# Howard W. Heaton

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*To extend the reach of mathematics in meaningful applications to society .*

## Education

University of California Los Angeles (UCLA) — Los Angeles, CA

M.A. Mathematics — June 2018

Ph.D. Mathematics — Expected Completion: June 2021

Dissertation Topic: To be determined

Advisor: Wotao Yin

Walla Walla University (WWU) — College Place, WA

Bachelor of Science — June 2016

Majors: Computer Science, Mathematics, Physics — GPA 3.97

## Research Interests

Scientific Computing · Optimization · Machine Learning · Learning to Optimize (L2O)

The primary area of research is optimization with a focus on developing fast and memory efficient iterative methods for problems with industry applications. This includes past experience in asynchronous computing and current work on learning to optimize (L2O). L2O schemes use machine learning to develop task-specific algorithms for problems that must be repeatedly solved, each time with new (but similar) data. This enables a reduction of computational cost by order(s) of magnitude when compared with state-of-the-art general purpose methods. This research may be applied to many optimization applications, e.g., feature extractions in vision and pattern recognition systems, object detection, image restoration, medical imaging, etc.

## Teaching Experience

**Mathematics Department, UCLA** | Los Angeles, CA — Fall 2016 – Fall 2019

Teaching assistant that gave weekly lectures, held offices hours for upper division courses and tutored at UCLA's Student Math Center for lower division courses.

- Calculus of Several Variables (MATH 32A) — Fall 2016
- Optimization (MATH 164) — Spring 2017
- Analysis (MATH 131A) — Fall 2017, Spring 2018
- Analysis (MATH 131B) — Winter 2018
- Methods of Applied Mathematics (MATH 146) — Fall 2017, Winter 2018

**Physics Department, WWU** | College Place, WA — Winter 2015 – Spring 2016

Departmental tutor covering algebra and calculus based physics, including kinematics, electricity and magnetism, optics, and special relativity.

**Computer Science Department, WWU** | College Place, WA — Fall 2014

Lab teaching assistant for an introduction to programming course using C++.

**Mathematics Department, WWU** | College Place, WA — Spring 2013

Tutored pre-calculus and calculus and lead a lab for an applied statistics course.

**Teaching Learning Center, WWU** | College Place, WA — Fall 2012 – June 2016

Tutored pre-calculus, calculus, probability, statistics, linear algebra, algebra and calculus based physics, and engineering statics and dynamics.

## Presentations

**Asynchronous Sequential Inertial Iterations for Common Fixed Points Problems** August 2018
Loma Linda Imaging and IMRT/IMPT Algorithm Workshop, Loma Linda University

**On Asynchronous Sequential Inertial Iterations for Convex Feasibility Problems** May 2018
UCLA Applied Math Seminar (290J)

**Implementation of Blob Basis Functions in pCT** August 2017
Loma Linda Imaging and IMRT/IMPT Algorithm Workshop, Loma Linda University

**Superiorization: How to Get Superior Results with Basic Methods** April 2016
Undergraduate Academic Symposium, Walla Walla University

**Implementation of blob basis functions in proton CT reconstruction** January 2016
Joint Mathematics Meetings – Student Poster Session, Seattle Washington

**Image Reconstruction from Computed Tomography Scans** April 2015
Undergraduate Academic Symposium, Walla Walla University

**Local Scales in Image Processing** March 2015
Mathematics Senior Seminar, Walla Walla University

**Blob Basis Functions in pCT** November 2014
Mathematics Department Seminar, Walla Walla University

**Blob Basis Functions in Proton Computed Tomography** August 2014
Poster for the Biomedical Undergraduate Research Program, Loma Linda University

## Papers

- H. Heaton, Y. Censor. Asynchronous Sequential Inertial Iterations for Common Fixed Points Problems with an Application to Linear Systems. *Journal of Global Optimization,* February 14, 2019. DOI: 10.1007/s10898-019-00747-4
(Reprint available at Springer Link and Springer SharedIt)

- Y. Censor, H. Heaton, and R.W. Schulte, Derivative-free superiorization with component-wise perturbations. *Numerical Algorithms,* April 11, 2018. DOI: 10.1007/s11075-018-0524-0.
(Reprint available at Springer Link and Springer SharedIt.)

## Awards & Recognitions

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| National Science Foundation GRFP Fellowship Awardee | Summer 2018 – Spring 2021 |
| American Association of Physicists in Medicine DREAM Fellowship | Summer 2015 |
| Helen Eby Memorial Scholarship | Spring 2015 |
| James and Ruth Bebee Computer Science Scholarship | Spring 2015 |
| Murray L. and Ilene Johnstone Scholarship | Spring 2014, Spring 2015 |
| Engineering Honor Society Member | Spring 2014 |
| $36,000 Academic Achievement Scholarship, WWU | Spring 2011 |
| $4,000 Leadership Award, WWU | Spring 2011 |
| Dean's List of Distinguished Students, WWU | Fall 2011 – June 2016 |

## Technical Skills

Programming: LaTeX, C++, Matlab, Pyton | Some Experience: APL, SnoBol, Lisp, ARM

Software/Packages: PyTorch, Mathematica, LabVIEW

## Professional Memberships

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| Association for Computing Machinery (ACM) | Fall 2015 – Spring 2016 |
| Mathematical Association of America (MAA) | Fall 2015 – Spring 2016 |
| American Mathematical Society (AMS) | Spring 2018 – Current |

## Undergraduate Research Experience & Projects

**Algorithm Superiorization with Component-wise Perturbations**

*Walla Walla University, Computer Science Senior Project* Fall 2015 – Spring 2016

Supervisors: Reinhard Schulte, Yair Censor

Developed means for use of a heuristic optimization methodology, known as superiorization, with component-wise perturbation schemes. This has application to total variation superiorization in CT image reconstruction.

**Methods for Incorporation of Blob Basis Functions into Experimental Proton CT**

*American Association of Physicists in Medicine DREAM Fellowship* Summer 2015

Supervisor: Reinhard Schulte

Developed and implemented algorithms for use of generalized Kaiser-Bessel window functions (called 'blobs') as a basis for 3D image representation during experimental pCT image reconstruction.

**Applying the TV Regularized $L^1$ Model and Gaussian Kernels in Image Decomposition**

*Walla Walla University, Mathematics Senior Project* Spring 2015

Supervisor: Benjamin Van Dyke

Wrote a project paper discussing local scales in image decomposition, which considered use of the total variation regularized $L^1$ model and also of convolutions with the Gaussian kernel. Initial advisement to the topic was from Kevin Vixie at Washington State University.

**Modeling Proton CT Image Reconstructions with Blob Basis Functions**

*Loma Linda University, Biomedical Undergraduate Research Program* Summer 2014

Supervisor: Reinhard Schulte

Developed schemes and software for basic simulations of 2D blob and voxel based image reconstructions in pCT, providing a proof-of-concept and motivation for further investigation.