

Sean Kulinski

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EDUCATION

Aug. 2019 – May 2023

PhD of Engineering in Computer Engineering

Purdue University, West Lafayette, Indiana

- *Area of Study:* Machine Learning and Artificial Intelligence
- Some Foci: Computer Vision, Learning with shifting conditions, Interpretable AI, Generative Modeling

Aug. 2015 – May 2019

Bachelor's of Science in Electrical Engineering

Purdue University, West Lafayette, Indiana

- *Area of Study:* Automatic Controls

PUBLICATIONS

Dec 2020

- **Sean Kulinski**, Saurabh Bagchi, David Inouye, "Feature Shift Detection: Localizing Which Features Have Shifted Via Conditional Distribution Tests", *Neural Information Processing Systems (NeurIPS)*, Dec 2020.

Present

- **Sean Kulinski**, David Inouye, "Explaining Dataset Shifts via Interpretable Transport" Under review

RESEARCH EXPERIENCE

Aug. 2019 – Present

Machine Learning Research Assistant

Advisor: Dr. David Inouye, West Lafayette, Indiana

- Designing a robust training scheme which allows a model to include information from multiple domains, allowing for a machine learning model to have better domain generalization performance.
- Derived method for interpretable optimal transport for the purposes of explaining distribution shifts to a human operator which can be used for system monitoring or knowledge discovery.
- Created a light-weight machine learning algorithm which uses deep density models to detect shifts in distributions as well as determine which feature(s) are causing the shift, allowing for online monitoring with little additional overhead.

May 2018 - Aug. 2019

Lead Undergraduate Researcher for Prosthetic Haptic Interfaces Project

Advisor: Dr. Hong Tan, West Lafayette, Indiana

- Began international collaborative research project with Centro di Ricerca "E. Piaggio" Lab from University of Pisa, Italy.
- Lead experiment to test effects of proprioceptive feedback of prosthesis delivered via skin stretching for upper limb prostheses.
- Developed GUI for data collection for human subjects with automatic data parsing.
- Designed and manufactured wearable motorized device to encode the state of robotic hand.

WORK EXPERIENCE

Oct 2021 – Apr 2022

Machine Learning Scientist

AbbVie, Remote [San Francisco, California]

- Lead the design and development of a novel computer vision model for processing histopathological images for the purpose of cancer detection and downstream diagnosis.
- Developed robust high-performance pipeline for continuous analysis of whole slide images for deployment to consumers.
- Assisted in building a consumer-facing custom viewer+annotator web-app for displaying mappings and meta-statistics generated by the model.

*May 2020 – Aug 2020***Machine Learning Engineer****Lawrence Livermore National Laboratory**, Livermore, California

- Identified issues in state-of-the-art computer vision frameworks for detection of COVID-19.
- Built computer vision models to conquer some of these issues, such as being robust to spatial distribution shifts. The models were trained using Livermore's Sierra HPC system.
- Used Natural Language Processing techniques on parsed Material Science publications to create an interpretable deep model to aid in the discovery of new nanostructures and nanomaterials.

*Jan. 2019 – Aug. 2019***Software and Embedded Electrical Engineer****Indiana Microelectronics**, West Lafayette, Indiana

- Developed Genetic Algorithm to automate and optimize design of transmission zero filters for Lockheed Martin.
- Designed automated testing of temperature drift for a closed-loop linear piezoelectric motor.
- Oversaw testing, calibration, and reworks for a phased-array filter system.

*Aug. 2019 – Dec. 2019***Graduate Teaching Assistant for ECE Senior Design****Purdue University**, West Lafayette, Indiana

- Directed a lab of 16 students through the process of bringing a hardware/software project from idea to product.
- Acted as a Senior Engineer and Manager to four different projects simultaneously.
- Held external workshops in various ECE skills such as Python, PCB design, and device testing.

*May. 2017 – Aug. 2017***Robotics R&D Testing Engineer****Stryker Corp.**, Fort Lauderdale, Florida

- Created dynamic power consumption measuring tool for loads on an arm-assisted surgical robot.
- Designed, laid out, and printed circuit board for high frequency and large duration measurements.
- Created tool for automatic formatting and parsing of raw input data for the purpose of immediate analysis.

TALKS AND LECTURES

*Nov 2020 - Dec 2020***Current Methods in Domain Generalization**

Led five lectures on the current approaches in Machine Learning for Domain Generalization covering:

- What is Domain Generalization, and it's main thrusts?
- Why do we want domain invariance, how is IRM different than ERM, and what are people doing now?
- Showed how data augmentation can be seen as a tool for domain generalization, with an example using *Mixup*.
- Additional methods in domain generalization such as Meta-Learning, Domain disentanglement, etc.

*Nov 2020 - Dec 2020***Primer on using Optimal Transport in Machine Learning**

Led introductory lectures on applying Optimal Transport in Machine Learning with four sessions:

1. What is Optimal Transport?
2. How can Optimal Transport be computed?
3. Walking through toy problems of exact computation of Wasserstein distances, visualization with McCann interpolations, and approximation using entropic regularization and Sinkhorn iterations.
4. Optimal Transport applications in Machine Learning such as WGAN and domain adaptation.

*Sep 2019***ECE Design Skills Workshop**

- Walked through how to use Python for automation and control of simple motorized and visual systems using a Raspberry Pi, stepper motors, and LCD screen.
- Showed process of laying out a printed circuit board design using Altium and how to output GERBER files for fabrication.
- Walked through PCB assembly process and showed suggested debugging practices for both hardware and software.

SKILLS

Programming Languages and Frameworks Python, MATLAB, C, LaTeX, Bash, Batch, Git, Numpy, Pandas, Scikit Learn, Pytorch, Keras, Scipy, PyOT, OpenCV, Excel, Linux, Jupyter, Altium

More Skills Leading and working within teams, strong mathematics background, statistics, data analysis, development using high-performance computing systems, Microsoft Office, product research and design

LEADERSHIP AND ACTIVITIES

2015 - Present Co-leader of Purdue's ML Reading Group (Present), Led lectures involving Python and Altium (2019), Elected Executive Board Member of Alpha Tau Omega Leadership Development Fraternity (2017), Volunteer at Natalie's Second Chance Dog Shelter (Present), Eagle Scout and Avid Backpacker (Present)