

# Axel Jacobsen

axel-jacobsen.github.io | axelnjacobsen@gmail.com

**LANGUAGES** Advanced in **Python**, experienced in **C**, **Java**, **Javascript**, learning **Julia**, **Lisp**, **Rust**. Experienced in **git**  
**DEEP LEARNING** Used LSTMs, CNNs, and various RL techniques (Asynchronous-Advantage Actor Critic, DQNs) in Pytorch

## RELEVANT EXPERIENCE

### CHAN-ZUCKERBERG BIOHUB | R&D ENGINEERING INTERN | JUN 2020 - DEC 2020, JUL 2021 - PRESENT

- Rewrote codebase of the Opentrons OT-2, an open-source pipetting robot
- Implemented Python's Type Hints with MyPy, speeding up development and increasing reliability of codebase
- Doubled the speed of certain frequent operations (e.g. picking up / dropping pipette tips)
- Created tests, accurate to 1  $\mu$ m over ~1 m, to measure drift of OT-2 using cross-correlation
- Reduced codebase size by ~75% while maintaining previous functionality, simplifying code for future maintenance / development
- Designed and implemented architecture of robot / software so any software-controlled instrument can be used during protocols (e.g. cameras, GPUs, thermocyclers)

### WILDLIFE COMPUTERS | ENGINEERING INTERN | MAY 2019 - AUG 2019

- Designed an isolator PCB to isolate digital lines from sensitive measurement devices, allowing low-noise and accurate voltage measurements
- Wrote C++ to test PCBs that arrive from fabrication - autonomously verifies PCB component placement to increase production throughput

### CONTROL MOBILE | DATA SCIENCE CO-OP | JAN 2018 - APR 2018

- Wrote Python scripts to analyze and rank order over 300 individual SQL queries by their runtime to optimize the SQL database; reduced the runtime to fetch and display customer data by 65%
- Worked with the backend team to fix existing bugs, write new code, and refactor current code

## PROJECTS

### DEEP LEARNING

- Asynchronous Advantage Actor-Critic Model written in Pytorch, optimized for multicore CPUs via multiprocessing
- LSTM-based Deep Q-Network, trained on Denmark Technical University's High-Performance Computing Cluster
- Feed-forward neural network written from scratch, implementing the math behind deep learning
- Currently writing a basic autograd library in Julia, in order to understand fundamentals of Pytorch

### ENGINEERING PHYSICS AUTONOMOUS ROBOT COMPETITION

- Designed and created an autonomous robot from scratch in 8 weeks, capable of navigating complex and dynamic course
- Implemented signal processing software to detect specific IR frequencies with sub-millisecond detection time
- Designed and created circuits to control the mechanical subsystems (robotic arm / claw)
- Wrote (in C) driver software for the robotic arm / claw, as well as software for high-level control loops of robot

## EDUCATION

### UNIVERSITY OF BRITISH COLUMBIA | EXPECTED MAY 2022

#### B.ASc Engineering Physics

*Coursework includes* Lagrangian Mechanics, Computational Modelling, Digital Systems and Microcomputers, Signals and Systems, Applied Quantum Mechanics, Linear Algebra, Honours Multivariable and Vector Calculus, Complex Analysis, Optics, Statistical Mechanics

### DENMARK TECHNICAL UNIVERSITY | WINTER 2019

#### Exchange Semester

*Coursework includes* Operating Systems, Deep Learning, Robotics, Computationally Hard Problems.  
Won DTU OS Course Competition for writing the fastest reverse hash server in C