

# Alex Ho

Curriculum Vitae  
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## RESEARCH INTERESTS

### General:

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

### Methods:

Finite element, 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: Data-Assimilated Eddy Diffusion Coefficient Estimation of Marine Lakes

Aug 2019 – Expected Graduation: May 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 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 submitted.

1.2 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 procedural noise. Utilize procedural noise to reduce input dimension for Bayesian optimization. [Github Code]

1.3 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 | 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, “Data-Assimilated Eddy Diffusion Coefficient Estimation with Application to Marine Lakes”, 2024 (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”, 2024 (Submitted).

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

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

## MENTORSHIPS

### **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 FEnlCs software for efficiently discretizing functions with FEM.
- Provided constructive feedback on Python coding and the structure of the research report.

## AWARDS

**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

### **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**

Data-Assimilated 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-Assimilated 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

## SKILLS

### CODING

Proficient:

Python • Pytorch • Tensorflow • FEniCs • MATLAB • Bash

Familiar/Studying:

R • C++

### SOFTWARE / VERSION CONTROL

Terminal • Git

### IDE'S / TEXT EDITORS

VS Code • Emacs • Vim • Jupyter Notebook  
• Atom