. **R. Song**, R. Chen, and X. Chen, Imaging three-dimensional anisotropic scatterers in multilayered medium by multiple signal classification method with enhanced resolution. Journal of the Optical Society of America A, 2012. 29(9): p. 1900-1905.

29. Zhu, J., X. Zhang, and **R. Song**, A unified mode solver for optical waveguides based on mapped barycentric rational chebyshev differentiation matrix. Journal of lightwave technology, 2010. 28(12): p. 1802-1810.

30. **R. Song**, J. Zhu, and X. Zhang, Full-vectorial modal analysis for circular optical waveguides based on the multidomain Chebyshev pseudospectral method. Journal of the Optical Society of America B: Optical Physics, 2010. 27(9): p. 1722-1730.
31. Chen, W. and **R. Song**, Analytical diagonal elements of regularized meshless method for regular domains of 2D Dirichlet Laplace problems. Engineering analysis with boundary elements, 2010. 34(1): p. 2-8.
32. Zhu, J. and **R. Song**, Fast and stable computation of optical propagation in micro-waveguides with loss. Microelectronics Reliability, 2009. 49(12): p. 1529-1536.
33. R. Song and W. Chen, An investigation on the regularized meshless method for irregular domain problems. Computer Modeling in Engineering and Sciences (CMES), 2009. 42(1): p. 59.

C: Human-machine interaction (sort by date):

1. Zhao, Y., S. Feng, C. Li, **R. Song**, D. Liang, and X. Chen, Source-Free Domain Adaptation for Privacy-Preserving Seizure Prediction. IEEE Transactions on Industrial Informatics, 2023.
2. Wei, Y., Y. Liu, C. Li, J. Cheng, **R. Song**, and X. Chen, TC-Net: A Transformer Capsule Network for EEG-based emotion recognition. Computers in Biology and Medicine, 2023. 152: p. 106463.
3. Mao, T., C. Li, Y. Zhao, **R. Song**, and X. Chen, Online Test-Time Adaptation for Patient-Independent Seizure Prediction. IEEE Sensors Journal, 2023.
4. Li, C., C. Shao, **R. Song**, G. Xu, X. Liu, R. Qian, and X. Chen, Spatio-temporal MLP network for seizure prediction using EEG signals. Measurement, 2023. 206: p. 112278.
5. Deng, Z., C. Li, **R. Song**, X. Liu, R. Qian, and X. Chen, EEG-based seizure prediction via hybrid vision transformer and data uncertainty learning. Engineering Applications of Artificial Intelligence, 2023. 123: p. 106401.
6. Zhao, Y., C. Li, X. Liu, R. Qian, **R. Song**, and X. Chen, Patient-specific seizure prediction via adder network and supervised contrastive learning. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2022. 30: p. 1536-1547.
7. Liu, Y., Y. Wei, C. Li, J. Cheng, **R. Song**, and X. Chen, Bi-CapsNet: A Binary Capsule Network for EEG-Based Emotion Recognition. IEEE Journal of Biomedical and Health Informatics, 2022. 27(3): p. 1319-1330.
8. Li, C., Y. Zhao, **R. Song**, X. Liu, R. Qian, and X. Chen, Patient-specific seizure prediction from electroencephalogram signal via multi-channel feedback capsule network. IEEE Transactions on Cognitive and Developmental Systems, 2022.
9. Li, C., B. Wang, S. Zhang, Y. Liu, **R. Song**, J. Cheng, and X. Chen, Emotion recognition from EEG based on multi-task learning with capsule network and attention mechanism. Computers in Biology and Medicine, 2022. 143: p. 105303.
10. Li, C., X. Lin, Y. Liu, **R. Song**, J. Cheng, and X. Chen, EEG-based emotion recognition via efficient convolutional neural network and contrastive learning. IEEE Sensors Journal, 2022. 22(20): p. 19608-19619.
11. Li, C., X. Huang, **R. Song**, R. Qian, X. Liu, and X. Chen, EEG-based seizure prediction via Transformer guided CNN. Measurement, 2022. 203: p. 111948.

12. Li, C., Y. Hou, **R. Song**, J. Cheng, Y. Liu, and X. Chen, Multi-channel EEG-based emotion recognition in the presence of noisy labels. Science China Information Sciences, 2022. 65(4): p. 140405.
13. Li, C., Z. Deng, **R. Song**, X. Liu, R. Qian, and X. Chen, EEG-based seizure prediction via model uncertainty learning. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2022. 31: p. 180-191.
14. Li, C., Z. Zhang, **R. Song**, J. Cheng, Y. Liu, and X. Chen, EEG-based emotion recognition via neural architecture search. IEEE Transactions on Affective Computing, 2021.
15. Tao, W., C. Li, **R. Song**, J. Cheng, Y. Liu, F. Wan, and X. Chen, EEG-based emotion recognition via channel-wise attention and self attention. IEEE Transactions on Affective Computing, 2020.
16. Liu, Y., Y. Ding, C. Li, J. Cheng, **R. Song**, F. Wan, and X. Chen, Multi-channel EEG-based emotion recognition via a multi-level features guided capsule network. Computers in Biology and Medicine, 2020. 123: p. 103927.
17. Cheng, J., M. Chen, C. Li, Y. Liu, **R. Song**, A. Liu, and X. Chen, Emotion recognition from multi-channel EEG via deep forest. IEEE Journal of Biomedical and Health Informatics, 2020. 25(2): p. 453-464.

Patents (sort by date):

1. Wu, H.-H., **R. Song**, and L. Pan, Distance-to-bed-boundary inversion solution pixelation. 2023, US Patent 11,574,459.
2. Wu, H.-H., G.A. Wilson, and **R. Song**, Inversion processing of well log data. 2022, US Patent 11,467,318.
3. **R. Song**, L. Pan, and H.-H. Wu, System and methods for evaluating a formation using pixelated solutions of formation data. 2022, US Patent 11,525,353.
4. **R. Song**, L. Pan, and H.-H. Wu, Multi-layer distance to bed boundary (DTBB) inversion with multiple initial guesses. 2022, US Patent 11,299,978.
5. Wilson, G.A., B. Donderici, and **R. Song**, Quality factors for appraising resistivity LWD inversion performance. 2021, US Patent 11,098,578.
6. Ma, J., **R. Song**, and G.A. Wilson, Optimized geosteering using real-time geological models. 2021, US Patent 11,118,441.
7. **R. Song**, G.A. Wilson, and B. Donderici, Methods of selecting an earth model from a plurality of earth models. 2020, US Patent 10,788,602.
8. Pan, L., C.-F. Wang, **R. Song**, and J. Ma, Bi-mode high frequency dielectric tool. 2020, US Patent 10,725,196.
9. Pan, L., C.-F. Wang, W.H. Huang, and **R. Song**, Modifying magnetic tilt angle using a magnetically anisotropic material. 2020, US Patent 10,620,334.
10. Pan, L., Y. Fan, and **R. Song**, Skin effect correction for focused electrode devices based on analytical model. 2020, US Patent 10,690,801.
11. Ewe, W.-B., **R. Song**, and G.A. Wilson, Dielectric logging tool comprising high-impedance metamaterials. 2020, US Patent 10,656,302.

12. Pan, L., C.-F. Wang, **R. Song**, and J. Ma, Electromagnetic sensor for a downhole dielectric tool. 2019, US Patent 10,436,931.
13. Pan, L., L.E. San Martin, and **R. Song**, Downhole logging tool using resonant cavity antennas with real-time impedance matching. 2019, US Patent 10,483,939.
14. Donderici, B., **R. Song**, G.A. Wilson, and P.F. Rodney, Frequency ratiometric processing of resistivity logging tool data. 2019, US Patent 10,317,563.
15. Kuo, C.-h. and **R. Song**, Acousto-electromagnetic measurement through use of Doppler spectrum for casing corrosion evaluation. 2018, US Patent 10,054,713.

Conference Presentations:

1. Wang, Y., X. Yang, X. Liu, **R. Song**, and J. Zhang. Remote assessment of physiological parameters by non-contact methods to detect mental stress. in Eighth International Conference on Electronic Technology and Information Science (ICETIS 2023). 2023. SPIE.
2. Qian, Z., X. Zhang, K. Xu, and **R. Song**, Physically Inspired Learning-based Microwave Imaging under Limited Aperture. 2023 Progress in Electromagnetic Research Symposium (PIERS 2023), Prague, 2023
3. Liu, X., Z. Sun, X. Li, **R. Song**, and X. Yang, VidBP: Detecting Blood Pressure from Facial Videos with Personalized Calibration. 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBC 2023, Sydney, 2023.
4. H Zhao, Y Liu, **R Song***, "Physical-Based Deep Unrolling Network for Solving Full-Wave Inverse Scattering Problems," 2021-2022 IEEE MTT-S International Microwave Biomedical Conference (IMBioC)Suzhou, 2022, oral presentation
5. M Li, **R Song***, "Electromagnetic Inverse Scattering With an Untrained Neural Network," 2022 IEEE MTT-S International Microwave Biomedical Conference (IMBioC)Suzhou, 2022, oral presentation
6. Y Huang, **R Song***, "Learning-based Electromagnetic Inverse Scattering with Mixed Boundaries," 2021-2022 Progress in Electromagnetic Research Symposium (PIERS 2021-2022)Hangzhou, 2022, oral presentation
7. Y Huang, **R Song***, "Structural similarity loss functions for deep learning based inverse scattering methods," 2020 IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO 2020)Hangzhou, 2020, oral presentation
8. **R Song**, Y Huang, "Electromagnetic inverse scattering with perceptual adversarial networks," 2020 IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO 2020)Hangzhou, 2020, oral presentation
9. S Zhang, **R Song***, J Cheng, Y Zhang, X Chen, "A feasibility study of a video-based heart rate estimation method with convolutional neural networks," 2019 IEEE International Conference on Computational Intelligence and Virtual Environments for Measurement Systems and Applications (CIVEMSA), Tianjin, 2019, oral presentation

RECENT GRANTS

- Research on personalized monitoring and reference-free evaluations of long-term video-based pulsatile information, National Natural Science Foundation of China, 2023.1-2026.12, PI.

- Intelligent interrogation assistance system based on non-contact physiological abnormality monitoring, Anhui Key Project of Research and Development Plan, 2021.1-2023.12, PI.
- Research on fast imaging method of inhomogeneous-background electromagnetic inverse scattering based on physics-driven learning, Anhui Provincial Natural Science Foundation, 2021.1-2023.12, PI.

PROFESSIONAL SERVICE

- International Conference on Numerical Electromagnetic Modeling and Optimization for RF, Microwave, and Terahertz Applications (NEMO), NEMO2020, TPC member & Session Chair.
- Progress in Electromagnetic Research Symposium, PIERS2024, Session Chair
- Guest Editorial Special Issue on Sensors: Sensor Based Pattern Recognition and Signal Processing
- Reviewers for more than thirty journals including IEEE TIM, IEEE TAP, and IEEE SPL etc.

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