Matthew Pennybacker, Ph.D.

12236 Shadetree Lane, Laurel, MD, 20708, (505) 210-1125

matt@pennybacker.net
https://www.pennybacker.net

Education

2008 – 2013 **M.S. and Ph.D. in Applied Mathematics**
University of Arizona, Tucson, AZ

2003 – 2007 **B.S. in Electrical Engineering and Computer and Systems Engineering**
Rensselaer Polytechnic Institute, Troy, NY

Work Experience

2019 – **Applications Engineer**
DeepSig, Inc., Arlington, VA

- Developed software in C++, Python, and Javascript for OmniSIG, a software suite for detecting RF signals using machine learning and for training neural networks
- Worked with a variety of software-defined radios and their associated APIs
- Designed a variety of analysis tools and algorithms for RF annotation data
- Implemented a simplified version of the OmniSIG neural network on a Xilinx UltraScale FPGA
- Created responsive web-based frontend components for displaying RF spectrograms and annotation data
- Built VM images and associated scripting for listing OmniSIG in the Azure and AWS marketplaces
- Configured and tested a non-standalone 5G lab deployment, including 4G/5G RAN and and 4G EPC functions
- Performed product training for governmental and commercial customers

2017 – 2019 **Senior Support Scientist**
Global Science and Technology, Inc., and NOAA, College Park, MD

- Created a real-time satellite sea surface temperature (SST) dataflow in Python using Airflow, which processes observational data from 10 satellite platforms
- Developed algorithms for regridding and collating satellite SST data, implemented these algorithms in C++, and provided support for their operational use
- Investigated pattern recognition for clouds and thermal fronts in SST data using image processing (edge detection) and machine learning (decision trees and k-means clustering) techniques
- Investigated applications of deep neural networks for SST retrieval and radiative transfer modeling for various infrared imagers (VIIRS, ABI, AHI)
- Implemented a high performance parallel C++ toolbox for n-d array manipulation, NetCDF and HDF format file I/O, image and signal processing, and common geospatial search algorithms
- Administered a 20-node CentOS Linux cluster with a 1.6 PB BeeGFS cluster filesystem, InfiniBand (RDMA) networking, and a redundant PostgreSQL database

2013 – 2017 **Assistant Professor**

University of New Mexico, Albuquerque, NM

- Developed high performance code for simulation of nonlinear partial differential equations on complex domains using structure preserving numerical methods
- Created a robust model of the biochemistry involved in the formation of patterns on plants (collaboration with Alan C. Newell and Patrick D. Shipman)
- Designed a time integration scheme for full-wave and effective medium simulations of metamaterials (collaboration with Daniel Appelö)
- Performed rigorous asymptotic analysis along with long-time numerical simulations to characterize nanostructures that form on certain surfaces following ion bombardment (collaboration with Patrick D. Shipman and R. Mark Bradley)
- Taught two upper-division undergraduate/graduate courses per semester, advised graduate and undergraduate research projects, refereed papers for applied mathematics and physics journals

2010 – 2011 **Visiting Scientist**

Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany

- Designed and fabricated a Rayleigh-Bénard gas convection apparatus for visualization of high aspect ratio convection patterns
- Developed and implemented a high-accuracy control system to regulate the temperature of a thick silicon plate and surrounding water bath
- Created protocols for photoresist application and exposure for out-of-spec wafer and photoresist thicknesses
- Developed massively parallel simulations of convective flow using a novel spectral method with Nvidia GPU hardware and the CUDA library

2008 **Graduate Technical Intern**

Intel Corporation, Folsom, CA

- Generated Verilog and VHDL for the pre-silicon logic design of integrated 2D and 3D graphics chipsets
- Developed unit tests for various components of the 2D graphics pipeline
- Maintained and expanded a logic testbench which emulated the signals and behavior of other hardware devices

Technical Skills

Programming Languages and Libraries

- Expertise in C/C++ and Python
- Significant object-oriented and parallel programming experience
- Experience developing neural network models and training routines in TensorFlow and PyTorch

Software and Hardware

- Expertise in MacOS and Linux
- Shell scripting with BASH and others
- Git version control system
- Administration of web, mail, database, and file servers
- Web development with React and jQuery