Lucas Zeer

Software Developer, Nanotech Engineer, Interactive Designer
zeer.io, **github.com/lucaszw**, **linkedin.com/in/lucas-zeer**

Education

BEng, Honours, With Distinction in Nanotechnology Engineering, University of Waterloo
September 2012 - April 2017

Masters in Design for Kids and Toys, Politecnico Di Milano
February 2020 - February 2021

Experience

Design Engineer Intern at Hape, Milan
November 2020 - Present
- Working on various toy concepts combing electronic and digital components
- Combing software and hardware elements in the toys for immersive experiences
- Continuing the development of an undisclosed toy concept I previously developed with two other students

Software Engineer at KitchenMate, Toronto
October 2018 - August 2020
- Developed with the following software stack: Node, Angular, Express, PostgreSQL, and Sequelize, and Ionic.
- Built a native mobile application for our customers.
- Implemented an automated machine learning pipeline and trained neural networks for predicting our food distribution.
- 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, GLSL, C# (Unity Game Engine), Ruby, and Matlab/Octave (Signal Processing Toolbox).

Machine Learning
- Experience with PyCaffe, Torch, and Tensorflow deep learning frameworks.
- Trained neural networks used in production software for predicting weekly food consumption
- Implemented end to end machine learning pipelines
- 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 material for DMF devices, and creating intelligent 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 Thingyverse.

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
- 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)	**Baylis Medical Capstone Design Award** University of Waterloo (Fall 2016)	**NormEsch Entrepreneurial Capstone Award** University of Waterloo (Winter 2017)	**Velocity Fund 25K** University of Waterloo (Summer 2015)
DisruptAI first place Microsoft sponsored hackathon (2019)	**Presidents Scholarship** University of Waterloo (2012)	**Engineers of the Future Trust** University of Waterloo (Fall 2016)	**Norman Esch ECOOP Award** University of Waterloo (Winter 2017)
Best in Fair District Science Fair (2012)	**Bronze Award in the National Science Fair** Charlottetown (2012) Toronto (2011)	**HKVCA Cross-Canada Wide Writing Contest** Second Place (2011)	**Selected Concept and Prototype for Design Workshop** Hape (2020)