Chase Goddard

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Education

Princeton University, Graduate School — **Princeton, NJ**
PhD, Machine Learning, Advisors: David Schwab, William Bialek — *Sept 2019 – Current*
Department of Physics
Courses Taught: Classical Mechanics, Graduate Preliminary Exam Prep Classes, Intro E&M, Computational Physics, Biophysics

Princeton University, Graduate School — **Princeton, NJ**
Master of Arts, Physics — *Sept 2019 – Sept 2021*

Cornell University, College of Arts and Sciences — **Ithaca, NY**
Bachelor of Arts, Physics & Computer Science, Advisors: Carl Franck, Julia Thom-Levy — *Aug 2015 – May 2019*
Research: X-ray spectroscopy, Experimental High-Energy Physics
Awards: Erik Cassel Prize
Courses Taught: Machine Learning, Mathematics for the Information Age

Publications

Specialization-generalization transition in in-context learning of linear functions

Chase Goddard, Lindsay M. Smith, Vudtiwat Ngampruetikorn, David J. Schwab

Published in the SciForDL workshop at NeurIPS 2024.

Model Recycling: Model component reuse to promote in-context learning

Lindsay M. Smith, **Chase Goddard**, Vudtiwat Ngampruetikorn, David J. Schwab

Published in the SciForDL workshop at NeurIPS 2024.

Optimization and variability can coexist

Marianne Bauer, William Bialek, **Chase Goddard**, Caroline M. Holmes, Kamesh Krishnamurthy, Stephanie E. Palmer, Rich Pang, David J. Schwab, and Lee Susman

In preparation, draft available upon request.

Testing for the continuous spectrum of x rays predicted to accompany the photoejection of an atomic inner-shell electron

Philip Jacobson, Andrija Rasovic, Arthur Campello, **Chase Goddard**, Matthew Dykes, Yuchao Chen, J. Y. Peter Ko, Stanislav Stoupin, Gwen Gardner, Justin Oh, and Carl Franck

Published in Physical Review A, Oct 2021.

Talks

Towards measuring generalization performance of deep neural networks via the Fisher information matrix

Chase Goddard, Kamesh Krishnamurthy, David J. Schwab

APS March Meeting 2024

The Evolution of the Fisher Information Matrix During Deep Neural Network Training

Chase Goddard, David J. Schwab

APS March Meeting 2023

Experience

Princeton University Physics Department — **Princeton, NJ**
Graduate Researcher — *Sept 2019 – Current*
Performed research on generalization in machine learning. In particular, worked on methods to efficiently but exactly compute the Fisher information for models with large numbers of parameters, on limited datasets. Devised and tested a generalization measure that compares eigendirections of the Fisher computed on the training set to those computed on the test set. In a separate project, we discovered a phase transition in the generalization performance of a transformer trained to do in-context learning on regression problems.

Cornell University Computer Science Department **Ithaca, NY**
Teaching Assistant *Jan 2019 – May 2019*
Teaching assistant for Prof. John Hopcroft on CS 4850, an upper undergraduate level course on the mathematical methods underpinning data science. The course covers a wide array of topics, including probability in high-dimensional space, random walks, Markov chains, ML theory (VC dimension and generalization bounds), streaming algorithms for big data, spectral clustering, non-negative matrix factorization, and phase transitions in random graphs.

Cornell Laboratory for Elementary and Particle Physics **Ithaca, NY**
Research Assistant *August 2017 – May 2019*
Worked with Professor Julia Thom on the Compact Muon Solenoid (CMS) detector at the Large Hadron Collider. Wrote finite-element analysis software to simulate heat transfer from two-phase carbon dioxide flow in a cooling system for the CMS forward pixel detector, integrating MATLAB and ANSYS code. The code will be used to model cooling systems for the HL-LHC upgrade.

Cornell University Computer Science Department **Ithaca, NY**
Teaching Assistant *August 2018 – Dec 2018*
Teaching assistant for Prof. Kilian Weinberger on CS 4780/5780, an upper undergraduate/master's level course on machine learning. The course focuses on supervised learning theory and applications, covering common algorithms (neural networks, SVMs, etc.) and using these algorithms to learn from real-world data. Hold weekly office hours, write and edit problem sets for the course, and grade exams, projects, and assignments.

CERN – Compact Muon Solenoid Experiment **Geneva, Switzerland**
Research Assistant *June 2018 – July 2018*
Summer research assistant for the CMS experiment with the Cornell group. Built a continuous integration framework for physics analysis projects and developed specific tools for a project which aims to study the physics of the top quark and the Higgs boson. These tools compile and test new additions to the software, and generate key plots and histograms to help debug the software and speed development.

Cornell Laboratory for Atomic and Solid State Physics **Ithaca, NY**
Research Assistant *August 2016 – December 2017*
Worked with Professor Carl Franck on new techniques for X-ray spectroscopy. Developed data analysis library for coincidence experiments using Python and MATLAB and analyzed data from experiments performed at the Cornell High Energy Synchrotron Source (CHESS). Designed and built an experiment to test a new technique for spectroscopy of strongly correlated condensed matter systems. The scheme allows for soft X-ray detection in a hard X-ray environment.

Boston Consulting Group – Bruce Henderson Institute **New York, NY**
Data Science Intern *May 2016 – August 2016*
Worked with PhD researchers in an internal think tank to build a database of financial and other data. Performed analyses on this data for publication in Fortune Magazine's "Fortune Future 50", a new ranking developed with BCG which identifies companies with high potential for growth. Wrote R scripts to interface with internet data repositories and automatically update the database each year.

Honors

Erik Cassel '90 Prize
May 2019
"Awarded to an undergraduate physics major who has demonstrated exceptional creativity and promise in applying computer programming to a project in physics or related fields."

Silver Medal, University Physics Competition
November 2018
Won for a paper on finding optimal solar sail trajectories to Mars (with Michael Terilli, Chetan Velivela).

Bronze Medal, University Physics Competition
November 2017
Won for a paper on the benefits and drawbacks of storing nuclear waste in space (with Michael Terilli, Chetan Velivela).