Sam Schwartz

Ph.D. Student

CV Last Updated April, 2019

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Education

Starting Fall 2019 — **Ph.D. Student in Computer Science**, *University of Oregon*, Eugene, Oregon.
Advisor: Hank Childs, Ph.D.

Expected Graduation in May 2019 — **Master of Science in Mathematics**, *Utah State University*, Logan, Utah.
Research focus in machine learning techniques for non-numerical training sets.
Advisor: David E. Brown, Ph.D.

Graduated Dec. 2016 — **Bachelor of Science in Computer Science**, *Utah State University*, Cum Laude.
Five-time "Dean's List" recipient. Departmental honors student.

Graduated Dec. 2016 — **Bachelor of Science in Mathematics**, *Utah State University*, Cum Laude.
Minors in Spanish and Organizational Communication.

Completed Aug. 2014 — **Study Abroad**, *Pontificia Universidad Católica de Valparaíso*, Valparaíso, Chile.
Study abroad semester with a focus on Latin American history and Chilean politics.
Conversationally proficient in Spanish due to the immersion experience.

Graduated May 2013 — **High School Diploma**, *Cottonwood High School*, Murray, Utah.
Sterling Scholar in Computer Technology, state runner up.

Experience

Academic & Pedagogical

Aug. 2017–Present — **Graduate Student Instructor**, *Utah State University*, Logan, Utah.
In this role, my responsibilities include researching the mathematics of machine learning techniques and teaching undergraduate mathematics classes.
I have been assigned as the instructor of record, recitation leader, or graduate teaching assistant for the following courses, ordered by course number:

- MATH 0995 - College Mathematics Preparation . . . . . Summer 2018
- MATH 1051 - Classical Algebra for Teachers . . . . . Spring 2018
- MATH 1060 - Trigonometry . . . . . Fall 2018, Spring 2019
- MATH 1100 - Calculus Techniques* . . . . . Fall 2017
- MATH 2270 - Linear Algebra* . . . . . Spring 2019
- MATH 3310 - Discrete Mathematics* . . . . . Fall 2018
- STAT 6910 - Neural Networks† . . . . . Spring 2019

* Recitation Leader, † Graduate Teaching Assistant

Mar. 2017 – Jul. 2017 **English & Technology Instructor**, *Chilean Ministry of Education*, Chillán, Chile.
One of the highlights of my professional and personal life was the opportunity I had to teach English as a second language for an academic semester in a Chilean high school. This volunteer experience was paid for via sponsorship from the Government of Chile and the United Nations. In this capacity, I also ran an extracurricular club called the *Technical English Club* to facilitate learning English based programming languages for students whose primary language was Spanish. I also facilitated, with sponsorship from Microsoft, Telefónica, and the Government of Chile, a two-week robotics summer camp.

Industry

May 2016 – Aug. 2016 **Software Development Summer Intern**, *Amazon.com*, Seattle, Washington.
As a summer intern at Amazon, my responsibilities revolved around creating automated data cleansing software to integrate legacy marketing information into newer systems. This was done by creating an in-house dashboard to minimize manual data manipulation and cleaning.

Oct. 2013 – May 2016 **Software Development & IT Consultant**, *Small Business Administration - SBDC*, Logan, Utah.
The Small Business Development Center (SBDC) program of the Small Business Administration works with start-ups across the nation to cultivate ingenuity, secure bank loans, develop marketing strategies, and provide information about community resources.

My responsibilities included consulting with entrepreneurs about the latest market trends in technology, developing e-commerce websites, advising business owners on system architecture, and providing support for the variety of IT related concerns new companies have. Projects involved industries as diverse as retail to bio-fuel.

Dec. 2010 – Aug. 2013 **Internal Applications Programmer**, *Worker's Compensation Fund*, Sandy, Utah.
My primary project with WCF was developing security software which allowed the internal audit department to review building, network, claims, underwriting and subsidiary system access levels and history while simultaneously notifying system administrators of change in access requests from managers throughout the company. Other projects included developing internal account lookup and modification tools for their helpdesk.

Languages

English Native
Spanish Conversationally Proficient

Skills

Languages, technologies, and frameworks with which I have worked include:

- Java
- Python
- R
- TensorFlow
- Keras
- Pytorch
- Git
- LaTeX
- Linux
- MySQL
- HTML
- Javascript
- PHP
- C#
- Maple
- LDAP
- Perl
- Sage

Research Publications, Grants, and Presentations

MS Thesis **Machine Learning Techniques Applied to Discrete & Combinatorial Structures**, *Samuel D. Schwartz*, 2019.

Abstract: Machine learning techniques, while well established for many observation types, have only recently come onto the scene for graphs and other combinatorial objects. Further, the use and efficacy of machine learning techniques in predicting computationally difficult invariants on discrete combinatorial objects is next to unknown. This thesis outlines methodologies useful for articulating discrete structures in the paradigm of many machine learning algorithms. Moreover, we examine several NP-hard problems in different articulations. We then report on the results of various techniques and methodologies in solving certain families of these problems.

Conference Presentation **Image Completion Techniques Applied to Matrix Factorization in the Boolean Semiring**, *Samuel D. Schwartz*, 2019, SIAM Wasatch Student Chapters Conference.

Abstract:
Matrix factorization under the reals is a solved problem. Decompositions, such as LU and QR, are taught in foundational Linear Algebra courses. Computationally, the algorithms to find a factorization of a real-valued matrix are polynomial in their time complexity. Once we restrict ourselves to the elements and operations in the Boolean semiring, however, the computational complexity to find any decomposition of a matrix becomes NP Complete. This presentation will discuss ways in which we can articulate the Boolean matrix factorization problem as a partially complete image. We will then show how machine learning techniques, such as random forests and neural networks, can be applied to this representation. In the processes of doing so, we will motivate how we can find polynomial time decompositions in the amortized case.

Invited Talk **Software Development in Production Environments for Researchers**, *Samuel D. Schwartz*, 2019, Data Analytics Club; Hosted for and by PhD Candidates, Utah State University.

Abstract:
Much of what we do as advanced undergraduates and graduate students in STEM revolves around writing programs to solve acute research problems.
Once the research problem is ameliorated by our code-fu skills, however, we are still left with the non-trivial task of publishing our software for use by others. This presentation discusses generalized practices for researchers which can facilitate this process.

Preprint **Modified Kernel Principal Component Analysis Results on NP-Class Problems in Digraphs**, *Samuel D. Schwartz and David E. Brown*, 2018.

Abstract:
Kernel methods, while well established for many observation types, have only recently come onto the scene for digraphs, and their use in predicting computationally difficult graph invariants is next to unknown. This paper outlines an algorithm which utilizes a modified kernel principal component analysis using a Ye-Wilson-Hancock kernel to generate contrived graph predictors. Those predictors are, by design, in a space which can then be readily analyzed and partitioned using traditional supervised learning approaches such as k-Nearest Neighbors or Support Vector Machines. Two NP-class problems are considered, with remarkably good prediction resulting.

Conference Presentation

How to Type Math: [Teaching] LaTeX , *Samuel D. Schwartz and Kaitlin S. Murphy*, 2018, Together we Teach (TweT).

Abstract:

In the modern era, typewritten work is the norm in every discipline and mathematics and statistics are no exception. Nevertheless, many undergraduate institutions provide little to no training to their students on how to typeset mathematical documents. Indeed, many instructors gladly accept handwritten work even in upper-level division mathematics courses. Contrasted with many upper division humanities classes, where a handwritten essay would likely be rejected upon receipt, mathematics and statistics departments nationwide do a poor job in preparing their students for the reality that both academia and industry expect professional mathematics to be typed. Given that a non-negligible number of incoming graduate students have no experience in using the most common framework used to typeset mathematical expressions, we present a ready-made workshop framework which will ameliorate the initially steep learning curve of LaTeX.

Grant, US$1,000

Analysis of Statistical Components of Tournaments Modeling Patterns in Voting and Social Choice Theory., *Samuel D. Schwartz*, 2015, College of Science Undergraduate Minigrant Program, Utah State University.

Service

Judge; Oral Defenses and Poster Presentations in STEM Fields., *2019*, Undergraduate Research Symposium., Utah State University.

Instructor; Pro Bono Six Day Python Bootcamp for Graduate Students., *2019*, Dept. Mathematics and Statistics, Utah State University.