

Guanxiong Luo, PhD in Computer Science

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🏠 Blog

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Areas of Specialization

- MR image reconstruction
- Machine learning
- Inverse problems
- Computational imaging
- Bayesian inference
- Image/Signal processing
- Generative modeling
- Optimization
- My projects @ ggluo.github.io

Employment

01/2020–present Research Scientist at University Medical Center Göttingen, Germany
09/2017–11/2019 Research Assistant at LKS Faculty of Medicine, University of Hong Kong

Research Experiences

Generative image priors for MRI reconstruction trained from magnitude-only images 2022,2023

1. Presented a workflow to train the generic and robust generative image priors for MRI reconstruction.
2. Evaluated trained priors in many reconstruction scenarios using different k-space acquisition patterns.
3. Performed distributed training on HPC across multiple GPUs by data parallelism (~100k MRI images).

🔗 Code: <https://github.com/mrirecon/image-priors> 📄 Project page

Bayesian MRI reconstruction with joint uncertainty estimation using diffusion models 2021, 2022

1. Presented an Bayesian framework for sampling posterior probability for MRI reconstruction.
2. Samples are drawn from the posterior using diffusion models, then the minimum mean square error estimate and uncertainty maps are computed from the samples.
3. The framework is evaluated from these perspectives: (1) the interpretation of the uncertainty of the image reconstructed from undersampled k-space; (2) the effect of the number of noise scales used to train the generative models; (3) using a burn-in phase in MCMC sampling to reduce computation; (4) the transferability of learned information. 🔗 Code: <https://github.com/mrirecon/spreco> 📄 Project page

Deploy generative image priors for image reconstruction using BART 2020, 2021

1. Integrated deep learning models into BART (a MRI reconstruction toolbox) using Tensorflow C API.
2. Developed a command line tool to convert models implemented with Tensorflow/Pytorch/JAX and deploy them using TensorRT as backend for inference. Code: [C++/C TRT](#) [BART-TRT](#)

Technical Skills

Open source projects: pypi: **spreco**; huggingface: **image priors**; git: **bart-trt, c++/c-trt**
Development environment: VS Code + Shell + Git on Debian
Use often: Python, TensorFlow, C, [BART](#), JAX, PyTorch, TensorRT
Use less often: C++, Matlab, R
Other tools: Pulse Sequence Programming, \LaTeX , PyPI, SLURM, Docker

Academic Records

Education


10/2020–10/2023 PhD in Computer Science, University of Göttingen, Göttingen, Germany
09/2017–10/2019 M.Phil in Radiology, The University of Hong Kong, HKSAR, China
09/2013–07/2017 B. Eng in Biomedical Engineering, Xi'an Jiaotong University, Xi'an, China

Award & Honor

2023 PhD Graduated with Magna cum Laude, University of Göttingen
2017 Postgraduate Scholarship awarded by The University of Hong Kong
2017 Outstanding Graduate of Class 2017 awarded by Xi'an Jiaotong University
2015 National Encouragement Scholarship awarded by Xi'an Jiaotong University

Thesis

[1] Guanxiong Luo. *Development of Advanced Generative Priors for MRI Reconstruction*, PhD thesis, University of Göttingen, 2023. 📄 Download

- [2] Guanxiong Luo. *The application of generative networks in MR image reconstruction*, M.Phil thesis, The University of Hong Kong, 2019.  Download

Journal Paper

- [1] Shoujin Huang, **Guanxiong Luo**^{*}, Xi Wang, Ziran Chen, Yuwan Wang, Huaishui Yang, Pheng-Ann Heng, Lingyan Zhang, and Mengye Lyu *Noise Level Adaptive Diffusion Model for Robust Reconstruction of Accelerated MRI*, preprint arXiv:2403.05245, March 2024. (*equal contribution)
- [2] Zuojun Wang, **Guanxiong Luo**, Ye Li, Peng Cao. *Using a Deep Learning Prior for Accelerating Hyperpolarized 13C Magnetic Resonance Spectroscopic Imaging on Synthetic Cancer Datasets*, Magn Reson Med. 2024.
- [3] **Guanxiong Luo**, Xiaoqing Wang, Moritz Blumenthal, Martin Schilling, Erik Hans Ulrich Rauf, Raviteja Kotikalapudi, Niels Focke, Martin Uecker. *Generative Image Priors for MRI Reconstruction Trained from Magnitude-Only Images*, preprint arXiv:2308.02340, Aug 2023.
- [4] **Guanxiong Luo**, Mengmeng Kuang, Peng Cao. *Generalized Deep Learning-based Proximal Gradient Descent for MR Reconstruction*, proceeding of 21st International Conference on Artificial Intelligence in Medicine, Portoroz, Slovenia, June 2023.
- [5] **Guanxiong Luo**, Moritz Blumenthal, Martin Heide, Martin Uecker. *Bayesian MRI Reconstruction with Joint Uncertainty Estimation Using Diffusion Priors*, Magn Reson Med. 2023; 90: 295-311.
- [6] Moritz Blumenthal, **Guanxiong Luo**, Martin Schilling, H. Christian M. Holme, Martin Uecker *Deep, deep learning with BART*, Magn Reson Med. 2023; 89: 678- 693.
- [7] **Guanxiong Luo**, Na Zhao, Wenhao Jiang, Edward S. Hui, Peng Cao. *MRI reconstruction using deep Bayesian estimation* , Magn Reson Med. 2020; 84: 2246-2261.

Conference Proceeding

- [1] **Guanxiong Luo**, Martin Heide, Martin Uecker. *Using data-driven Markov chains for MRI reconstruction with Joint Uncertainty Estimation*, Power Pitch Session, ISMRM 2022.
- [2] Moritz Blumenthal, **Guanxiong Luo**, Martin Schilling, Markus Haltmeier, Martin Uecker. *NLINV-Net: Self-Supervised End-2-End Learning for Reconstructing Undersampled Radial Cardiac Real-Time Data*, Oral Scientific Session, ISMRM 2022.
- [3] **Guanxiong Luo**, Moritz Blumenthal, Xiaoqing Wang, Martin Uecker. *All you need are DICOM images*, Poster Session, ISMRM 2022.
- [4] **Guanxiong Luo**, Xiaoqing Wang, Volkert Roeloffs, Zhengguo Tan, Martin Uecker. *Joint estimation of coil sensitivities and image content using a deep image prior*, Oral Scientific Session, ISMRM 2021.

Talk

- 09/2023 About *Bayesian MRI reconstruction with joint uncertainty estimation using diffusion priors* at 11th Applied Inverse Problems Conference, Göttingen, Germany
- 01/2023 About *Estimate the uncertainty for MRI reconstruction with learned Bayesian models* at Institute for Numerical and Applied Mathematics, University of Göttingen
- 07/2022 About *Data Driven Methods for Fast MRI reconstruction* at Cardiac MRI Lab, Shanghai Jiaotong University
- 05/2021 About *Using image priors with BART* at ISMRM 2021 Software Session on BART

Teaching

- WS 2021 Teaching assistant for a course on the application of data science to smart city
- WS 2021 Tutorials for undergraduates and graduates, teaching assistant for a course on deep learning

Service to the Profession

Reviews for IEEE Transactions on Medical Imaging, IEEE Transactions on Computational Imaging, Artificial Intelligence in Medicine, ISMRM

Other

Languages Mandarin, English

Hobbies Soccer, Tennis, Photography, Calligraphy

Citizenship Chinese