Madison G. McGaffin, Ph.D. *Imaging, inverse problems, and optimization*
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Professional Experience

Feb. 2022 – Feb. 2023 **Microsoft**, Redmond, WA – *Mixed Reality Researcher*

Camera algorithms for self-tracking devices

- Investigated autoexposure, noise compensation, calibration, and tuning algorithms for self-tracking devices.
- Collaborated with rendering, SLAM, and hardware experts to prototype devices.

Nov. 2016 – Jan. 2022 **Apple Inc.**, Cupertino, CA – *Computer Vision Engineer and Manager*

Camera software imaging algorithms and implementation

- Designed, implemented, and optimized denoising, fusion, and tonemapping algorithms for iPhones 8 – 12.
- Collaborated closely with firmware, hardware, and image quality teams.
- Led team that revitalized Panorama feature in iOS 15.

Automatic camera tuning

- With image quality team, explored and implemented automatic camera tuning system. Used both classical and ML algorithms.

Other algorithm research

- Research and work in image and video registration, stitching, and encoding.

Education

Sep. 2010 – May 2015 **University of Michigan**, Ann Arbor, MI

M.S., Ph.D. in Electrical Engineering: Systems (Signal Processing)

Thesis: *X-ray CT Image Reconstruction on Highly Parallel Architectures*

Advised by Jeffrey A. Fessler

- State-of-the-art image reconstruction speeds via new algorithms and GPUs

Sep. 2006 – May 2010 **Tufts University**, Medford, MA

B.S., *summa cum laude*, in Electrical Engineering & Mathematics

Research Experience

May 2015 – Sep. 2016 **University of Michigan**, Ann Arbor, MI – *Postdoctoral research fellow*

Plenoptic imaging for 3D reconstruction of translucent objects

- Collaborated with colleagues from mechanical engineering and optics
- Designed and implemented fast (GPU-friendly) model for plenoptic camera

X-ray CT reconstruction on Parallel Architectures

- Worked with GE Healthcare on next-generation GPU-based CT reconstruction
- Collaborated with colleagues in comp-sci on fast "SIMD-ized" CT model
- Developed algorithms for distributed and multi-GPU CT reconstruction

Sep. 2010 – May 2015 **University of Michigan**, Ann Arbor, MI – *Graduate student research assistant*

GPU algorithms

- Developed and maintained software for multi-GPU image denoising and CT
- Collaborated with GE Healthcare and GE Global Research on two patents

Algorithm "building blocks" development and analysis

- Novel work on filter- and "majorizer-" design for accelerated and distributed algorithms

Jun. 2009 – May 2010 **MIT Lincoln Laboratory**, Group 33, Lexington, MA – *Student intern*

Senior project: Signal processing for X-band inverse synthetic aperture radar

- Multi-threaded MUSIC-based algorithm for ISAR super-resolution

Over-the-horizon radar target simulator embedded system

- Implemented with USRP running modified FPGA "hardware" and C software

Technical skills

Problem domains	Imaging, inverse problems, optimization, machine learning
Design languages and packages	Python, PyTorch, MATLAB
Implementation languages	C, C++, Objective-C, Swift, Rust, OpenCL, Metal
Operating systems	iOS / macOS, Linux, Windows

Teaching and mentoring

May 2015 – Sep. 2016	Mentor for junior group members
Fall '11, '12, '14	Teaching assistant: Music Signal Processing Ran weekly labs, office hours and grading for a class of ≈ 40 students
Summer '11, '15	Undergraduate research advisor Directed undergraduate students Joe Kurleto and Shamik Ganguly in GPU-related X-ray CT reconstruction projects
Spring 2010	Tutor, Introduction to Electromagnetics
Fall 2008	Grader, Discrete Mathematics
Spring '07, '08	Teaching assistant, Introduction to Computer Science

Journal papers and preprints

[1] M. McGaffin and J. A. Fessler. Alternating dual updates algorithm for X-ray CT reconstruction on the GPU. *IEEE Trans. Computational Imaging*, 1(3):186–99, September 2015.

[2] M. McGaffin and J. A. Fessler. Edge-preserving image denoising via group coordinate descent on the GPU. *IEEE Trans. Im. Proc.*, 24(4):1273–81, April 2015.

[3] M. G. McGaffin and J. A. Fessler. Algorithmic design of majorizers for large-scale inverse problems, 2015. arxiv 1508.02958.

Patents and invention disclosures

[1] M. G. McGaffin and J. A. Fessler. Invention disclosure: Accelerated and distributed iterative coordinate descent for model-based X-ray CT reconstruction, January 2016.

[2] D. Pal, E. Drapkin, J-B. Thibault, S. Srivastava, R. Thome, M. G. McGaffin, D. Kim, and J. A. Fessler. Patent application: Systems and methods for parallel processing of imaging formation, May 2015.

[3] F. Lin, M. G. McGaffin, Z. Yu, J-B. Thibault, S. Ramani, J. A. Fessler, B. De Man, and D. Pal. Patent 20140369581: Iterative reconstruction in image formation, December 2014.

Selected conference papers and talks

[1] M. G. McGaffin and J. A. Fessler. Multi-node model-based image reconstruction with GPUs. In *SIAM Conf. Imaging Sci., Abstract Book*, 2016. To appear.

[2] M. G. McGaffin and J. A. Fessler. Accelerated parallel and distributed iterative coordinate descent (ICD) for X-ray CT. In *Proc. 4th Intl. Mtg. on image formation in X-ray CT*, 2016. To appear. (oral).

[3] R. Sampson, M. G. McGaffin, T. F. Wenisch, and J. A. Fessler. Investigating multi-threaded SIMD for helical CT reconstruction on a CPU. In *Proc. 4th Intl. Mtg. on image formation in X-ray CT*, 2016. To appear. (poster).

[4] M. G. McGaffin and J. A. Fessler. Duality-based projection-domain tomography solver for splitting-based X-ray CT reconstruction. In *Proc. 3rd Intl. Mtg. on image formation in X-ray CT*, pages 359–62, 2014.

[5] M. G. McGaffin and J. A. Fessler. Fast edge-preserving image denoising via group coordinate descent on the GPU. In *Proc. SPIE 9020 Computational Imaging XII*, page 90200P, 2014.

Awards

2016	SIAM Early Career Travel Award
2015	Fully3D GPU Award
2012 – 2015	Rackham Travel Grant
2013, 2015	Fully3D Travel Grant
2010	GAANN Fellowship
2010	Amos Emerson Dolbear Scholarship
2006 – 2010	IBM Watson Scholarship