

# Lucas Zeer

Software Developer, Nanotech Engineering (Grad 2017)  
[zeer.io](http://zeer.io), [github.com/lucaszw](https://github.com/lucaszw), [linkedin.com/in/lucas-zeer](https://linkedin.com/in/lucas-zeer)

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## Education

### **BEng, Honours, With Distinction in Nanotechnology Engineering, University of Waterloo**

September 2012 - April 2017

## Experience

### **Software Engineer at KitchenMate, Toronto**

October 2018 - Present

- Developed with the following software stack: Node, Angular, Express, PostgreSQL, and Sequelize, and Ionic.
- Built a native mobile application for our customers.
- Generated recursive algorithms for automating our costing and production.
- Scaled our backend software as we grew from 5 to 30 offices (around 20 active customers per office).
- Performed code reviews, supervised numerous software interns.
- Lead an internal team project that earned a \$5000 prize in a machine learning hackathon.
- Developed internal tool in Angular for comparing various hypotheses using Jupyter Notebooks.
- Migrated codebase to Webpack, Yarn Workspaces, and ES6.

### **Founder of The Brainery Inc, Kitchener**

February 2018 - October 2018

- Filed a provisional patent relating to actuation of droplets using magnetic traps.
- Developed a hardware device called the FerroBot as well as control software using web technologies.
- Built a solution that required no expensive disposables and a low manufacturing cost.
- Built an electron based control application (Node, Backbone, ThreeJS, and D3).
- Released weekly YouTube videos covering a range of Ferrofluid related subject matter.

### **Lead Software Developer at Sci-Bots, Kitchener**

June 2017 - May 2018

- Developed various open source frameworks for Sci-Bots' digital microfluidics device.
- Created an electron based MQTT communication library for a variety of lab hardware.
- Took advantage of 3D transformations for video overlay functionality.
- Handled scheduling and execution of digital microfluidics protocols.
- Created a plugin and process manager for handling Python and Node JS child processes.
- Worked on a companion library for enabling programmable control of the DropBot in both Python and JS.

### **Software Developer at Nvidia Deep Learning, Santa Clara**

Coop May 2016 - September 2016

- Worked on an open source machine learning server for training neural networks in Python and Lua.
- Served thousands of users around the world.
- Developed machine learning algorithms for feature extraction (in Caffe and Torch).
- Extended the web based UI for neuron and network visualizations (using Flask and AngularJS).
- Enhanced the web applications' job scheduler and REST API.
- Performed code reviews, developed tests, and followed Kanban and Agile development procedures.

### **Technical Cofounder at Lani Inc, Kitchener**

September 2013 - June 2015

- Technical cofounder of a software startup involving 3D printing.
- Developed a platform for scheduling, pricing, and visualizing 3D prints.
- Built with Ruby on Rails, Backbone JS, and Coffeescript.
- Deployed on Heroku.

- Created a 3D Model renderer using Three JS and WebGL as well as many backend Mesh libraries for mesh repair, model stitching, and other pre and post processing procedures.

## **Software Developer at Nvidia, Santa Clara**

January 2016 - April 2016

- Developed a PCIe and NVLink topology Linux Visualization Tool.
- Implemented various traversal and graphing algorithms such as Reingold-Tildford Algorithm, and Forced Layouts.
- Worked on a WebGL and ReactJS based internal spec designer tool involving: UV Mapping, Active Grid Textures, and Voxel Painting.

## **National Institute for Nanotechnology, Edmonton**

January 2014 - April 2014

September 2014 - December 2014

- Designed various audio distortion and amplifier circuits, as well as signal processing software in Python, C++, and Matlab.
- Second authorship on the paper: "Musical molecules: the molecular junction as an active component in audio distortion circuits."
- Worked in a ISO Class 6 cleanroom on developing silicon based components.

## **Menlo Systems GMBH**

May 2013 - August 2013

- Programmed a ray tracing simulation that accounted for gaussian optics (such that rays could be bent by movable lenses).
- Built to operate in real time and could be optimized to match certain characteristics.
- Developed an embedded optical mechanical system in C++ for Astro Combs to account for the redshift of interstellar light.
- Aided astronomers in finding earth-like exoplanets then the current limits of our technology through the software.
- Responsible for the setup of the optical-mechanical systems using Hollow Core fibres for maximum optic coupling.

# **Skills**

## **Languages of Choice**

- JavaScript (Node), C++, Python, C# (Unity Game Engine), Ruby, and Matlab/Octave (Signal Processing Toolbox).

## **Machine Learning**

- Experience with PyCaffe, Torch, and Tensorflow deep learning frameworks.
- Developed for the open source DIGITS (Deep Learning GPU Training System) project at Nvidia.
- Worked on feature extraction techniques for Convolutional Neural Nets for Caffe and Torch.
- Built a Network Visualization tool for Caffe and Torch.

## **Cloud Platform and Web Development**

- Full stack web developer with a high level of experience in: Node, HTML5/CSS3, MVC & Web Frameworks.
- Express, Sequelize, Angular, React, Flask, Rails.
- PostgreSQL, Redis, Mongo, MySQL, and beyond.
- Electron, Bootstrap, Nginx, and Linux/Bash.
- Deployed many applications on various cloud platforms such as AWS (EC2, Lambda), Heroku, and Docker.

## **3D Graphics**

- Strong knowledge of 3D Meshes, 3D Rendering / Graphics Algorithms, and Game Development.
- Used WebGL and ThreeJS for many personal and corporate related projects.

## **Programming Models / Design Patterns**

- Extensive knowledge of object oriented programming, MVC architectures, reactive programming patterns, and functional programming paradigms.

## Signal Processing

- Audio Distortion Software, Spectral Analysis of Audio Waveforms, Electrical-Mechanical, and Optical-Mechanical systems.

## Electronics

- Switching Boards, RC Filters, Amplifiers, Oscillators, Differentiators, Transformers, Tesla Coils, etc.
- Worked with complex systems for audio related circuits, optical systems, bioinformatics, and microfluidics.
- In depth experience in circuit design tools such as EagleCAD and KiCAD.

## Digital Control Systems

- Multi-threading, drawing, and control of optical sensors.
- Worked on control systems for both microfluidic devices, and fuzzy logic systems.
- Wide range of experience with many IC electronics, and low level communication protocols.

# Main Projects

## DropLab DMF Device (Capstone Project)

- A breadboard for moving fluids using a grid of electrodes.
- This project involved developing a transformer based amplifier circuit, implementation of a new materials, and software for improving DMF device automation.
- Built a local flask based web server to control and monitor the board using a REST API.
- Developed a React JS front end to display the current board state and running recipes.
- Contracted to extend the software for Sci-Bots' open hardware platform: the DropBot.

## Autonomous Driving Dashboard System

### Fuzzy Logic and Neural Networks

- Developed a car dashboard system to identify the various traffic symbols in front of a driver.
- Built using the Torch framework and an AlexNet neural network architecture.
- Application ran as a local web server with a React based front-end.

## Biofeedback Reader

- Developed an analogue device to capture and record galvanic skin response.
- Created a multi-threaded java application for real-time monitoring.
- The purpose of the project was to create a fun game for family and friends using GSR as a form of lie detector.

## Multi-Agent Path Finding for Dense Systems

### Undergraduate Research Project (NE 459) with Prof. William Cowan

- Javascript based path finding systems for multi-agents in a dense setting.
- Approached via similar paradigms as those used in train, and traffic based systems.
- This was incorporated into a digital micro-fluidic system to handle multiple moving drop units simultaneously.

## Real-time Unity Mesh Importer

- Worked on a plugin to import/export STL files via HTTP requests in the Unity Game Engine.
- Applications include allowing developers to add 3D Printing design tools to their games, as well as potentially allowing developers to export assets to sites such as Thingiverse.

## Bubble Wall

### Hack the 6ix 2019

- Built a bubble wall with colleagues that could be controlled wirelessly.
- Made up of 10 individually addressable valves, led strips, Bluetooth 4, Arduino, and a high power switching board.
- Software utilized React and Web Bluetooth.

## Light Box Design Software

DisruptAI 2019

- First Place Prize Winner (\$5000)
- Developed a software application in ThreeJS for designing paper light boxes in SVG format.
- Wrote custom gcode for printing designs using a standard laser engraver or cutter.
- Demonstrated potential for encouraging individuals to create image segmentation datasets.

## My Favourite Courses

### Object Oriented Programming for Nano-Simulations

- Fundamentals of Object Oriented Programming, C++, Pointers & Dynamic Memory Allocation, Memory Management, Inheritance, Templates, and the STL, Numerical Analysis
- Linear Algebra in C++, Fourier Transforms in C++, and Monte Carlo Methods.

### Computational Intelligence: Fuzzy Logic and Neural Networks

- The course introduces novel concepts for computational intelligence based on soft computing techniques.
- Concepts on knowledge based reasoning, fuzzy inferencing systems and connectionist modelling based on artificial neural networks.

### Micro and Nano Scale Computer-aided Design (CAD)

- Modeling and simulation of micro, nano, and fluidic systems.
- Learned how to use Finite Element Analysis to simulate how a design would act under real world forces.
- Review of differential-equation systems, boundary conditions, and solvers for complex, coupled transport problems.

### Continuum Mechanics

- Analysis of differential equations to model fluidic systems using tensor operations and tensor calculus.
- Applications for this course include modelling of fluids using the Navier-Stokes equations.

### Nano-Electronics (Applied Quantum Mechanics)

- Continuation of Quantum Mechanics with a focus on applications in next generation electronic devices.
- Exploration of simulation techniques used across open source projects on Nanohub
- Accompanied by a project to introduce students to open research, and contribution.

### Algorithms and Data Structures

- Course covered asymptotic and algorithm analysis, relationships and data structures.
- Lists, queues, stacks, hash tables, trees, priority queues and heaps.
- Sort algorithms, Graphs and graph algorithms, algorithm design techniques.
- Complexity classes and NP completeness.

## Awards

#### Autodesk Capstone Software Design Award

University of Waterloo  
(Winter 2017)

#### DisruptAI first place

Microsoft sponsored hackathon  
(2019)

#### Best in Fair

District Science Fair  
(2012)

#### Baylis Medical Capstone Design Award

University of Waterloo  
(Fall 2016)

#### Presidents Scholarship

University of Waterloo  
(2012)

#### Bronze Award in the National Science Fair

Charlottetown (2012)  
Toronto (2011)

#### NormEsch Entrepreneurial Capstone Award

University of Waterloo  
(Winter 2017)

#### Engineers of the Future Trust

University of Waterloo  
(Fall 2016)

#### HKVCA Cross-Canada Wide Writing Contest

Second Place  
(2011)

#### Velocity Fund 25K

University of Waterloo  
(Summer 2015)

#### Norman Esch ECOOP Award

University of Waterloo  
(Winter 2017)