

# Declan Oller

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## Quick Overview

- PhD in physics, MS in physics, BA in Math and Physics
- Since completing PhD, Machine Learning/Data Science consulting and research
- 8 peer reviewed publications (5 first author), 1 patent
- Professional experience using Machine Learning, Deep Learning, Data Science, and Reinforcement Learning techniques to achieve results
- References available upon request

## EDUCATION

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2011 – 2017 **Doctor of Philosophy, Physics, Brown University, Providence, RI**

- Doctoral advisor: Professor Jimmy Xu
- Dissertation: "Anodic Alumina as a Scalable Platform for Structural Coloration and Optical Rectification"

2011 – 2013 **Master of Science, Physics, Brown University, Providence, RI**

- Classes: Classical Mechanics, Quantum Mechanics I & II, Electrodynamics, Statistical Mechanics, Laboratory Experiments and Techniques, Solid State Physics I & II, Semiconductor Heterostructures, VLSI Design

2007 – 2011 **Bachelor of Arts, Mathematics and Physics, Clark University, Worcester, MA**

- Thesis advisor: Professor Charles Agosta
- Thesis: "Experiments with Thermophoresis Using Direct Simulation Monte Carlo Simulations"

## SKILLS

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### Languages and Libraries

- Python (Pandas, scikit-learn, PyTorch, TensorFlow, SciPy, OpenCV, PyMC3), GNU/Linux, C++, Haskell, Mathematica, LabVIEW, OR-Tools, Gurobi, Onshape, MATLAB, Java, JavaScript

### Methods and techniques

- Machine learning, data science, optimization algorithms, reinforcement learning, deep learning, Bayesian modeling, generative models, evolutionary algorithms, data analysis, data visualization, mathematical modeling, functional programming, computer simulation

## WORK EXPERIENCE

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2018 – current **Machine learning and optimization consultant**

Technical consulting, Perciplex LLC, Providence, RI

- Optimization and machine learning consulting for exploration of a network concept
- C++, Omnet++, Python, GitHub
- Machine learning applied to large quantities of time series data
- Python, PyTorch, Deep learning, Generative models, Reinforcement Learning, GitHub

- 2019 – 2020 **Mathematical modeling consultant**  
 Boston Medical Center, Boston, MA
- Used Bayesian modeling to calculate number of Take Home Naloxone kits needed to save a given number of lives and other statistics for a public health study
  - Worked on a large scale data pipeline architecture
  - PI: Professor Traci Green
  - Python, Pandas, PyMC3, GitHub
- 2012 – 2017 **Research Assistant**  
 Professor Jimmy Xu, Department of Physics, Brown University, Providence, RI
- Experimental, computer simulation, and modeling research on Scalable Structural Col- oration, Optical Rectification, Resistive Switching, Confined Electron Systems
  - Regularly performed microfabrication, experiment setup, data analysis
  - Article, grant, and project review writing and editing
  - Trained and directed undergraduate and newer graduate students
  - Python, Mathematica, Data analysis, computer simulation
- 2011 – 2011 **Research Assistant**  
 Professor Sean Ling, Department of Physics, Brown University, Providence, RI
- Numerical computer simulation of first passage times for DNA translocation in the nanopore research experiment using C++
- 2010 – 2011 **Research Assistant**  
 Professor Charles Agosta, Physics Department, Clark University, Worcester, MA
- Simulation of rarefied gas for general boundary conditions using Monte Carlo techniques with C++
- 2009 – 2009 **Physical Technician**  
 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA
- Development of Matlab code for the data acquisition program of an Advanced Fre- quency Counter for an experiment of the Weak Equivalence Principle

## PUBLICATIONS

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- **Declan Oller**, Tobias Glasmachers, and Giuseppe Cuccu, “Analyzing Reinforcement Learning Benchmarks with Random Weight Guessing.” In Proceedings of the 19th International Conference on Autonomous Agents and MultiAgent Systems. International Foundation for Autonomous Agents and MultiAgent Systems (2020).
- **Declan Oller**, R. M. Osgood III, Jimmy Xu, and Gustavo E. Fernandes, “Optical Rectification in a Reconfigurable Resistive Switching Filament”, Appl. Phys. Lett. 115, 043101 (2019).
- **Declan Oller**, De He, Jin Ho Kim, Domenico Pacifici, Jimmy Xu, and Gustavo E. Fernandes. “Colour gamuts arising from absorber–dielectric–metal optical resonators.” Coloration Technology (2017).
- **Declan Oller**, Gustavo E. Fernandes, Stylianos Siontas, Jimmy Xu, and Domenico Pacifici. “Scalable physical coloration.” Materials Research Bulletin 83 (2016): 556-562.
- **Declan Oller**, Gustavo E. Fernandes, Jin Ho Kim, and Jimmy Xu. “Investigation of quantum confinement within the tunneling-percolation transition for ultrathin bismuth films.” Physica B: Condensed Matter 475 (2015): 117-121.
- Gustavo E. Fernandes, Jin Ho Kim, **Declan Oller**, and Jimmy Xu. “Reduced graphene oxide mid-infrared photodetector at 300 K.” Appl. Phys. Lett. 107, 111111 (2015).
- De He, Zhijun Liu, Gustavo E. Fernandes, Tianyi Shen, **Declan Oller**, Domenico Pacifici, Jin Ho Kim, and Jimmy Xu. “High-purity red coloration via mode-selective absorption in a layered thin-film cavity.” AIP Advances 8, 065226 (2018).

- Rachel Odessey, Tianyi Shen, **Declan Oller**, De He, Jin Ho Kim, Jimmy Xu, Domenico Pacifici. "Reduced angle sensitivity of structural coloration on an industrial aluminium platform." *Coloration Technol.* 2020; 00: 1– 6.

## PATENT

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- "Wireless mesh data network with increased transmission capacity", US10517092B1, 2019.

## SELECTED PROJECTS

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### Top-down program synthesis with a REPL and reinforcement learning

- Used Reinforcement Learning to optimize a policy for a Constructive Solid Geometry program synthesis task.
- Python, PyTorch, GitHub, A2C

### Variational Autoencoders in Haskell

- Created a VAE in Haskell and an Adam optimizer from scratch.
- Haskell, cabal, hmatrix, GitHub

### Solving the Cat and Mouse math puzzle game using Reinforcement Learning

- Used the DDPG and A2C RL algorithms to solve the sparsely rewarded "Cat and Mouse" puzzle game.
- Python, PyTorch, GitHub, DDPG, A2C

### Reinforcement Learning robot

- Used Reinforcement Learning to make a physical robot I built successfully learn to play a game with no prior information about it
- Python, PyTorch, SciPy, GitHub, deep Q-learning

### NeuroEvolution agents for winning OpenAI gym games

- Made an Evolutionary Algorithm to evolve neural network policies for agents to win OpenAI gym games, using no gradient descent
- Python, OpenAI Gym, GitHub

### Genetic Algorithms for solving the brachistochrone problem

- Made a gradient-free Genetic Algorithm to solve the classic "brachistochrone problem" of physics and others
- Python, GitHub

### Modular NeuroEvolution agents combined with gradient descent

- Expanded on a previous project, by using NeuroEvolution to determine neural network topology and gradient descent to train the networks, and created a framework for capturing successful neural networks as discrete modules
- Python, PyTorch, GitHub

### Solving Skyscrapers and other puzzles using OR-Tools

- Used a constraint satisfaction package to solve the "Skyscrapers" puzzle game and others
- Python, OR-Tools, GitHub

### Realtime image recognition and data analysis of neighborhood traffic

- Used Python, OpenCV, Tensorflow, and Pandas with a Raspberry Pi/camera to do realtime image recognition of a camera stream of traffic
- Python, OpenCV, Pandas, TensorFlow, Raspberry Pi

### Centipede robot

- Built a centipede robot out of 3D-printed parts I designed, controlled with a hierarchical object-oriented structure
- Python, GitHub, 3D printing

## An interactive introduction to Simulated Annealing

- Wrote an interactive tutorial using d3.js, illustrating the basics of Simulated Annealing optimization with two physics-based examples
- d3.js, GitHub, JavaScript

### ADDITIONAL INFORMATION

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Interests Cello, Guitar, Photography, Strategy games