

# RICHARD LANAS PHILLIPS

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## EDUCATION

### Cornell University, Ithaca NY

*Began Fall 2019*

Ph.D. Student in Computer Science

Dean's Fellow, Center for the Study of Inequality Affiliate

#### Relevant Graduate Coursework

Advanced Machine Learning Systems

Algorithmic Game Theory

Data-Driven Optimization

Seminar on Information Networks

(Theoretical) Foundations of Modern ML

Social Inequality: Contemporary Theories, Debates, and Models

Machine Learning - University of Pennsylvania

### Haverford College, Haverford PA

*Awarded May 2018*

B.S. in Computer Science with High Honors

Thesis: *Explaining Neural Network Predictions with Image Certainty Translation*

Advised by Sorelle A. Friedler

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## EXPERIENCE

### ICES Principal Investigator: Cluster Based Approaches for Population Segmentation

May 2021 -

*Cornell University and the University of Toronto*

I'm collaborating with Madeleine Udell and Laura C. Rosella to develop machine learning segmentation approaches for multi-scale data collected from all Ontarians over time. By rigorously testing existing and new analytic approaches to segmentation and studying the impact in a decision-making organization, there becomes an opportunity to better use population level data to inform health system planning and management. This project combines individual-scale health data from billing services, prescription information, survey responses, immigration and other demographic information, lab results, and more from over 15 million people.

### Algorithmic Fairness Group, Research Assistant & Graduate Consultant

November 2015 - May 2019

*Haverford College*

I collaborated with Sorelle A. Friedler and advised her and her co-authors Carlos Scheidegger & Suresh Venkatasubramanian on various fairness and interpretability-related projects. I worked on my own projects in a tight network of experts in a fast-paced, academic setting.

- Developed a theoretical framework for understanding why individual active learning recommendations are made
- Assisted in developing a measure for bias in model confidence based in the legal precedent of disparate impact
- Developed unsupervised strategy for characterizing trends in uncertainty for any dataset
- Developed an algorithm using adversarial modeling, such as in GANs, to transform images to help domain experts understand classifier predictions

### Dark Reactions Project, Research Assistant

April 2015 - May 2018

*Haverford College*

On a team, I gathered data on a set of reactions that had previously gone unpublished as they failed to produce a desirable product. Our goal was to leverage this data to accelerate new materials discovery. For my coding contributions, see the [Dark Reactions Github](#).

- Built initial recommendation pipeline that facilitated numerous exploratory syntheses and exploited model predictions to recommend diverse syntheses that were likely to succeed
- Researched and published a solution for estimating long term organic battery material stability
- Designing and implementing active learning strategies to select samples to run for computationally intensive density functional theory and Hartree-Fock calculations
- Made an active learning pipeline for recommendations of reaction syntheses to perform to better understand organically templated crystal formation. Implemented in Django and uses the RDKit

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## PEER REVIEWED PUBLICATIONS

### “One for One, or All for All: Equilibria and Optimality of Collaboration in Federated Learning”

Blum, A. T., Haghtalab, N., *Phillips, R. L.*,\* Shao, H.\*

\* Indicates shared first authorship

*The Thirty-eighth International Conference on Machine Learning* (21% Acceptance Rate)

### “WILDS: A Benchmark of in-the-Wild Distribution Shifts”

Koh, P. W., Sagawa, S., Marklund, H., Xie, S. M., Zhang, M., Balsubramani, A., Hu, W., Yasunaga, M., Phillips, R. L., Beery, S., Leskovec, J., Kundaje, A., Pierson, E., Levine, S., Finn, C., Liang, P.

*The Thirty-eighth International Conference on Machine Learning* [Project Home](#) (3% Selected for Long Talk)

### “Disentangling Influence: Using Disentangled Representations to Audit Model Predictions”

Marx, C. T., Phillips, R. L., Friedler, S. A., Scheidegger, C., Venkatasubramanian, S.

*Conference on Neural Information Processing Systems 2019* [Arxiv Preprint Link](#) (21% Acceptance Rate)

### **“Interpretable Active Learning”**

Phillips, R. L., Hyun Chang, K., Friedler, S. A.

*Conference on Fairness, Accountability, and Transparency (FAT\*) 2018* [PMLR Link](#) (24% Acceptance Rate)

### **“Interpretable Active Learning”**

Phillips, R. L., Hyun Chang, K., Friedler, S. A.

*Workshop on Human Interpretability at ICML 2017* [Arxiv Link](#)

### **“Bio-Inspired Electroactive Organic Molecules for Aqueous Redox Flow Batteries. 1. Thiophenoquinones”**

Pineda, S., Martin-Noble, G., Phillips, R. L., Schrier, J.

*J. Phys. Chem. C*, 2015, 119 (38), pp 21800–21809 [ACS Link](#)

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## INVITED AND CONTRIBUTED TALKS

### **“Interpretable Active Learning”**

*Conference on Fairness, Accountability, and Transparency (FAT\*) 2018* New York, USA February 23, 2018 [Youtube](#)

### **“Interpretable Active Learning”**

*Workshop on Human Interpretability at ICML 2017* Sydney, Australia August 10, 2017 [Workshop Site](#)

### **“Active Learning Recommendations for Exploratory Synthesis”**

*Undergraduate Science Symposium 2016* Haverford, PA September 24, 2016

### **“Precise Organic Molecule Geometric Descriptors”**

*Rutgers-Bryn Mawr Undergraduate Research Workshop on Computational Geometry 2016* Camden, NJ July 25, 2016

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## POSTER PRESENTATIONS

### **“Applying Interpretability Methods for Accountable Data Pipelines”**

Phillips, R. L.

*CCC Early Career Researcher Symposium 2018* [Workshop Link](#)

### **“Locally Interpretable Models to Generate Annotated Active Learning Recommendations”**

Phillips, R. L., Hyun Chang, K., Friedler, S. A.

*New England Machine Learning Day 2017* [Workshop Link](#)

### **“Computational Screening for High Performance Aqueous Redox Flow Battery Materials”**

Phillips, R. L., Schrier, J.

*14th Annual MERCURY Conf. for Undergrad. Comp. Chem* 2015 [Abstract Link](#)

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## HONORS AND AWARDS

### **Dean’s Excellence Fellowship**

Competitive fellowship covering stipend, tuition, and fees for a handful of first-year Cornell Ph.D. students from backgrounds underrepresented in doctoral programs.

### **Computing Research Association’s (CRA) Outstanding Undergraduate Researcher Award**

Recognizes North American undergraduates who show ‘outstanding potential’ in an area of computing research. Excellence in research is the primary consideration. Awarded to one student from a liberal arts college and four in total.

### **Arnold and Mabel Beckman Foundation Beckman Scholar**

Funds roughly 12 outstanding undergraduate research institutions to pass on full financial support for 15 months to a select number of students. This includes a stipend, scholarship and funding for conference travel and research materials. In 2016 there were 58 Beckman Scholars nationally and 2 from Haverford College.

### **John P. Chesick Scholar**

Fellowship awarded yearly to 15 exceptional students at Haverford College from underrepresented or under-resourced backgrounds.

### **President and Provost’s Discretionary Funding for Investigative Research in Cuba**

Proposed a research project in Cuba based on coursework completed at Swarthmore College. Received funding with one other Haverford student to travel to Cuba for two weeks to further the investigative research with surveys, interviews, and meetings with local scholars with the goal of publishing peer-reviewed research on the topic.

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## SERVICE

### **Organizer, Bias and Discrimination Working Group, (Fall 2021-)**

An MD4SG Research Group.

### **Multicultural Academic Council Mentoring Program**

**Cornell CS PhD Admissions** Including additional early reading and feedback for students of underrepresented backgrounds in CS.

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## LANGUAGES AND LIBRARIES

Python, MySQL, R, Matlab, LaTeX, Mathematica, HTML, C++, Pandas, Unix-Like Scripting, Bash scripting, scikit-learn, NetworkX, Django, NumPy, OpenCV, SciPy, Keras, Tensorflow, RDKit

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## PROJECTS

### **Beckman Journal Club Co-Founder and President (2016-2018), Haverford College**

Co-founder and president of the Beckman Journal Club at Haverford. The club is a monthly meeting of the Beckman Scholars from each year along with their primary investigators and invited faculty. Students present recent notable publications in their respective fields to the highly interdisciplinary group. They field questions and guide a discussion on impact and applications.

### **Delta Bond Length Tool**

A tool created to track changes in the lengths of common bonds across a family of reactions, as an approximate quantitative measure of long term stability for reversible reactions or to create a machine learning data set. Involves searching for subgraph isomorphism over chemical graphs and makes use of NetworkX and Numpy. [Github Link](#)

### **Neural Network for Molecular Geometry Optimization Project**

Paper for Swarthmore Adaptive Robotics course “Generating Near-Optimized Molecular Geometries Across Reactions using Neural Networks & Back Propagation.” Took molecular geometry coordinates optimized with computationally expensive density functional theory calculations and developed a model to provide comparable quality optimization of molecules in a held out test set. Involved experimenting with different translations from low-level coordinates to higher level feature sets to train a machine learning model on a structured problem with limited data. [Paper Link](#)

### **University of Pennsylvania CIS 520 Sentiment Analysis Project**

Classified selected tweets with attached images as either positive or negative. Implemented bag of words models with SVMs, neural networks, k-nearest neighbors models, and k-means. Used transfer learning to train a convolutional neural network to identify patterns between image features and tweet sentiment.

### **Open-Source Implementation of “Generating Focussed Molecule Libraries for Drug Discovery with Recurrent Neural Networks” in Keras**

Implemented model outlined by Segler et al. to generate novel molecules with a LSTM RNN. [Github Link](#)

### **KINSC Student Advisory Board (2017-2018)**

One of five students that directly made recommendations to the natural sciences steering committee at Haverford College.