

# Howard W. Heaton

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*To further my education in applied mathematics and refine my abilities  
so that I may contribute to society with meaningful mathematical research.*

## 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

The primary area of research is optimization with a focus on developing fast and memory efficient iterative fixed point methods in a general Hilbert space setting. This includes parallel asynchronous methods where each computing agent (e.g., CPU core) computes updates with the most recent information received, even if the latest results from other agents have not arrived. Asynchronous computing offers great improvement over synchronous computing with respect to computational efficiency and resilience to delays from failed communication and/or slow agents. Another area of current research is developing a general theory and framework for incorporating machine learning into algorithmic development where an individual problem must be repeatedly solved, each time with new (but similar) data. Recent works have experimentally shown it is possible to use a collection of data to “learn” a new task-specific algorithm for solving the problem at hand, which is able to execute order(s) of magnitude faster than corresponding state-of-the-art general purpose algorithms. This research may be applied to feature extractions in real-time vision and pattern recognition systems, object detection, image restoration, medical imaging, etc.

## TEACHING EXPERIENCE

<b>Mathematics Department, UCLA</b>   Los Angeles, CA	Fall 2016 – Spring 2018
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
<b>Physics Department, WWU</b>   College Place, WA	Winter 2015 – Spring 2016
Departmental tutor covering algebra and calculus based physics, including kinematics, electricity and magnetism, optics, and special relativity.	
<b>Computer Science Department, WWU</b>   College Place, WA	Fall 2014
Lab teaching assistant for an introduction to programming course using C++.	
<b>Mathematics Department, WWU</b>   College Place, WA	Spring 2013
Tutored pre-calculus and calculus and lead a lab for an applied statistics course.	
<b>Teaching Learning Center, WWU</b>   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

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 | Some Experience: Python, APL, SnoBol, Lisp, ARM Assembly  
Software: Mathematica, LabVIEW

## PROFESSIONAL MEMBERSHIPS

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, thereby providing a proof-of-concept and motivation for more extensive investigations.