

# Matthew Retchin

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## RESEARCH EXPERIENCE

FEB. 2021 – MAY 2023

### Columbia Artificial Intelligence and Robotics Lab

#### *Master's Thesis: Koopman Constrained Policy Optimization*

- Accepted for publication at **ICML 2023 Workshop** in Honolulu, Hawaii.
- Developed a novel neural network architecture in PyTorch for box-constrained model predictive control using Koopman operator theory.
- This architecture can swap constraints at test time without any retraining necessary with better generalization than baselines.
- Researched the use of this architecture with classic control tasks where system dynamics are completely unknown to the controller.

FEB. 2019 – NOV. 2019, AUG. 2020 – JAN. 2021

### Kriegeskorte Visual Inference Lab

#### *Visual Concept Learning in Artificial Neural Networks*

- Created Flying Objects, an interactive psychophysics video game framework that tests object permanence / working memory. Humans can interact using mouse and keyboard, neural net via API.
- Published in the **Conference on Cognitive Computational Neuroscience**.
- Currently a foundation for a major research direction in the Kriegeskorte lab.
- Reviewed and presented literature on neural network architectures with object oriented inductive biases.

JUNE 2018 – AUG 2018

### Philips Research North America

#### *Natural Language Processing & Computer Vision*

- Worked on neural image captioning algorithm for radiology using PyTorch.
- Built pipeline to extract text and image features via sentence parsing, word embedding, and image augmentation with NLTK, Gensim, NumPy/SciPy.

JUL 2017 – MAY 2018

### MIT Department of Brain and Cognitive Sciences

#### *Speech Recognition*

- Implemented algorithms for statistical analysis, monkey speech recognition, and an ETL pipeline using Keras, SciPy, and the HDF5 serialization format.

## HONORS & AWARDS

**Dean's List** (Spring 2017, Spring 2019, Fall 2019, Fall 2020)

**Columbia Engineering Ignition Grant for COVID-19 Tracing App** (2020)

- Ignition Grants are financial grants to assist Columbia University students in launching new businesses, both social and not-for-profit ventures.

**Hult Prize Regional Finalist** (2017)

- Chosen as one of 300 Regional Finalists of over 50,000 team applicants (Undergraduates, MBAs, and Graduates) from around the world.
- Created a social enterprise to provide opportunities to refugee populations, competing for \$1 million in seed funding.

**Best of Category, Computational Biology at International Science and Engineering Fair (ISEF)** (2015)

- Placed first in inaugural Computational Biology category.
- Overall top 20 of over 1300 projects at the largest international science competition.
- Trained miRNA-mRNA interaction model with Keras and created search engine.

## EDUCATION

### Columbia University

2021 – 2023 Master of Science  
*Computer Science*  
CUM. GPA: 3.80/4.00

2016 – 2020 Bachelor of Arts  
*Computer Science*  
CUM. GPA: 3.66/4.00

## SKILLS

### Programming Languages

Python, JavaScript, Java, Bash/Shell, PostgreSQL, HTML, CSS, C#,  $\LaTeX$ , C, C++, Haskell

### Libraries & Frameworks

PyTorch, JAX, NumPy, SciPy, Matplotlib, Keras, Scikit-Learn, Pandas, Node.js

### Software

Linux, Vim, git, tmux, Unity3D, Blender

## RELEVANT COURSEWORK

### Master's Thesis

2023 **doi:10.7916/5xtw-x577**

### Graduate

Computer Vision  
Robot Learning  
Analysis of Algorithms  
Parallel Functional Programming

### Undergraduate

Computational Aspects of Robotics  
Computer Science Theory  
Natural Language Processing  
Artificial Intelligence  
Fundamentals of Computer Systems

## INTERESTS

Piano, Guitar, Creative Writing, Cycling, Squash, Kayaking, Go, Chess