TYLER W. HUGHES

Computational Physicist ⋄ 619 770 9446 ⋄ tylerwhughes91@gmail.com

EDUCATION

PhD, Applied Physics Sept 2014 - August 2019
Stanford University, Stanford, CA
PhD Thesis: *Adjoint-Based Optimization and Inverse Design of Photonic Devices*
Advisor: Prof. Shanhui Fan

Master of Science, Applied Physics Sept 2014 - June 2016
Stanford University, Stanford, CA

Bachelor of Science, Physics Sept 2009 - May 2013
University of Michigan, Ann Arbor, MI
With Distinction and Highest Honors —— GPA: 3.82/4.0
Honor's Thesis: *Economical GaAs Solar Cells by Epitaxial Lift-Off and Substrate Reuse*

EXPERIENCE

Research Scientist Sept 2019 - present
Flexcompute *flexcompute.com*

· Developing numerical electromagnetics algorithms and software for fast, large scale simulation.

Graduate Research Assistant / PhD Student Sept 2014 - August 2019
Fan Group, Stanford University *web.stanford.edu/group/fan*

· Developed novel algorithms and open source software for automated inverse design of photonic devices.
· Invented methods for training neural network hardware based on photonic integrated circuits.
· Designed integrated photonics system for laser-driven particle accelerators on a chip.

Machine Learning Intern June 2018 - Sept 2018
Rasa Technologies *rasa.com*

· Built and evaluated machine learning models for natural language understanding (NLU).
· Researched and implemented named-entity recognition strategies for extracting information from text.
· Contributed major lookup table matching feature to widely used open source software package.

Junior Software Engineer Jan 2014 - Aug 2014
GudTech Inc. *gudtech.com*

· Performed full stack development of commercial software for inventory management applications.
· Designed a business intelligence tool based on multi-dimensional databases.

Research Assistant July 2013 - Jan 2014
Centre for Quantum Technologies, National University of Singapore *sites.google.com/site/coldiongroup*

· Designed and simulated surface electrode ion traps for scalable quantum computation.
· Helped new lab with vacuum chamber assembly, electrical component design and construction, & laser operation.

Research Assistant Sept 2011 - May 2013
Optoelectronic Components and Materials, University of Michigan *umich.edu/~ocm/index.html*

· Developed a process to greatly reduce GaAs thin film, flexible solar cell cost through substrate reuse.
· Performed computational optimization design studies for antireflective coating, contact grid, & solar concentrator.

SKILLS AND INTERESTS

Skills	Electromagnetic simulation, numerical methods, scientific computing, machine learning
Interests	Inverse design algorithms, optical computing hardware, automatic differentiation
Technologies	Scientific Python (numpy, etc), C/C++, Julia, Matlab, JAX, Tensorflow, Pytorch

OPEN SOURCE PROJECTS

Ceviche	Electromagnetic Simulator with Automatic Differentiation	*link*
Wavetorch	Pytorch-Based Wave Equation Solver and Analog RNN Design Tool	*link*
Angler	Inverse Design and Simulation Tool for Nonlinear Photonics	*link*
Symbolic Regression	Machine Learning Tool For Converting Raw Data into Equations	*link*
Neuroptica	Optical Neural Network Systems Level Modeling and Simulation	*link*
Rasa	Machine Learning Framework to Automate Text-Based Conversations	*link*

SELECTED PUBLICATIONS

Hughes, T. et al. *Training of photonic neural networks through in situ backpropagation.* Optica (2018).
Hughes, T. et al. *Wave Physics as a Recurrent Neural Network.* Science Advances (2019).
Hughes, T. et al. *Adjoint method and inverse design for nonlinear nanophotonic devices.* ACS Photonics (2018).
Williamson, I. A. D., **Hughes, T.** et al. *Reprogrammable Electro-Optic Nonlinear Activation Functions for Optical Neural Networks.* IEEE JSTQE (2018).
Minkov, M. et al. *Inverse Design of Photonic Crystals through Automatic Differentiation.* ACS Photonics (2020).
Hughes, T. et al. *Forward-Mode Differentiation of Maxwell's Equations.* ACS Photonics (2019).
Hughes, T. et al. *Reconfigurable Photonic Circuit for Controlled Power Delivery to Laser-Driven Accelerators on a Chip.* Physical Review Applied (2019).
Hughes, T. et al. *Method for Computationally Efficient Design of Dielectric Laser Accelerator Structures.* Optics Express (2017).
Hughes, T. et al. *On Chip laser power delivery system for dielectric laser accelerators.* Physical Review Applied (2018).
Hughes, T., Fan, S. *Plasmonic Circuit Theory for Multiresonant Light Funneling to a Single Spatial Hot Spot.* Nano Letters (2016).

SELECTED TALKS

Hughes, T. et al. *Training of photonic neural networks through in situ backpropagation.* (Invited). CLEO (2019).
Hughes, T. et al. *Adjoint-based inverse design of nonlinear nanophotonic devices.* CLEO (2019).

COMPUTER SCIENCE & MACHINE LEARNING COURSEWORK (STANFORD U.)

CS 229	Machine Learning
CS 221	Artificial Intelligence
CS 230	Deep Learning
CS 107	Computer Organization & Systems
CS 42	Contemporary Javascript
CS 106B	Programming Abstractions

LINKS

Personal Website	twhughes.github.io
Google Scholar	scholar.google.com/citations?user=-AHhToYAAAAJ&hl=en
Github	github.com/twhughes
LinkedIn	linkedin.com/in/tylerwhughes