Derek Hart, PhD

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RELEVANT EXPERIENCE

Georgia Institute of Technology, Harold Kim Lab **Jan. 2017 – Sep. 2022**
Graduate Research Assistant *Atlanta, GA*

- Computational: DNA Modeling & Simulation
  - Used advanced statistical sampling methods along with high-performance computing resources to efficiently observe rare DNA reactions.
  - Extracted, analyzed, and visualized statistical observables from very large simulation files using Python data science libraries
  - Simulations were organized and run in parallel with Bash scripting in a Linux-based environment
- Experimental: Single-molecule fluorescence resonance energy transfer (smFRET) microscopy
  - Built image and signal processing toolbox to convert microscopy videos into 1D FRET traces
  - Implemented Hidden Markov statistical models to estimate reaction rates from noisy temporal data
  - Developed C++ code to interact with scientific camera and a variety of optical instruments
  - Created a novel DNA-based fluorescent dye assay using standard molecular biology protocols
- Delivered results in journal manuscript (in peer review), by invitation at a conference in Montpellier France, and in my recent thesis defense

Georgia Institute of Technology, Physics Department **Aug. 2016 – Aug. 2019**
Graduate Teaching Assistant *Atlanta, GA*

- Evaluated exams, labs, and homework with course instructors weekly to improve student outcomes
- Mentored students during laboratory sections and office hours

NOTABLE PROJECTS

- Predicting diabetes risk with imbalanced data using a simple neural network (link)
- Estimating house prices from a mixed-type dataset with random forest and XGBoost models (link)
- Building a genotype-to-phenotype model with a “fat” wheat breeding line dataset using support vector regression (link)

EDUCATION

Georgia Institute of Technology **Sep. 2022**
PhD, Physics *Atlanta, GA*

- 3.7/4.0 GPA; Georgia Tech Institute Fellowship

Colorado School of Mines **May 2016**
BS, Engineering Physics *Golden, CO*

- 3.9/4.0 GPA; Physics Faculty Distinguished Graduate
- Selected to participate in summer undergraduate research programs at the Los Alamos National Laboratory and the National Institute of Standards and Technology

SKILLS & INTERESTS

- **Languages**: Python, MATLAB, Bash, LaTeX, C++, R, SQL
- **Data Science:** Pandas, Scikit-learn, Matplotlib, Seaborn, neural networks, decision trees, support vector machines, Matplotlib, data preprocessing, hyperparameter tuning
- **Computational**: Molecular Dynamics & Monte Carlo simulations, forward-flux sampling, umbrella sampling, oxDNA, Hidden Markov Modeling, Linear Regression
- **Molecular Biology**: PCR, gel electrophoresis, DNA purification & quantification, plasmid cloning
- **Interests:** Cooking, Reading, Japanese, Piano