

# CURRICULUM VITAE

Rencheng Song

## CONTACT INFORMATION

School of Instrument Science and Optoelectronics Engineering, Hefei University of Technology, Hefei, China.

Cell Phone: 86-18656371138  
Email: rcsong@hfut.edu.cn

## RESEARCH INTERESTS

My research interests lie in human-centered intelligent perception and natural human-machine interaction, including computer vision-based external perception of human vital signs, inverse scattering-based internal structural perception, and natural human-machine interaction based on multi-source perceptual information such as videos and various physiological signals.

## 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 intelligent perception (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 anterior-posterior 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.**, 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.
11. **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.
12. 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.
13. **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.
14. **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.
15. **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.
16. 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.

17. 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.
18. 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-based intelligent perception (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. 162731C16281.
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)čňSuzhou, 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)čňSuzhou, 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)čňHangzhou, 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)čňHangzhou, 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)čňHangzhou, 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.

Last updated: October 11, 2023