DEREK HART

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TECHNICAL EXPERIENCE

– Used Python and Bash to acquire, aggregate, analyze, and visualize data from molecular dynamics simulations performed on a remote high-performance cluster

– Constructed regression and neural network models with Scikit-learn and Keras to predict outcomes for imbalanced or sparse datasets

– Developed a microscope interface and data collection platform using C++ for an experimental biophysics project

– Created a MATLAB toolbox using both image and signal processing methods to interpret experimental data

– Long-term experience communicating technical results to a variety of audiences via oral presentations and written publications.

EDUCATION

Georgia Institute of Technology, *Atlanta GA*

– Ph.D. in Physics, Minor in Advanced Optics	Expected Sep 2022
– M.S. in Physics, GPA: 3.70/4.00	2018
– Award: Georgia Tech Institute Fellowship	

Colorado School of Mines, *Golden CO*

– B.S. in Engineering Physics, GPA: 3.87/4.00	2016
– Award: Physics Faculty Distinguished Graduate	

SKILLS

Programming:	Python (Scikit-Learn, Keras, Seaborn, Matplotlib, Pandas), C++, Bash, R, SQL, LaTeX, Javascript, Octave
Software:	MATLAB, oxDNA, Linux, Adobe Suite, Visual Studio, RStudio, Microsoft Office suite

WORK EXPERIENCE

Data Scientist *(self-employed)* — 2022

Scikit-Learn Project: Predicting house prices

- Estimated house prices with high accuracy using Decision Tree Regressor and XGBoost models
- Performed exploratory feature analysis and visualization to choose estimator input variables
- Developed a simple sklearn pipeline to impute and encode categorical input features with missing values

Keras Project: Predicting diabetes risk

- Predicted diabetes risk with a simple neural network using Keras' Sequential model
- Rebalanced dataset with random oversampling
- Ranked diabetes risk factors using permutation importance

Graduate Research Assistant — 2017 - Present
Kim Lab, School of Physics, Georgia Institute of Technology, *Atlanta GA*
Computational project: Coarse-grained DNA modeling

– Constructed, organized, and performed oxDNA simulations using Bash in a high-performance computing environment
– Used Python tools such as Pandas and Seaborn to collect, aggregate, analyze, and plot large datasets
– Implemented a forward flux sampling to efficiently capture rare biological events on computationally feasible timescales

Experimental project: Single-molecule DNA biophysics

- Coded software in C++ to interact with scientific camera and other optical instruments via a user-friendly interface
- Created a collection of MATLAB scripts to process raw video data as well as analyze FRET trace data
- Designed and implemented a unique single-molecule DNA assay using molecular biology techniques
- Custom built a total internal reflection microscope

Graduate Teaching Assistant   2016 - 2019
School of Physics, Georgia Institute of Technology, *Atlanta GA*

- Developed students' problem solving and programming skills in group and individual settings
- Evaluated exams and study materials with instructors to improve course outcomes

Private Tutor   2013 - 2016
CollegeDrive Test Prep and Tutoring, *Denver CO*

- Interacted one-on-one with hundreds of high school students from all backgrounds for ACT, SAT & AP exams
- Designed custom lesson plans for each client to fit their goals and time-constraints
- Mediated difficult parent-student relationships, matching their expectations for better results

Research Fellowship   June 2015 - July 2015
National Institute of Standards and Technology, *Gaithersburg MD*

- Calibrated advanced mass sensor instruments used in ongoing work at a leading research organization during an 8-week summer program
- Independently learned to operate and extract data from a laser Doppler vibrometer
- Interpreted, visualized and presented critical results to a technical audience via oral presentation

Laboratory Internship   May 2014 - July 2014
Los Alamos National Laboratory, *Los Alamos NM*

- Explored using nuclear magnetic resonance methods to measure the water content in drought-stricken aspens in a 10-week summer program.
- Presented novel methods and results in both a written report and poster presentation

PUBLICATIONS

Hart, D.J., Jeong, J., Gumbart, J.C., and Kim, H.D. (2022) Weak tension accelerates hybridization and dehybridization of short oligonucleotides. *bioRxiv* [in peer review]

ORAL PRESENTATIONS

Annual Meeting of the International Physics of Living Systems Network
University of Montpellier, *Montpellier, France*

- Weak tension accelerates hybridization and dehybridization of short oligonucleotides   2022

Physics of Living System Seminar
Georgia Institute of Technology, *Atlanta GA*

- Kinetics of DNA melting and hybridization under small tension   2021
- How do DNA bending and twisting affect CRISPR-Cas12 binding and cleavage?   2019
- Tracking Polymer Tangles   2018

Annual Meeting of the American Physical Society
Virtual conference

- Nucleic acid melting under small tension   2021