Zihang Song

PhD Candidate in Information and Communication Systems

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RESEARCH INTERESTS

My research is at the intersection of learning-driven cognitive communication and signal processing. I am especially interested in solving the sparse inverse problems from compressive samples of wideband radio signal and practical sensing matrices design by optimization and learning methods.

EDUCATION

2020 – pres	**University of Surrey**
	PhD Student, Information and Communication Systems
	Postgraduate Researcher, EPSRC project GHz bandwidth sensing (GBSense)
	Dissertation (about to submit): "Compressed Spectrum Sensing based on a Periodic Nonuniform sub-Nyquist sampling framework: from theory to practice"
	Committee: Yue Gao (Supervisor), Rahim Tafazolli, Pei Xiao, De Mi
2019-2020	**Queen Mary University of London**, PhD Student, Electronic engineering
2018	**Beihang University**, M. S., Radio Physics (high honors)
2016	**Beihang University**, B. S., Applied Physics (high honors)

EXPERIENCES

ACADEMIC

RESEARCH ASSISTANTSHIPS

EPSRC Fellowship Project GHz Bandwidth Sensing (GBSense), *PI: Yue Gao,* 2019 – pres

- Compressed spectrum sensing (CSS) framework design and hardware verification for mmWave communication
- Signal processing software and interface development on portable Linux platform (C and C++ based on Qt Environment, with python script embedded)
- FPGA development of interleaved high-speed data transmission (VHDL and Verilog on Lattice/Xilinx FPGA)
- Embedded system development for the CSS system (C on low-power MCU)
- Software development on National Instruments mmWave Transceiver System (LabVIEW)
- Managing the website www.gbsense.net for data sharing and research cooperation.
- DNN-based Sub-Nyquist automatic modulation recognition

Deep Space Environment Frequency Modulation Atomic Force Microscopy (NSFC), 2016 – 2019

- Amplitude control algorithm based on Kalman filter for frequency-modulated AFM and FPGA development
- Fast image reconstruction algorithm based on Bayesian compressed sensing

REVIEWER FOR INTERNATIONAL JOURNALS

- IEEE Transactions on Signal Processing
- IEEE Transactions on Cognitive Communications and Networking
- IEEE Transactions on Vehicular Technology
- IEEE Internet of Things Journal
- Frontiers of Computer Science

TEACHING ASSISTANTSHIP

- EEE1028 – Laboratories, Design & Professional Studies, Spring 2020

PUBLICATIONS

Journal Papers

[J1] Z. Song, J. Yang, H. Zhang and Y. Gao, "Approaching Sub-Nyquist Boundary: Optimized Compressed Spectrum Sensing Based on Multicoset Sampler for Multiband Signal", IEEE Transactions on Signal Processing 70 (2022): 4225-4238.

[J2] Z. Song, Y. Gao and R. Tafazolli, "A survey on spectrum sensing and learning technologies for 6g." IEICE Transactions on Communications 104.10 (2021): 1207-1216.

[J3] Y Gao, Z Song, H Zhang, S Fuller, A Lambert, Z Ying, P Mähönen, Y Eldar, S Cui, M.D Plumbley, C Parini and A Nallanathan. "Sub-Nyquist spectrum sensing and learning challenge." Frontiers of Computer Science 15, no. 4 (2021): 1-5.

[J4] J, Yang, Z. Song, et al., "Adaptive Compressed Spectrum Sensing for Multiband Signals." IEEE Transactions on Wireless Communications 20.11 (2021): 7642-7654.

[J5] Zhang, Y., Li, Y., Song, Z., Wang, Z., Qian, J., & Yao, J. (2019). A novel method to remove impulse noise from atomic force microscopy images based on Bayesian compressed sensing. Beilstein Journal of Nanotechnology, 10(1), 2346-2356.

[J6] Lin, R., Li, Y., Zhang, Y., Wang, T., Wang, Z., Song, Z., ... & Qian, J. (2019). Design of A flexure-based mixed-kinematic XY high-precision positioning platform with large range. Mechanism and Machine Theory, 142, 103609.

[J7] Y. Li, L. Zhang, G. Shan, Z. Song, et al., A Homemade Atomic Force Microscope Based on a Quartz Tuning Fork for Undergraduate Instruction, American Journal of Physics, 2016.6, 84(6):478~482

[J8] H. Liu, Y. Li, Y. Zhang, Y. Chen, Z. Song, et al., Intelligent Tuning Method of PID Parameters Based on Iterative Learning Control for Atomic Force Microscopy, Micron, 2018.01.01, 104(1): 26~36

[J9] Y. Zhang, Y. Li, Z. Wang, Z. Song, et al., A fast image reconstruction method based on Bayesian compressed sensing for the undersampled AFM data with noise." Measurement Science and Technology 30.2 (2019): 025402.

[J10] Z. Wang, J. Qian, Y. Li, Y. Zhang, G. Shan, Z. Dou, Z. Song and R Lin. Time-frequency Analysis of the Tip Motion in Liquids Using the Wavelet Transform in Dynamic Atomic Force Microscopy 2018. Nanotechnology

[J11] Y. Li, Z. Song, et al., (2019). A double-electrolyte etching method of high-quality tungsten probe for undergraduate scanning tunneling microscopy and atomic force microscopy experiments. European Journal of Physics, 40(2), 025004.

Conference Papers

[C1] Z. Song, H. Qi and Y. Gao, "Real-time Multi-Gigahertz Sub-Nyquist Spectrum Sensing System for mmWave," the 3rd ACM Workshop on Millimeter-Wave Networks and Sensing Systems (mmNets), co-located with ACM MobiCom, 2019.

[C2] Z. Song, Y. Li, et al., A Novel Amplitude Control Algorithm for Frequency-Modulation Atomic Force Microscope Based on Kalman Filter, 6th International Congress on Microscopy & Spectroscopy, 2019

[C3] J, Yang, Z. Song, et al., "Cross Validation Based Adaptive Compressed Spectrum Sensing without Testing Set." GLOBECOM 2020 - 2020 IEEE Global Communications Conference IEEE, 2020.

[C4] Y. Zhang, Y. Li, Z. Song and J. Qian, A Novel Method of Manufacturing Quartz Tuning Fork Probe for Atomic Force Microscopy, 20th International Conference on Non-contact Atomic Force Microscopy, Suzhou, 2017.9.25-2017.9.29

UNPUBLISHED WORKS

[U1] Z. Song, H. Zhang and Y. Gao, "Hardware-based Sensing Matrix Optimization for Sub-Nyquist Spectrum Sensing", IEEE Transactions on Wireless Communications (Under Review)

[U2] Z. Song, H Zhang, S Fuller, A Lambert, Z Ying, P Mähönen, Y Eldar, S Cui, M.D Plumbley, C Parini, A Nallanathan and Y Gao. "Sub-Nyquist spectrum sensing and learning challenge." Frontiers of Computer Science (Under Review)

[U3] Z. Song, and Y. Gao, "mmWave compressed spectrum sensing platform", IEEE Internet of Things Journal (in preparation)

[U4] Z. Song, and Y. Gao, "Theory to practice of sparse spectrum reconstruction with simultaneous feature auto-grouping", IEEE Transactions on Industrial Informatics (in preparation)