

Alex Ho

Curriculum Vitae
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RESEARCH INTERESTS

General:

Data science, inverse problems, machine learning, optimization, mathematical modeling, numerical analysis

Methods:

Finite element analysis, adjoint-based inversion, neural network (e.g. convolutional neural networks, recurrent neural networks), Bayesian optimization (e.g. Gaussian processes, expected improvement), reinforcement learning (e.g. deep symbolic regression)

Applications:

Geoscience (e.g. fluid dynamics, limnology), computer vision (e.g. object detection adversarial attacks)

EDUCATION

UNIVERSITY OF CALIFORNIA MERCED | DOCTORAL OF PHILOSOPHY IN APPLIED MATHEMATICS

Advisors: Dr. François Blanchette and Dr. Noémi Petra

Thesis: Eddy Diffusion Coefficient Estimation using Adjoint-Based and Machine Learning Algorithm with an Application to Marine Lakes

Aug 2019 – Expected Graduation: July 2025 | Merced, California

UNIVERSITY OF CALIFORNIA MERCED | BACHELOR OF SCIENCE IN APPLIED MATHEMATICS

Advisors: Dr. Roummel Marcia and Dr. François Blanchette

Aug 2015 – Dec 2018 | Merced, California

PROFESSIONAL EXPERIENCE

1. LAWRENCE LIVERMORE NATIONAL LAB (LLNL) INTERNSHIPS

1.1 Computational Engineering Division (CED) Scholar | Summer 2023 | Livermore, California

Jacob Pettit, Dr. Mikel Landajuela, and Dr. Brenden Peterson | LLNL CED Mentors

- Developed a reinforcement learning algorithm and experimented with the decision tree task in DisCo-DSO project, a continuation of Deep Symbolic Regression (DSO). DisCo-DSO paper was accepted to AAAI25.

1.2 Data Science Summer Institute (DSSI) Scholar | Summer 2021 | Livermore, California

Dr. Bhavya Kailkhura and Jacob Pettit | LLNL CASC and CED Mentors

- Developed a Bayesian optimization model for adversarial machine learning. Deployed digital and real-life adversarial attacks on state-of-the-art object detector YOLOv5 using BoTorch and OpenCV. Utilize procedural noise to reduce input dimension for Bayesian optimization. [Github Code]

1.3 Computational Engineering Division (CED) Scholar | Summer 2020 | Livermore, California

Dr. Brenda Ng | LLNL CED Mentor

- Applied an actor-critics model with reinforcement learning and deep learning framework for cyber security data. Developed visual assistance for the training processes of the network in order to effectively monitor the training process.

2. AUTONOMY TECHNOLOGY RESEARCH (ATR) CENTER INTERN | AIR FORCE RESEARCH LABORATORY

Edmund Zelnio | ATRC Mentor

Summer 2019 | Dayton, Ohio

- Explored and implemented deep learning architectures for solving Air Force problems in the field of remote sensing and autonomy technologies. Fine-tuned hyperparameters of neural network architectures such as DenseNet, ResNet, and CycleGan. Utilized transfer learning for accuracy improvement. Distribution C.

3. STUDENT RESEARCHER | UNIVERSITY OF CALIFORNIA MERCED

Dr. Roummel Marcia | Undergraduate Research Advisor

May 2018 – Jan 2019 | Merced, California

- Developed machine learning approach based on stacked autoencoders for separating images that have been superimposed at the detection stage. Implemented approach in PyTorch and tested on the customized superimposed MNIST dataset. Investigated different loss functions to improve performance.

PUBLICATIONS

ALEX HO , N. Petra, M. Dawson, F. Blanchette, “Adjoint-based Inversion for the Diffusion Coefficient in Marine Lakes”, 2025 (In Preparation).

J. Pettit, C. Lee, J. Yang, **ALEX HO** , D. faissol, B. K. Petersen, M. Landajuela, “DisCo-DSO: Coupling Discrete and Continuous Optimization for Efficient Generative Design in Hybrid Spaces”, AAAI, 2025.

ALEX HO , J. Alvarez, R. Marcia, “Image Denoising using Recurrent Neural Network with Limited Data”, 55th Asilomar Conference on Signals, Systems, and Computers, 2021.

O. DeGuchy, **ALEX HO** and R. Marcia, “Image Disambiguation with Deep Neural Networks”, Applications of Machine Learning, SPIE Optical Engineering + Applications, 2019.

TEACHING EXPERIENCE

CALCULUS II FOR PHYSICAL SCIENCES AND ENGINEERING | UNIVERSITY OF CALIFORNIA MERCED

Aug 2024 – Dec 2024 | Merced, California

Jan 2024 – May 2024 | Merced, California

Aug 2019 – May 2020 | Merced, California

PROBABILITY AND STATISTICS | UNIVERSITY OF CALIFORNIA MERCED

Sep 2022 – Dec 2022 | Merced, California

PROFESSIONAL SERVICES

SPIE CONFERENCE PROGRAM COMMITTEE | SPIE OPTICS + PHOTONICS 2025

Michael E. Zelinski | Program Chair

Jan 2025 – Aug 2025 | San Diego, California

- Review the paper submitted and verify that they are of sufficient quality for publication.
- Promote the conference as a conference ambassador at UC Merced.

RESEARCH MENTOR FOR UNDERGRADUATE STUDENT | UNIVERSITY OF CALIFORNIA MERCED

Dr. François Blanchette | Supervisor

Aug 2022 – May 2023 | Merced, California

- Leveraged by my expertise in numerical discretization to guide a student in discretizing functions using Finite Element Method (FEM).
- Give weekly tutorials on using FEniCS software for efficiently discretizing functions with FEM.
- Provided constructive feedback on Python coding and the structure of the research report.

AWARDS

2025 NATIONAL SCIENCE FOUNDATION (NSF) RESEARCH AND TRAINING GRANT (RTG) FELLOWSHIP

2024 UNIVERSITY CALIFORNIA, MERCED, APPLIED MATHEMATICS SUMMER RESEARCH FELLOWSHIP

2023 NATIONAL SCIENCE FOUNDATION (NSF) RESEARCH AND TRAINING GRANT (RTG) FELLOWSHIP

2023 APPLIED MATH INTERSHIP RECOGNITION AWARD, UNIVERSITY OF CALIFORNIA, MERCED

2022 NATIONAL SCIENCE FOUNDATION (NSF) RESEARCH AND TRAINING GRANT (RTG) FELLOWSHIP

2021 NSF RESEARCH TRAINEESHIP (NRT) INTELLIGENT ADAPTIVE SYSTEMS (IAS) FELLOWSHIP PROGRAM

2021 APPLIED MATH INTERSHIP RECOGNITION AWARD, UNIVERSITY OF CALIFORNIA, MERCED

2020 NSF RESEARCH TRAINEESHIP (NRT) INTELLIGENT ADAPTIVE SYSTEMS (IAS) FELLOWSHIP PROGRAM

2019 NSF RESEARCH TRAINEESHIP (NRT) INTELLIGENT ADAPTIVE SYSTEMS (IAS) FELLOWSHIP PROGRAM

PROFESSIONAL PRESENTATIONS

2025

Time and Space Dependent Diffusion Coefficient Estimation in Marine Lakes
SIAM CSE 25 | Fort Worth, Texas

Time and Space Dependent Diffusion Coefficient Estimation in Marine Lakes
Energy and Environment Seminar | Merced, California

2024

PDE Constrained Optimization Inexact Newton-Conjugate Gradient (PDECOIN-CG) using Marine Lake Data
Energy and Environment Seminar | Merced, California

Coupling Discrete and Continuous Optimization for Efficient Generative Design in Hybrid Spaces
SIAM SAMPLe Seminar | Merced, CA

2023

Eddy Diffusion Estimation in Marine Lakes with Multi-Data Optimization
American Physical Society, DFD | Washington, D.C.

Multi-Data Optimization with Variational Inverse Problem
Energy and Environment Seminar | Merced, California

Marine Lakes Modeling and Data-Driven Eddy Diffusion Estimation
Society for Industrial and Applied Mathematics, CSE | Amsterdam, Netherland

2022

Data-Driven Eddy Diffusion Estimation in Marine Lakes
Energy and Environment Seminar | Merced, California

Turbulent Eddy Diffusion Estimation with PDE-Constrained Optimization
Energy and Environment Seminar | Merced, California

2021

Data-Assimilated Image Augmentation
DSSI Seminar | Livermore, California

A Deep Learning Approach for Computing Curvature in Level-Set Methods
Optimization Seminar | Merced, California

2020

Derivation of Recurrent Neural Network using Ordinary Differential Equation
Lawrence Livermore National Laboratory | Livermore, California

Image Denoising using Limited Data
Lawrence Livermore National Laboratory | Livermore, California

Deep Recurrent Neural Network Denoising using Prior Distribution
Optimization Seminar | Merced, California

2019

Image Disambiguation with Deep Neural Networks
SPIE Optical Engineering + Applications | San Diego, California

Stacked Autoencoder and Image Processing
SIAM UC Merced Chapter SAMPLe | Merced, California

Image Disambiguation with Deep Neural Networks
Optimization Seminar | Merced, California

COURSES TAKEN

- Numerical Analysis I (Textbook: "Numerical Mathematics" by G. Himmerlin and K. Hoffman)
- Numerical Analysis II (Textbook: "Finite Difference Methods for Ordinary and Partial Differential Equations" by R.J. LeVeque)
- Ordinary Differential Equations (Textbook: "A Second Course in Elementary Differential Equations" by P. E. Waltman)
- Partial Differential Equations (Textbook: "An Introduction to Partial Differential Equations" by Y. Pinchover and J. Rubinstein)

- Inverse Problem (Textbook: “Computational Method for Inverse Problem” by C. R. Vogel)
- Fluid Dynamics (Textbook: “Fluid Mechanics” by P. K. Kundu, I. M. Cohen, and D. R. Dowling)
- Numerical Lin Alg & Opt (Textbook: “Numerical Linear Algebra” by L. N. Trefethen and D. Bau, III)
- Deep & Reinforcement Learning (Textbook: “Deep Learning” by I. Goodfellow, Y. Bengio, and A. Courville)
- Adv. Methods of Applied Math (Textbook: “Applied Functional Analysis: Applications to Mathematical Physics” by E. Zeidler)
- Asymptotics & Perturbations (Textbook: “Advanced Mathematical Methods for Scientists and Engineers” by C. M. Bender and S. A. Orszag)
- Scientific Computing (Textbook: “C++ for Scientific Computing” by R. Kriemann)

SKILLS

CODING

Proficient:

Python • Pytorch • Tensorflow • OpenCV • FEniCs • MATLAB

Familiar:

R • C++

SOFTWARE / VERSION CONTROL

Terminal • Git

IDE'S / TEXT EDITORS

VS Code • Emacs • Vim • Jupyter Notebook
• Atom