

# Xiao Wang

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## Research interests

Computed tomography (CT) reconstruction, machine learning, high performance computing, numerical methods for optimization problems, statistical image processing, medical physics

## Current Research Direction

Apply adaptive choices of deep learning and statistical distribution prior models to model-based tomographic reconstruction for clinical imaging and biology microscopy applications.

Design dual-source and dual-energy CT reconstruction algorithm that tightly integrates its data acquisition physics and scanner geometry with the imaging process.

Develop high performance and parallel numerical methods for computing model-based tomographic reconstruction.

## Education

2012–2017 Ph.D., Electrical and Computer Engineering, Purdue University

Thesis Title: High Performance Tomography

Advisors: Charles A. Bouman and Samuel P. Midkiff

2012–2016 M.S.E.E, Electrical and Computer Engineering, Purdue University

2009–2012 B.A., Computer Science, Saint John's University (MN)

2009–2012 B.A., Mathematics, Saint John's University (MN)

## Academic Appointments

2017–current Postdoc Research Fellow, Radiology (Advisor: Simon Warfield), Harvard Medical School, Harvard University

2012–2017 Research Assistant, Electrical and Computer Engineering, Purdue University

## Hospital Appointments

2017–current Research Fellow, Radiology, Boston Children’s Hospital

2017–current Member, Computational Radiology Laboratory, Boston Children’s Hospital, Harvard Medical School

## Honors and Awards

2018 Young Investigator Award from the Society for Pediatric Radiology (SPR)

2017 Finalist for ACM Gordon Bell Prize

2016 Travel Awards for PPOPP 2016, ICASSP 2016, SC15

2015 Bronze Medal for ACM Student Research Competition (SC Conference)

## Research Grants

[1] Principal Investigator: **Xiao Wang**.

“Fast Magnetic Resonance Imaging Data Acquisition And Accurate Neural Circuits Mapping”. National Energy Research Scientific Computing Center (NERSC), Contract No. DE-AC02-05CH11231, 01/08/18-1/13/20, 1,000,000 allocated computing hours on Cori KNL Supercomputer.

[2] Principal Investigator: **Xiao Wang**.

“Consensus Equilibrium Method for Extreme-Scale CT Image Reconstruction”. National Energy Research Scientific Computing Center (NERSC), Contract No. DE-AC02-05CH11231, 03/08/18-1/13/20, 30,190,000 allocated computing hours on Cori KNL Supercomputer.

[3] Principal Investigator: **Xiao Wang**.

Co-investigators: Simon Warfield, Robert MacDougall, Patrick Johnston, Amy Danehy, and Yanbo Zhang.

”High Performance Engine for Dose-Reduced CT Imaging System”.

Society for Pediatric Radiology Young Investigator Research Grant, 7/1/2018-7/1/2019, \$30,000.

## Highly Selective Computer Science Conference Publications

Note that for my research in computer engineering (supercomputing), *conferences* are the primary venues. For my research in signal processing and medical physics, *journals* are the primary venues.

[1] **X. Wang**, V. Sridhar, Z. Ronaghi, R. Thomas, J. Deslippe, D. Dilworth, G. Buzzard, S. Midkiff, C. Bouman, and S. Warfield. Consensus equilibrium framework for super-resolution and extreme-scale ct reconstruction. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, SC ’19, New York, NY, USA, 2019. ACM. [\[pdf\]](#)

- [2] **X. Wang**, A. Sabne, P. Sakdhnagool, S. J. Kisner, C. A. Bouman, and S. P. Midkiff. Massively parallel 3d image reconstruction. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis, SC '17*, pages 3:1–3:12, New York, NY, USA, 2017. ACM. **Selected as finalist for 2017 ACM Gordon Bell Prize.** [\[pdf\]](#)
- [3] A. Sabne, **X. Wang**, S. J. Kisner, C. A. Bouman, A. Raghunathan, and S. P. Midkiff. Model-based iterative ct image reconstruction on gpus. In *Proceedings of the 22Nd ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming, PPOPP '17*, pages 207–220, New York, NY, USA, 2017. ACM. [\[pdf\]](#)
- [4] **X. Wang**, A. Sabne, S. J. Kisner, A. Raghunathan, C. A. Bouman, and S. P. Midkiff. High performance model based image reconstruction. In *Proceedings of the 21st ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming, PPOPP '16*, pages 2:1–2:12, New York, NY, USA, 2016. ACM. [\[pdf\]](#)

## Signal Processing Conference Publications

- [1] **X. Wang**, K. A. Mohan, S. J. Kisner, C. A. Bouman, and S. P. Midkiff. Fast Voxel Line Update for Time-Space Image Reconstruction. In *The 41st IEEE International Conference on Acoustics, Speech and Signal Processing, ICASSP'16*, 2016. [\[pdf\]](#)

## Preprints Under Review

- [1] V. Sridhar, **X.Wang**, G. Buzzard, and C. A. Bouman. Distributed memory framework for fast iterative ct reconstruction using multi-agent consensus equilibrium. Under review at *IEEE Transaction on Computational Imaging*. Preprint available at [\[pdf\]](#), November 2019

## Working Paper Under Preparation

- [1] **X.Wang**, R. MacDougall, C. A. Bouman, and S. K. Warfield. Model-based iterative reconstruction for dual-source and flying-focal spot computed tomography. Preprint available at [\[pdf\]](#), 2019

## Patents

- [1] C. A. Bouman, S. P. Midkiff, S. J. Kisner, and **X. Wang**. Tomography system. U.S. Patent US20180025514A1, 2015

## Peer Lectures

- [1] “Consensus Equilibrium Framework for Super-Resolution and Extreme-Scale CT Reconstruction,” Supercomputing Conference, SC'19, Denver, November 18th, 2019
- [2] “Plug-and-Play Prior Model for CT Image Reconstruction,” Lawrence Berkeley National Lab Workshop on Tomographic Reconstruction, October 28-30, 2018

- [3] “Massively Parallel 3D Image Reconstruction,” Supercomputing Conference, SC’17, Denver, November 16th, 2017
- [4] “Tomography Inversion Engine,” Lawrence Berkeley National Lab Workshop on Algorithms for Tomographic Reconstruction, November 9th, 2017
- [5] “Massively Parallel 3D Image Reconstruction,” Lawrence Berkeley National Lab Workshop on Algorithms for Tomographic Reconstruction, November 8th, 2017
- [6] “Massively Parallel Iterative Reconstruction,” Northeastern University ALERT Department of Homeland Security Center, Oct. 14th, 2017
- [7] “Toward Advanced Baggage Screening: Reconstruction and Automatic Target Recognition,” Northeastern University ALERT Department of Homeland Security Center, January 11th, 2017
- [8] “High Performance Tomography,” Lawrence Berkeley National Lab Workshop on Algorithms for Tomographic Reconstruction, November 9th, 2016
- [9] “High Performance Model Based Image Reconstruction,” Purdue University, Department of Computer Science, October 6th, 2016
- [10] “Fast Voxel Line Update for Time-Space Image Reconstruction,” ICASSP’16, Shanghai, China, March 22nd, 2016
- [11] “High Performance Model Based Image Reconstruction,” PPOPP’16, Barcelona, Spain, March 11th, 2016

## **Reviewer Activities**

- [1] Reviewer, International Journal of Parallel and Distributed Computing (JPDC), 2016-current
- [2] Reviewer, SIAM Journal on Scientific Computing, 2017-current
- [3] Reviewer, IEEE Transactions on Image Processing, 2019-current
- [4] Reviewer, Acta Radiologica (journal for clinical radiology), 2019-current

## **Teaching**

- [1] Guest Lecturer, Purdue University, ECE 563: Programming Parallel Machines (Spring 2017)
- [2] Graduate Teaching Assistant, Purdue University, ECE 637: Digital Image Processing (Fall 2014, 2015, 2016)
- [3] Lab Instructor, St. John’s University (MN), CSCI 150: Introduction to the Science of Computing (Fall 2010, Spring 2011, Summer 2011)
- [4] Lab Instructor, St. John’s University (MN), CSCI 160: Problem Solving, Programming and Computers (Fall 2010, Spring 2011)
- [5] Class Curriculum Designer, St. John’s University (MN), Design new python lab projects for CSCI 150 (Summer 2011)

- [6] Undergraduate Teaching Assistant, St. John's University (MN), MA 124: Probability and Statistical Inference (Spring 2011)
- [7] Undergraduate Tutor at Math Skills Center, St. John's University (MN), MA 118 (Essential Calculus), MA 119 (Calculus I), and MA 120 (Calculus II) (Fall 2010, Spring 2011)

## **Other Employments**

- 2016–2017    Computer Engineer Intern, High Performance Imaging LLC  
                  Develop high performance Model-Based Iterative Reconstruction (MBIR) algorithm for CT security baggage scanning and explosive detection
- 2012–2014    Research Assistant, Physics Department, Purdue University  
                  Develop high performance and parallel algorithm for high energy particle tracking in the Large Hadron Collider.
- 2010–2011    Assistant Head to Computer Science Teaching Assistants, Computer Science Department, St. John's University (MN)