MING DU Ph.D.

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EXPERIENCE

2019 - now	**Postdoctoral appointee**
	Argonne National Laboratory, Lemont, USA
	• Developed *Adorym*, an automatic differentiation-based reconstruction framework capable of 2D/3D image reconstruction and parameter refinement for multiple x-ray imaging techniques.
	• Deployed the reconstruction framework on the ALCF Theta supercomputer for scaling up to giga-voxel objects.
	• Developed a distributed algorithm for large 2D wavefield propagation on high performance computers (HPCs).
2015 - 2019	**Ph.D. student (Research assistant)**
	Northwestern University, Evanston, USA
	• Developed *Tomosaic*, a Python software package for beyond-field-of-view x-ray tomography.
	• Innovated the use of *TensorFlow/Autograd/PyTorch* as automatic differentiation engines in beyond-depth-of-focus object reconstruction.
	• Conducted x-ray microtomography acquisition at the Advanced Photon Source, beamline 32-ID.
	• Used computing clusters at the Argonne Leadership Computing Facility for high-performance computation.
	• Involved in the development of *AuTomo*, an automated data processing protocol.
2014	**Student researcher**
	Singapore Institute of Manufacturing Technology, Singapore
	• Experimentally studied the pore size dependence of anodic aluminum oxide on voltage and electrolyte temperature.
	• Developed a tool for unsupervised data analysis.

EDUCATION

2015 - 2019	**Doctor of Philosophy**, *Northwestern University, Evanston, USA*
	Department of Materials Science and Engineering
	Advised by Prof. Chris Jacobsen
	Thesis title: *To the Breadth, and to the Depth: Scalable 3D Imaging of Extended Objects with High Resolution Using X-ray Microscopy*
2011 - 2015	**Bachelor of Engineering**, *National University of Singapore, Singapore*
	Department of Materials Science and Engineering

TEACHING

2018 Winter	**Teaching assistant**, *Northwestern University*
	MSE 395-4: Computational Thermodynamics and Kinetics
2018 Fall	**Teaching assistant**, *Northwestern University*
	MSE 401: Chemical and Statistical Thermodynamics of Materials
2018 Winter	**Teaching assistant**, *Northwestern University*
	MSE 361: Crystallography and Diffraction

PUBLICATIONS

M. Du, D. Gürsoy. and C. Jacobsen, "Near, far, wherever you are: simulations on the dose efficiency of holographic and ptychographic coherent imaging". Journal of Applied Crystallography **53**, 748–759 (2020).

M. Du., Y. S. G. Nashed, S. Kandel, D. Gürsoy, and C. Jacobsen, "Three dimensions, two microscopes, one code: Automatic differentiation for x-ray nanotomography beyond the depth of focus limit". Science Advances **6**, eaay3700 (2020).

R. Vescovi[1], M. Du[1], V. De Andrade, W. Scullin, D. Gürsoy, and C. Jacobsen, "Tomosaic: efficient acquisition and reconstruction of teravoxel tomography data using limited-size synchrotron X-ray beams," Journal of Synchrotron Radiation **25**, 1478–1489 (2018).

M. Du, R. Vescovi, K. Fezzaa, C. Jacobsen, and D. Gursoy, "X-ray tomography of extended objects: a comparison of data acquisition approaches," Journal of the Optical Society of America A **35**, 1871–9 (2018).

M. A. Gilles, Y. S. G. Nashed, M. Du, C. Jacobsen, and S. M. Wild, "3D x-ray imaging of continuous objects beyond the depth of focus limit," Optica **5**, 1078–1086 (2018).

A. Shahbazi, J. Kinnison, R. Vescovi, M. Du, R. Hill, M. Joesch, M. Takeno, H. Zeng, N. M. da Costa, J. Grutzendler, N. Kasthuri, and W. J. Scheirer, "Flexible Learning-Free Segmentation and Reconstruction of Neural Volumes," Scientific reports **8**, 1448 (2018).

R. Chard, R. Vescovi, M. Du, H. Li, K. Chard, S. Tuecke, N. Kasthuri, and I. Foster, "High-Throughput Neuroanatomy and Trigger-Action Programming," in (ACM Press, 2018), pp. 1–7.

M. Du, R. Vescovi, R. Chard, N. Kasthuri, C. Jacobsen, E. Dyer, and D. Gursoy, "An Automated Pipeline for the Collection, Transfer, and Processing of Large-scale Tomography Data," Biophotonics Congress: Biomedical Optics Congress 2018 (Microscopy/Translational/Brain/OTS) (2018), paper BF4C.2 BF4C.2 (2018).

M. Tondravi, W. Scullin, M. Du, R. Vescovi, V. De Andrade, C. Jacobsen, K. P. Kording, D. Gursoy, and E. Dyer, "A Pipeline for Distributed Segmentation of Teravoxel Tomography Datasets," Microsc Microanal **24**, 166–167 (2018).

M. Du and C. Jacobsen, "Relative merits and limiting factors for x-ray and electron microscopy of thick, hydrated organic materials," Ultramicroscopy **184**, 1–17 (2017).

C. J. Jacobsen, V. De Andrade, J. Deng, M. Du, D. Gursoy, Y. S. Nashed, and T. Peterka, "Wavefront Reconstruction in 3D X-ray Microscopy," in (OSA, 2016), p. W2A.12.

M. Du, X. Yin, C. Tang, T. J. Huang, and H. Gong, "Takovite-derived 2-D Ni/Al double hydroxide monolayer and graphene hybrid electrodes for electrochemical energy storage applications with high volumetric capacitance," Electrochimica Acta **190**, 521–530 (2016).

X. Yin, T. J. Huang, C. Tang, M. Du, L. Sun, Z. Shen, and H. Gong, "Significantly different mechanical properties and interfacial structures of $Cu_2ZnSn(S,Se)_4$ films prepared from metallic and sulfur-contained precursors," Solar Energy Materials and Solar Cells **134**, 389–394 (2015).

M. Du, X. Yin, and H. Gong, "Effects of triethanolamine on the morphology and phase of chemically deposited tin sulfide," Materials Letters **152**, 40–44 (2015).

[1] Co-first authors with equal contributions.

CONFERENCE SPEECHES & TALKS

"Three dimensions, two microscopes, one code: Automatic differentiation for x-ray nanotomography beyond the depth of focus limit, " *ALCF Simulation, Data, and Learning Workshop*, Lemont, U.S.A. (2019).

"A Multifunctional Tool for X-Ray Ptychographic and Holographic 3D Imaging Beyond the Depth-of-Focus Limit, " *Gordon Research Seminar - X-ray Science*, Easton, U.S.A. (2019).

"Using Automatic Differentiation for Coherent Diffraction Imaging and Reconstructing Beyond Depth of Focus (co-presented with Saugat Kandel), " *Ptycho-Developer-2019*, Berkeley, U.S.A. (2019).

"3D object reconstruction beyond the depth-of- focus limit using automatic differentiation, "*Coherence 2018*, Port Jefferson, U.S.A. (2018).

"An automated pipeline for the collection, transfer, and processing of large-scale tomography data, "*Biophotonics Congress: Biomedical Optics Congress 2018*, Hollywood, U.S.A. (2018).

EXTRACURRICULAR ACTIVITIES

2018 - present | **Member**, Northwestern University Society of Physics Students

2017	**Volunteer**, Baxter Symposium at Northwestern University
2013 - 2015	**Co-chair**, Movement for Intellectually Disabled of Singapore (Fernvale branch)
2014	**Chair**, Movement for Intellectually Disabled of Singapore (Fernvale branch) summer camp

PROFESSIONAL ACTIVITIES

2020 - 2021	**Principal Investigator** of an ASCR Leadership Computing Challenge (ALCC) grant tilted "Distributed large wavefield propagation and 3D reconstruction beyond the depth of focus limit".
2020	**Co-organizer** of workshop titled "Advances in Phase Retrieval Methods for High-resolution X-ray Imaging" in 2020 APS/CNM User Meeting (proposal approved; workshop cancelled due to COVID-19).
2018 - present	**Reviewer** of more than 9 manuscripts submitted to *Optics Express*, *Applied Optics*, and *Biomedical Optics Express*.
2018 - present	**Member**, The Optical Society of America.

SKILLS

Experimental: X-ray microtomography at a synchrotron beamline; scanning electron microscopy
Programming: Python, MATLAB, Mathematica, C, R, TensorFlow, PostgreSQL, Linux, LaTeX
Other skills: Computer graphics (Adobe Photoshop, Adobe Illustrator), computer animation and 3D modeling (Adobe After Effects, Maxon Cinema 4D, Blender), computer aided design (Autodesk Fusion 360), music composing, arranging and mixing (Apple Logic Pro, Adobe Audition)

LANGUAGES

English: Fluent   **Chinese:** Native   **Japanese:** Beginner   **French:** Beginner