

Chao Wang

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Highlights

Educational Background:	PhD in Mathematics, The Chinese University of Hong Kong, 2018
Main Projects:	<ul style="list-style-type: none">• Deep learning and sparse recovery approaches for medical imaging• 3D space debris localization via rotating point spread function
Academic Achievements:	<ul style="list-style-type: none">• Best Paper Award (CSIAM17), Best Poster Award (AoE17)• Research Grant (HKRGC), Travel Grant (SIAM-IS18, IS20)• Publications in top journals/conferences: SIIMS, SISC, TSP, PMB, AMOS, etc. (as the 1st author/corresponding author)
Teaching Experience:	Teaching in 6 different courses
Leadership:	<ul style="list-style-type: none">• Organizing UCD AI & Biomedical Imaging Workshop• Student Chapter Representative (with SIAM Leadership at SIAM-AM17)• Awarded SIAM Student Chapter Certificate of Recognition

Employment & Experience

University of California, Davis	California, USA
<ul style="list-style-type: none">• Postdoctoral Researcher at TETRAPODS Institute of Data Science	Jul. 2020 - Present
Advisors: Prof. Chen-Nee Chuah & Prof. Nina Amenta	
University of Texas (UT) Southwestern Medical Center & UT Dallas	Texas, USA
<ul style="list-style-type: none">• Postdoctoral Researcher at Medical Artificial Intelligence and Automation Lab	Oct. 2018 - Jun. 2020
Advisors: Prof. Xun Jia & Prof. Yifei Lou	

Education

The Chinese University of Hong Kong	Hong Kong
<ul style="list-style-type: none">• Ph.D. in Mathematics (GPA: 3.92/4.00)	2015 - 2018
Advisor: Prof. Raymond H. Chan	
Dissertation: Sparse Recovery Algorithms for 3D Imaging Using Point Spread Function Engineering	
Shantou University	Shantou, China
<ul style="list-style-type: none">• M.Sc. in Applied Mathematics (GPA: 3.84/4.00)	2012 - 2015
Advisor: Prof. Fu-Rong Lin	
Thesis: Research on Regularization Parameter Selection Methods in Inverse Problems	
Hanshan Normal University	Chaozhou, China
<ul style="list-style-type: none">• B.Sc. in Mathematics (GPA: 3.78/4.00)	2008 - 2012

Research Interests

Scientific Computing, Image Processing, Interdisciplinary Mathematical Modeling, Compressed Sensing, Convex and Nonconvex Optimization, Medical Imaging, Machine Learning, Numerical Linear Algebra

Research Grants

Co-Investigator, HKRGC Grant	2021 - 2023
<ul style="list-style-type: none">• Novel Computational Methods for 3D Point Source Localization based on Point Spread Function Analytics	
SIAM Early Career Travel Grant Award	2020
<ul style="list-style-type: none">• 2020 SIAM Conference on Imaging Science (IS20)	

SIAM Student Travel Grant Award

2018

- 2018 SIAM Conference on Imaging Science (IS18)

Publications

Preprint/Submitted (* indicates corresponding author)

- [1] **C. Wang**, M. Tao, C.N. Chuah, J. Nagy, and Y. Lou*. "Minimizing L_1 over L_2 norms on the gradient." arXiv preprint arXiv:2101.00809, submitted to *Inverse Problems*.
- [2] **C. Wang***, M. Tao, J. Nagy, and Y. Lou. "Limited-angle CT reconstruction via the L_1/L_2 minimization." arXiv preprint arXiv:2006.00601, submitted to *SIAM Journal on Imaging Sciences*.

Accepted/Published

- [3] **C. Wang**, M. Yan, and Y. Lou*. "Accelerated schemes for the L_1/L_2 minimization." *IEEE Transaction on Signal Processing*, 68, 2660 – 2669, 2020.
- [4] **C. Wang**, Y. Gonzalez, C. Shen, B. Hrycushko, and X. Jia*. "Simultaneous Needle Catheter Selection and Dwell Time Optimization for Preplanning of HDR Brachytherapy of Prostate Cancer", *Physics in Medicine & Biology*, accepted. DOI:10.1088/1361-6560/abd00e
- [5] **C. Wang**, Y. Gonzalez, C. Shen, and X. Jia* "Simultaneous needle selection and dwell time optimization in prostate cancer high-dose-rate brachytherapy." *Medical Physics* 47 (6), E367-E367, 2020.
- [6] Y. Huang, Y. Zhong, **C. Wang**, Y. Gonzalez, C. Shen, and X. Jia*. "Comprehensive calibration and evaluation of a cone-beam CT on a pre-clinical small animal radiation research platform", *Medical Physics* 47 (6), E731-E731, 2020.
- [7] **C. Wang***, R.H. Chan, R.J. Plemmons, and S. Prasad, "Point spread function engineering for 3D imaging using a continuous exact L_0 penalty (CELO) based algorithm." *Mathematical Methods in Image Processing and Inverse Problems*, Springer, to appear.
- [8] Y. Rahimi, **C. Wang***, H. Dong, and Y. Lou. "A scale invariant approach for sparse signal recovery." *SIAM Journal on Scientific Computing*, 41(6), A3649–A3672, 2019.
- [9] **C. Wang***, G. Ballard, R.J. Plemmons, and S. Prasad "Joint 3D localization and classification of space debris using a multispectral rotating point spread function." *Applied Optics*, 58, 8598-8611, 2019.
- [10] **C. Wang***, R.H. Chan, M. Nikolova, R.J. Plemmons, and S. Prasad. "Non-convex optimization for 3-dimensional point source localization using a rotating point spread function." *SIAM Journal on Imaging Sciences*, 12(1):259–286, 2019.
- [11] **C. Wang***, R.J. Plemmons, S. Prasad, R.H. Chan, and M. Nikolova. "Novel sparse recovery algorithms for 3D debris localization using rotating point spread function imagery." In *Proc. 2018 AMOS Technical Conference*, Maui, HI. 2018.
- [12] X. Fang, F. Lin, and **C. Wang***. "Estimation of a regularization parameter for a robin inverse problem." *East Asian Journal on Applied Mathematics*, 7(2) 325-342, 2017.

Manuscripts in preparation

- [13] **C. Wang**, R.H. Chan, and F. Malgouyres. "Single best replacement for 3D point source localization using double helix point spread function."
- [14] **C. Wang**, H. Jung, C. Shen, and X. Jun. "Simultaneous image reconstruction and Element decomposition for iodine contrast agent visualization in multi-energy cone beam CT."
- [15] M. Chowdhury, **C. Wang**, and Y. Lou. "Limited-angle CT reconstruction under Poisson noise model using a scale invariant approach."

Honors & Awards

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- **SIAM Student Chapter Certificate of Recognition** 2018
 - **Best Poster Presentation Award** 2017
4th AoE Symposium on Organelle Biogenesis and Function
 - **Best Student Paper Award** 2017
Annual Meeting of China Society for Industrial and Applied Mathematics
 - **CUHK Postgraduate Studentship** 2015 - 2018
 - **Second Prize of the National Post-Graduate Mathematic Contest in Modeling** 2013
 - **Outstanding Graduate Student Award** at Shantou University 2013
 - **Second Prize of the National Mathematics Contest**, Guangdong Division (Rank 16th) 2011
 - **National Endeavor Scholarship** 2009 - 2010

Teaching

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- The Chinese University of Hong Kong** **Hong Kong**
- **Teaching Assistant**, Department of Mathematics 2015 - 2018
 - MATH4230 Optimization Theory, Spring 2018
 - MATH3215A Operations Research, Fall 2017
 - MATH2221 Mathematical Laboratory, Spring 2017
 - MATH3215 Operations Research, Spring 2017
 - MATH2010 Advanced Calculus I, Spring 2016
 - MATH3210 Linear Programming, Fall 2015
- Shantou University** **Shantou, China**
- **Teaching Assistant**, Department of Mathematics 2013
 - MAT1002B Linear Algebra and Analytic Geometry, Fall 2013

Projects

Machine Learning for Solving Inverse Problems

- 1) **Learning Self-supervised Manifold in Anatomical Imaging** Jul. 2019 - Jun. 2020
 - DeepFake based architecture for common low dimensional model among CT images
- 2) **Classification of Satellite Image Objects in the Peruvian Amazon** Aug. 2018
 - Apply Super-pixel technique to split high resolution satellite into subregions
 - Semi-supervised learning classification with SVM among speeded up robust features of subregions
- 3) **Intelligent inverse treatment planning via deep reinforcement learning** Sep. 2019 - Jun. 2020
 - Deep reinforcement learning to operate a treatment planning system
 - Adjust treatment planning parameters in Dose-volume histogram (DVH) based optimization model

Model-based Methods for Solving Inverse Problems

- 1) **Multitasking Scheme in Cerebral Oxygen Extraction Fraction** Sep. 2020 - Present
 - Joint reconstructions of quantitative susceptibility mapping and oxygen extraction fraction for cerebral metabolic rate of oxygen mapping
- 2) **Scale Invariant Approach and Its Application on Medical Imaging** Oct. 2018 - Present
 - Propose a brand-new approximation on L_0 norm: L_1/L_2 ratio
 - Customized to cater to specific imaging applications: MRI and limited-angle CT reconstruction
 - Accelerate schemes with convergence analysis on ratio model
- 3) **Sparse Dictionary based Material Elemental Decomposition in Multi-energy CT** Jul. 2019 - Present
 - Utilize multi-energy information to joint CT reconstruction and elemental decomposition
 - Apply to liver tumor visualization via iodine contrast agent

- 4) Group Sparsity in High-dose-rate Brachytherapy of Prostate Cancer** Feb. 2020 - Jun. 2020
 - Formulate a preplanning of HDR brachytherapy into a group sparsity optimization problem
 - Simultaneous needle catheter selection and dwell time optimization
- 5) Parameter Selection Methods in Regularization Models for Inverse Problems** Sep. 2013 - Jun. 2015
 - Consider a Robin inverse problem in partial differential equation as well as image denoising problem
 - Propose a parameter selection method based on normalized cumulative periodogram (NCP)

Point Spread Function Engineering

- 1) Spectral Imaging of Space Debris using PSF engineering** Dec. 2018 - Jun. 2019
 - Three-stage method: 3D localization, spectral signature estimation and its classification
 - Utilized multi-spectral information to improve 3D localization
- 2) Nonconvex Optimization on Point Source Localization from PSF Engineering** Jun. 2017 - Mar. 2018
 - Nonconvex optimization models solving by nonconvex algorithms for two different kinds of noise
 - Iterative scheme for the estimation of flux
- 3) Sparse Recovery Algorithms for 3D Localization by Matching Pursuit** Oct. 2016 - May 2017
 - Fast computational implementation for single best replacement

Numerical Linear Algebra

- 1) Matrix Factorization and Analysis** Jul. 2010 - Jun. 2012
 - Project of the Innovative Experimental Program for Undergraduate Students
 - Schur decomposition for the matrices with specific structure

Professional Activities

Referee Service 2019 - Present

- IEEE Transactions on Geoscience and Remote Sensing (TGRS)
- Journal of Mathematical Imaging and Vision (JMIV)
- Journal of Scientific Computing (JSC)
- Journal of Microscopy
- Research in the Mathematical Sciences (RMSB)

Conference Organization Jan. - Mar. 2021

- AI & Biomedical Imaging Workshop at UC Davis, online

Mentorship (Ph.D. student project advisor) 2018 - Present

- Yaghoub Rahimi (UT Dallas, Oct. 2018 - Jun. 2019)
- Mujibur Chowdhury (UT Dallas, Oct. 2020 – Present)
- Zhengfeng Lai (UC Davis, July. 2020 - Present)

Student Chapter Representative Jul. 2017

- SIAM Chapter Meeting with SIAM Leadership at SIAM Annual Meeting in Pittsburgh, PA, USA

Research Exchange & Visiting

- Research Associate Aug. - Sep. 2018 & Jun. - Jul. 2017
 - Department of Computer Science Wake Forest University, USA
 - Advisor: Prof. Robert Plemmons

- Research Assistant Jun. 2015
 - Department of Mathematics at CUHK, Hong Kong
 - Advisor: Professor Raymond H. Chan
- Visiting Scholar 2013 - 2018
 - University of Bologna, Bologna, Italy (May - Jun. 2018)
 - Berlin Mathematical Society, Berlin, Germany (Jul. - Aug. 2016)
 - The Chinese Academy of Sciences, Beijing, China (Jul. - Aug. 2013)
- Treasurer** 2017-2018
 - Student Chapter of SIAM, The Chinese University of Hong Kong

Presentations

- Invited Talk, Frontiers in Biomedical Imaging Seminar Series, UCD BME, online Nov. 2020
- Invited Talk, Machine Learning Working Group, UCD Health, online Oct. 2020
- Invited Talk, Mathematics of Data and Decisions at Davis, UCD Math, online Oct. 2020
- Joint AAPM & COMP Virtual Meeting, online Jul. 2020
- SIAM Conference on Image Science (IS20), online Jul. 2020
- SIAM Conference on Computational Science and Engineering (CSE19) , WA, USA Feb. 2019
- 2019 Georgia Scientific Computing Symposium, Georgia Institute of Technology, GA, USA Feb. 2019
- Scientific Computing Seminar, Emory University, GA, USA Feb. 2019
- Advanced Maui Optical and Space (AMOS) Surveillance Technologies Conference, HI, USA Sep. 2018
- Invited Talk, Wake Forest University, NC, USA Aug. 2018
- Invited Talk, Shantou University, Shantou, China Jul. 2018
- SIAM Conference on Image Science (IS18), Bologna, Italy Jun. 2018
- SIAM Conference on Applied Linear Algebra (ALA18), HKBU, HK May 2018
- International Workshop on Image Processing and Inverse Problems, CSRC, Beijing, China Apr. 2018
- 4th AoE Symposium on Organelle Biogenesis and Function, CUHK, Hong Kong Dec. 2017
- International Conf. & AoE Symposium on Organelle Biogenesis and Function, CUHK, HK Sep. 2017
- 15th Annual Meeting of China SIAM, Qingdao, China Oct. 2017
- 2017 Imaging Science Camp at SUST, Shenzhen, China Mar. 2017
- East Asian Section of SIAM Conference (EASIAM), Macau Jun. 2016
- 2014 Imaging Science Camp at SYSU, Guangzhou, China May 2014

Skills

Programming:

- MATLAB (Proficient), Python (Competent), Mathematica (Competent), C/C++ (Competent)

Software/API:

- TensorFlow, Keras, MS Office, LaTeX

Language:

- English (Fluent), Cantonese Chinese (Native), Mandarin Chinese (Fluent), Teochew Chinese (Native)

Last updated on 2021-1-7