

# LUCAS FREY

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## EXPERIENCE

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### Machine Learning Engineer / Data Scientist

*Lam Research*

Jun 2019 –Present

*Fremont, California*

- Lead developer of a design optimization framework used to solve high dimensional optimization problems for internal and external stakeholders
- Implemented a probabilistic deep learning framework to solve inverse optimization problems
- Reviewed all pull requests meant to merge changes to core code or branches
- Developed image processing and computer vision algorithms to solve complex image analysis problems
- Designed high and low-level system overviews of large-scale software
- Presenting research progress at Lam internal technology conference in May 2020
- Attended deep learning conferences and stayed up to date on many advances in machine learning related to image segmentation and analysis

### Data Science Intern

*Lam Research*

Jun 2018 –Jun 2019

*Fremont, California*

- Implemented computer vision algorithms for analyzing high volume, high magnification images of semi-conductors
- Implemented GUI front-end to deploy automatic image analysis applications
- Developed Convolutional Neural Networks (CNNs) for image classification and segmentation
- Implemented image segmentation framework to aid in the development of algorithms to automate image analysis for process engineers.
- Presented talk on CNNs to a multi-disciplinary team of engineers

### Computer Science Tutor

*Self-Employed*

Oct 2017 –Jun 2018

*Corvallis, Oregon*

- Developed own curriculum to teach high school student C++ and Java programming
- Assisted student in achieving the highest score on the AP Computer Science Exam
- Taught concepts of pointers, stack vs heap, object orientation, parallelism, polymorphism, algorithms and data structures

## WORK PROJECTS

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### **Design Optimization Via Sequential Time-Series Modeling**

Jun 2019 –Present

*Lam Research*

- Developed scalable deep learning models to solve design optimization problems
- Improved design iteration speed by utilizing the prior knowledge of domain experts to boost model performance
- Managed code repository used by internal and external research partners
- Implemented particle swarm and gradient based optimization algorithms
- Implemented sparse models to improve robustness, accuracy, memory, and power usage
- Incorporated Bayesian methods for uncertainty estimation
- Utilized custom built cost functions to constrain and regularize the optimization process
- Implemented models in **Python** and **Jupyter Notebooks** using **Keras** and **Tensorflow**

### **Deep Learning Image Segmentation Pipeline**

Jun 2018 –Present

*Lam Research*

- Developed pipeline for building, training, validating and deploying deep learning models
- Replicated results of academic journals on Dense, Inception, and Resnet variant CNNs and Unets
- Built Generative Adversarial Networks (GANs) such as Pix2PixHD for domain adaptation
- Achieved 97% pixel 6-fold cross-validation accuracy on noisy, high resolution images
- Implemented models in **Python** and **Jupyter Notebooks** using **Keras**, **Tensorflow** and **PyTorch**

### **Automated Computer Vision Tools**

Jun 2018 –Present

*Lam Research*

- Developed defect detection, segmentation and measurement algorithms used by process engineers to analyze thousands of 1500x1500 scanning electron microscope images per week
- Designed front-end and back-end documents and diagrams for image analysis software systems
- Improved efficiency of engineers by automating image analysis, saving an estimate 10 hours per week
- Implemented solutions in **Python** using **OpenCV**, **Keras** and **Tensorflow**

## EDUCATION

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### Oregon State University

*Bachelor of Science*

**Major** Computer Science Applied in Machine Learning

**Minor** Mathematics

Sep 2016 – Jun 2019

*Corvallis, Oregon*

Major GPA 3.67/4.0

Overall GPA 3.58/4.0

## RELEVANT COURSEWORK & AWARDS

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### Core Courses

Computational Biology

Operating Systems (Comfortable in Unix)

Software Engineering (Methodologies & Testing)

Graph Theory (Graduate level course)

Linear Algebra

Statistics for Engineers

Analysis of Algorithms & Data Structure

### Awards

President's List (2 terms)

Dean's List (3 terms)

Honor Roll (4 terms)

Capital Manor's Foundation Scholarship (2016)

## ACADEMIC PROJECTS

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### Driverless Formula Racecar

[Github.com/lcsfrey/OSU-Driverless-Formula-Student](https://github.com/lcsfrey/OSU-Driverless-Formula-Student)

Sep 2018 - Aug 2019

- Developed deep learning computer vision and localization systems for a fully autonomous racecar
- Trained neural networks for object detection using **Python** and **PyTorch**
- Experimented with state-of-the-art architectures including Single Shot Detectors and Faster-RCNN
- Developed software to visualize, compare, and benchmark models using **Tensorboard**
- Developed software to deploy object recognition models in the **Robot Operating System (ROS)**
- Deployed models on the **NVIDIA AGX Xavier** embedded device
- Refactored team's existing **S.L.A.M.** algorithm to support multithreading
- Achieved 8th out of 20th place at **Formula Student Germany 2019 Driverless Competition**
- Achieved 6th out of 20th place in the design competition at **Formula Student Germany 2019**

### Traveling Salesman Problem (TSP) Algorithms

[Github.com/lcsfrey/TSP\\_Algorithms](https://github.com/lcsfrey/TSP_Algorithms)

Aug 2017 - Mar 2018

- Implemented genetic and multithreaded heuristic graph algorithms to approximate the TSP
- Outperformed entire class of 30 in 7 out of 7 in both speed and accuracy on competition test cases
- Implemented algorithms in **C++**
- Continued development outside of class building GUI in **Qt Creator** to display graph algorithms
- Implemented augmented reality graph overlay to display graph over drawings of graph nodes

### Aces Up Solitaire Game

[Github.com/lcsfrey/Aces-Up](https://github.com/lcsfrey/Aces-Up)

Oct 2017 - Dec 2017

- Worked on an agile development team of 4 completing multiple 2-week sprints over the term
- Utilized **Git** version control and a branch workflow to maintain the integrity of project files
- Developed front-end and back-end systems in both mobile and desktop versions using **Java**, **HTML**, **CSS**, **JavaScript**, and the **Ninja Web Framework**

## EXTRA-CIRRUCULAR

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### Artificial Intelligence / Machine Learning Club

- Discussed AI/ML related problems, architectures, and other topics
- Gave talks on state-of-the-art architectures deep learning architectures

### Formula Racing Club

- Discussed solutions to autonomous problems involving path planning, mapping, and localization
- Participated in the Formula Student Germany and Formula Student Spain driverless racing competitions
- Presented weekly progress on driverless formula racecar project

### Robotics Club

- Led team of 6 on yearlong projects to develop robots to compete in the FIRST Tech Challenge
- State finalists and two-time regional champions in competitions of 30+ teams each
- Developed autonomous systems to complete tasks utilizing touch, light, IR and rotation sensors
- Volunteered at local middle school teaching children how to build and program Lego NXT robots

## PERSONAL PROJECTS

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### Super Mario Reinforcement Learning Agent

[Github.com/lcsfrey/Reinforcement-Learning-Mario](https://github.com/lcsfrey/Reinforcement-Learning-Mario)

- Implemented Recurrent CNN-LSTM in **PyTorch** for action prediction
- Built using **Python**, **PyTorch**, and **OpenAI Gym**

### Foveated Incremental Learning Convolutional Neural Network (CNN)

[Github.com/lcsfrey/Active\\_Learning\\_Pytorch](https://github.com/lcsfrey/Active_Learning_Pytorch)

- Implemented CNN in **PyTorch** for sparse prediction of foveated images to mimic human eye
- Built using **Python**, **PyTorch**, and **OpenCV**

### Augmented Reality Graph Algorithm

[Github.com/lcsfrey/openCV\\_modules](https://github.com/lcsfrey/openCV_modules)

- Created augmented reality computer vision algorithm that draws paths through graphs on paper
- Built using **Python** and **OpenCV**, **pybind11**, and **C++**

### Security Camera

[Github.com/lcsfrey/openCV\\_modules](https://github.com/lcsfrey/openCV_modules)

- Developed motion sensitive camera that can highlight movement in frame and write footage to files
- Built using **Python** and **OpenCV**

## TECHNICAL STRENGTHS

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### Computer Languages

C/C++, Python, Java

### Software & Tools

OpenCV, pybind11, ROS, Git, Tensorflow, Keras, Tensorboard, PyTorch, Jupyter Lab/Notebook, Matplotlib, Pandas, Qt

### Applied Fields

Image Segmentation, Object Detection, Automation, Hyperparameter Optimization, Design Optimization