

# Weijie Gan

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## BIOGRAPHY

I am a **third-year Ph.D. candidate** at the Department of Computer Science and Engineering, **Washington University in St. Louis**, advised by **Dr. Ulugbek Kamilov** and **Dr. Hongyu An**. My research focuses on algorithms designs and applications for deep learning-based computational imaging. My research topics are related to self-supervised learning, image reconstruction, image registration, and correction of physical model uncertainty. My work has been applied to real-world **Magnetic Resonance Imaging (MRI)** system and licensed by Siemens Healthcare. I also work on the theoretical analysis of my algorithms.

**Research Interests:** Computational Imaging, Biomedical Imaging, Inverse Problems, Optimization, Machine Learning, and Deep Learning.

## EDUCATION

<b>Washington University in St. Louis</b> , St. Louis, MO, United States Ph.D. Candidate in Computer Science Advisor: Prof. Ulugbek Kamilov and Prof. Hongyu An	2020.08 - Expected 2024
<b>Washington University in St. Louis</b> , St. Louis, MO, United States M.Sc. in Computer Science	2018.08 - 2020.05
<b>South China University of Technology</b> , Guangzhou, China B.Eng. in Automation & B.Business in Administration (dual-degree) Advisor: Prof. Hongxia Gao	2014.08 - 2018.05

## WORK EXPERIENCE

<b>Los Alamos National Laboratory (LANL)</b> , Los Alamos, NM, United States Research Intern in the <i>Applied Mathematics and Plasma Physics Group (T-5)</i> Worked with Dr. Brendt Wohlberg on deep learning-based ptychographic image reconstruction algorithms.	2022.05 - 2022.10
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## AWARDS

- Honor (**top 15%**), Department of Computer Science, Washington University in St. Louis, 2021.
- 2019 Fall & 2020 Spring **Master's Fellowship** of Washington University in St. Louis (1,366.96 \$/month).
- 2019 Fall & 2020 Spring **Engineering School Tuition Scholarship** of Washington University in St. Louis (15% reduction Tuition  $\approx$  4,500 \$ in total).
- 2015 & 2016 **Annual Third Prize Scholarship** of South China University of Technology.

## PUBLICATION

(\* indicates equal contribution)

**Preprinted:**

- a1 **W. Gan**, C. Ying, P. E. Boroojeni, T. Wang, C. Eldeniz, Y. Hu, J. Liu, Y. Chen, H. An, and U. S. Kamilov, "Self-Supervised Deep Equilibrium Models for Inverse Problems with Theoretical Guarantees." [arXiv: 2210.03837].
- a2 **W. Gan\***, Y. Hu\*, C. Ying, T. Wang, C. Eldeniz, J. Liu, Y. Chen, H. An, and U. S. Kamilov, "SPICE: Self-Supervised Learning for MRI with Automatic Coil Sensitivity Estimation." [arXiv: 2210.02584].
- a3 X. Xu, **W. Gan**, S. V.V.N. Kothapalli, D. A. Yablonskiy, and U. S. Kamilov, "CoRRECT: A Deep Unfolding Framework for Motion-Corrected Quantitative R2\* Mapping." [arXiv: 2210.06330].
- a4 **W. Gan\***, H. Gao\*, Z. Sun, and U. S. Kamilov, "SINCO: A Novel structural regularizer for image compression using implicit neural representations" [arXiv: 2210.14974].

#### Journal & Conference:

- b1 **W. Gan**, Y. Sun, C. Eldeniz, J. Liu, H. An, and U. S. Kamilov, "Deformation-Compensated Learning for Image Reconstruction without Ground Truth", **IEEE Trans. Med. Imag. (TMI)**, 2022. [impact factor=11.03]
- b2 J. Liu, X. Xu, **W. Gan**, S. Shoushtari, U. S. Kamilov, "Online Deep Equilibrium Learning for Regularization by Denoising", Proc. Adv. Neural Inf. Process. Syst. (**NeurIPS**), 2022.
- b3 S. Chen, T. J. Fraum, C. Eldeniz, J. Mhlanga, **W. Gan**, T. Vahle, U. B. Krishnamurthy, D. Faul, H. M. Gach, M. M. Binkley, U. S. Kamilov, R. Laforest, H. An, "MR-assisted PET respiratory motion correction using deep-learning based short-scan motion fields", **Magn. Reson. Med. (MRM)**, 2022.
- b4 X. Xu, S. V. V. N. Kothapalli, J. Liu, S. Kahali, **W. Gan**, D. Yablonskiy, and U. S. Kamilov, "Learning-based Motion Artifact Removal Networks for Quantitative R2\* Mapping," **Magn. Reson. Med. (MRM)**, 2022.
- b5 W. Shangguan, Y. Sun, **W. Gan**, U. S. Kamilov, "Learning Cross-Video Neural Representations for High-Quality Frame Interpolation", Proc. European Conference on Computer Vision (**ECCV**), 2022.
- b6 **W. Gan\***, Y. Hu\*, C. Eldeniz, J. Liu, Y. Chen, H. An, and U. S. Kamilov, "SS-JIRCS: Self-Supervised Joint Image Reconstruction and Coil Sensitivity Calibration in Parallel MRI without Ground Truth," Proc. IEEE Int. Conf. Comp. Vis. (**ICCV**) Workshops, 2021.
- b7 M. Xie, J. Liu, Y. Sun, **W. Gan**, B. Wohlberg, and U. S. Kamilov, "Joint Reconstruction and Calibration using Regularization by Denoising," Proc. IEEE Int. Conf. Comp. Vis. (**ICCV**) Workshops, 2021.
- b8 **W. Gan\***, C. Eldeniz\*, S. Chen, T. J. Fraum, D. R. Ludwig, Y. Yan, J. Liu, T. Vahle, U. B. Krishnamurthy, U. S. Kamilov, H. An, "Phase2Phase: Respiratory Motion-Resolved Reconstruction of Free-Breathing MRI Using Deep Learning Without a Ground Truth for Improved Liver Imaging," **Investig. Radiol.**, 2021. [impact factor=10.06]
- b9 **W. Gan**, Y. Sun, C. Eldeniz, H. An and U. S. Kamilov, "Deep Image Reconstruction using Unregistered Measurements without Groundtruth," Proc. Int. Symp. Biomedical Imaging 2021 (**ISBI**), 2021.
- b10 J. Liu, Y. Sun, **W. Gan**, X. Xu, B. Wohlberg, and U. S. Kamilov, "Stochastic Deep Unfolding for Imaging Inverse Problems," Proc. IEEE Int. Conf. Acoustics, Speech and Signal Process. (**ICASSP**), 2021.
- b11 J. Liu, Y. Sun, **W. Gan**, X. Xu, B. Wohlberg, and U. S. Kamilov, "SGD-Net: Efficient Model-Based Deep Learning with Theoretical Guarantees," **IEEE Trans. Comput. Imag. (TCI)**, 2021.
- b12 **W. Gan**, C. Eldeniz, J. Liu, H. An, and U. S. Kamilov, "Image Reconstruction for MRI using Deep CNN Priors Trained without Ground Truth," Proc. 54th Asilomar Conf. Signals, Systems, & Computers (**Asilomar**), 2020.
- b13 J. Liu, Y. Sun, C. Eldeniz, **W. Gan**, H. An, and U. S. Kamilov, "RARE: Image Reconstruction using Deep Priors Learned without Ground Truth," **IEEE J. Sel. Top. Signal Process. (JSTSP)**, 2020.

#### Abstract:

- c1 S. Chen, C. Eldeniz, T. J. Fraum, D. Ludwig, **W. Gan**, U. S. Kamilov, D. Yang, and H. An, "Respiratory Motion Detection and Reconstruction Using CAPTURE and Deep Learning Phase2Phase Network for a 0.35 T MRI-LINAC System," Ann. Meeting American Association of Physicists in Medicine (**AAPM 2022**) (Washington, DC, 10-14 July), p. 66527, 2022. [Best-in-Physics Award in Imaging]
- c2 M. David, Y. Yuan, A. Bacon, A. Movva, S. Shah, B. Lang, **W. Gan**, I. Berke, U. S. Kamilov, S. Lake, "Machine Learning Approaches to Segment and Cluster Cells of Cartilage and Capsule in Histology Sections", 4th Annual CU Orthopedic Research Symposium and D'Ambrosia Diversity Lectureship, 2022

- c3 S. Chen, **W. Gan**, C. Eldeniz, U. S. Kamilov, T. J. Fraum, H. An, “DL-MOTIF: Deep Learning Based Motion Transformation Integrated Forward-Fourier Reconstruction for Free-Breathing Liver DCE-MRI”, Proceedings of the 30th Annual Meeting of the **ISMRM**, pp. 3469, 2022.
- c4 P. E. Boroojeni, P. Commean, C. Eldeniz, **W. Gan**, G. Skolnick, K. Patel, U. S. Kamilov, H. An, “Rapid high-resolution cranial bone MRI using deep-learning prior image reconstruction”, Proceedings of the 30th Annual Meeting of the **ISMRM**, pp. 2440, 2022.
- c5 S. Chen, C. Eldeniz, **W. Gan**, U. S. Kamilov, T. Fraum, H. An, “Forward-Fourier Motion-Corrected Reconstruction for Free-Breathing Liver DCE-MRI”, Proceedings of the 29th Annual Meeting of the **ISMRM**, pp. 0128, 2021.
- c6 S. Chen, C. Eldeniz, **W. Gan**, U. S. Kamilov, D. Yang, M. Gach, H. An, “Respiratory Motion Detection and Reconstruction Using CAPTURE and Deep Learning for a 0.35 T MRI-LINAC System: An Initial Study”, Proceedings of the 29th Annual Meeting of the **ISMRM**, pp. 4254, 2021.
- c7 J. Liu, C. Eldeniz, Y. Sun, **W. Gan**, S. Chen, H. An, U. S. Kamilov, “RED-N2N: Image reconstruction for MRI using deep CNN priors trained without ground truth”, Proceedings of the 28th Annual Meeting of the **ISMRM**, pp. 0993, 2020.
- c8 C. Eldeniz, **W. Gan**, S. Chen, J. Liu, U. S. Kamilov, H. An, “Phase2Phase: Reconstruction of free-breathing MRI into multiple respiratory phases using deep learning without a ground truth”, Proceedings of the 28th Annual Meeting of the **ISMRM**, pp. 0807, 2020.

#### **Patent:**

- d1 H. An, U. S. Kamilov, **W. Gan**, C. Eldeniz, and L. Jiaming, “Systems and Methods of Reconstructing Magnetic Resonance Images using Deep Learning,” US Patent App. 17/079,177, 29 2021.

#### **PRESENTATION & TALK**

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- p1 “Deep Learning Method for Accelerated Magnetic Resonance Imaging (MRI) without Groundtruth”, WashU Imaging Sciences Pathway (ISP) Retreats 2021, Virtual.
- p2 “Deep Image Reconstruction using Unregistered Measurements without Groundtruth”, Proc. Int. Symp. Biomedical Imaging (ISBI), 2021, Virtual.
- p3 “Image reconstruction for MRI using deep CNN priors trained without ground truth”, Proc. 54th Asilomar Conf. Signals, Systems, & Computers (Asilomar), 2020, Virtual.

#### **TEACHING SERVICE**

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##### **As Course Teaching Assistant:**

- ESE 415 Optimization, WashU. 2021 Spring & 2022 Spring.
- ESE 513/CSE 534A Large-Scale Optimization for Data Science, WashU. 2021 Fall.

#### **PROFESSIONAL SERVICES**

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##### **Professional societies:**

- IEEE Signal Processing Society, Student Member (2020 - present).
- The International Society for Magnetic Resonance in Medicine, Graduate Trainee (2020 - present).

**Journal Reviewer:** BMC Medical Imaging, Scientific Report, IEEE Transaction on Medical Imaging (TMI), IEEE Transaction on Computational Imaging (TCI).

**Conference Reviewer:** IEEE CVF Computer Vision and Pattern Recognition Conference (CVPR 2023), IEEE CVF International Conference on Computer Vision Workshop (ICCVW 2021), IEEE International Symposium on Biomedical Imaging (ISBI 2021/2022/2023), IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP 2022/2023), International Conference on Machine Learning (ICML 2022), and IEEE International Conference on Image Processing (ICIP 2022).

## MEDIA COVERAGE

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- m1 “New deep learning method boosts MRI results without requiring new data.” by Beth Miller, Newsroom of the WashU Source, 7 September 2021, <https://source.wustl.edu/2021/09/new-deep-learning-method-boosts-mri-results-without-requiring-new-data/>.
- m2 “A single MRI scan can manage respiratory motion” by Tami Freeman, PhysicsWorld, 19 Jul 2022, <https://physicsworld.com/a/a-single-mri-scan-can-manage-respiratory-motion/>.

## STUDENT SUPERVISION

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**Co-advised with Prof. Ulugbek Kamilov:**

- Yuan, Yangpeng (Undergrad student, now at Duke)
- Hu, Yuyang (MS student, now Ph.D. at WashU)
- Ian, Hudson (MS student, now at Microsoft)