Peter Caday

Education

University of Washington (2010–2015)

Ph.D., Mathematics; 3.97 GPA (out of 4.0).
M.S., Mathematics.

Advisors: Gunther Uhlmann, Plamen Stefanov.

Massachusetts Institute of Technology (MIT) (2006–2010)

S.B., Mathematics. 4.97 GPA (out of 5.0).

Current Employment

Postdoctoral Fellow, Rice University (2015 – present)

Research focus: numerical algorithms for seismic and ultrasound imaging.

- Currently developing a novel seismic imaging algorithm using Riemannian geometry and optimal transport.
- Developed and implemented an iterative numerical algorithm for removing unwanted scattered waves.
- Wrote ODE/PDE solvers; implemented linear and nonlinear optimization methods.
- Taught matrix algebra and co-taught numerical analysis.

Programming Experience

- Languages: C, C++, Matlab, Julia, x86 and PowerPC assembly.
- Experience working in Mac, Windows, and Linux environments.

Relevant Coursework

- Design and Analysis of Algorithms (MIT)
- Advanced Data Structures (MIT)
- Numerical Linear Algebra and Numerical Analysis (UW)
- Numerical Optimization (UW)

Awards and Fellowships

- Research Training Group Fellowship in Inverse Problems and PDE, 2012 – 2014.
- Excellence in Teaching Award, UW Mathematics Department, 2013.
- Walker Family Achievement Rewards for College Scientists Fellowship, 2010 – 2013.
- Phi Beta Kappa, 2010.
- Robert C. Byrd Honors Scholarship, 2006 – 2010.

Selected Projects

Seismic imaging with optimal transport

Full waveform imaging (FWI) is the current standard for high-resolution seismic imaging, but requires a good guess of what lies under the Earth's surface to initialize its optimization procedure. In this project, I am leveraging optimal transport, a tool already in use in computer graphics, in an effort to increase FWI's robustness. The code is written in Julia for performance and prototyping speed.

Removing multiple reflections

In wave-based imaging, multiple reflections are often confuse interpretation of the data. Along with my research group, I developed, rigorously analyzed, and implemented in Matlab and C++ a time-reversal based algorithm for controlling unwanted multiple scattering that assumes no knowledge of the object to be imaged.

Algorithms for computing Fourier integral operators (FIOs)

FIOs are a class of mathematical operators that can model the travel of light and sound waves and reconstruct images in medical, seismic and radar imaging. I refined and implementing a generic algorithm for computing a common class of FIOs. Designed for ease of use by future researchers, it is developed in Matlab, with some C++.

Ghost images and hiding objects in synthetic aperture radar

In this project, I studied a simplified radar system and the circumstances where objects could be hidden from it. I implemented in Matlab an algorithm that can be used to set up hidden objects, or simulate ghost objects that might appear in the reconstructed image.

Publications

- "Recovery of piecewise smooth wave speeds in the acoustic inverse problem," in progress. With M. V. de Hoop, V. Katsnelson, G. Uhlmann.
- "Scattering control for the wave equation with unknown wave speed," submitted (2017). With M. V. de Hoop, V. Katsnelson, G. Uhlmann.
- "Computing Fourier integral operators with caustics," Inverse Problems **32** (2016).
- "On numerics and inverse problems," thesis (2015).
- "Cancellation of singularities in synthetic aperture radar," Inverse Problems **31** (2015).

Previous Employment

Teaching Assistant, University of Washington (2010 – 2015)

Instructor for algebra, business algebra, and differential equations classes.
Conducted quiz sections for large first-year math classes.
Oversaw a small group of new teaching assistants.

Student Worker, MIT Libraries Acquisitions & Licensing (2007 – 2010)

Processed donated and newly purchased library items.
Wrote new macros and updated existing ones for automating computer tasks.

Farm Worker, Caday Gardens (1995 – 2006)

Picked, sorted, and packed produce for family farm.
Drove tractor; occasionally helped supervise work crew.