Derek Hart, PhD

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RELEVANT EXPERIENCE

ASRT, Inc. (Contractor for the CDC Viral Vaccine Preventable Diseases Branch) **Dec. 2023 – Present**
Data Manager, Bioinformatician *Atlanta, GA*

- Developed reproducible genome assembly and phylogenetics pipelines with Snakemake and Nextflow
  - Features: metadata validation, singularity containerization, quality control reports, and HPC deployment
- Built interactive phylogenetic trees and map plots to assess epidemiological data with Rshiny and Javascript
- Managed and analyzed whole genome sequencing and metagenomics data from clinical samples, collected with Illumina and Oxford Nanopore instruments
- Regularly presented technical bioinformatics methods & results to epidemiologists and microbiologists

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

- Computational: DNA Modeling & Simulation
  - Used advanced statistical sampling methods to efficiently observe rare DNA reactions during molecular dynamics simulations
  - Analyzed & visualized statistical observables with Python data science tools (e.g. Pandas, Seaborn)
  - Deployed simulations as parallel array jobs in an HPC environment
- Experimental: Single-molecule fluorescence resonance energy transfer (smFRET) microscopy
  - Designed and synthesized a novel DNA-based FRET assay
  - Built image and signal processing MATLAB 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
- Delivered results in journal manuscript (accepted), 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 one-on-one during laboratory sections and office hours

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
- Participated in undergraduate research programs at Los Alamos National Laboratory and the National Institute of Standards and Technology

SKILLS & INTERESTS

- **Languages**: Python, Bash, MATLAB, LaTeX, Groovy, R, R Shiny, Javascript, C++, SQL
- **Bioinformatics**: Snakemake, Nextflow, Linux, BLAST, D3, Docker, MultiQC, Highcharts
- **Data Science:** Pandas, Scikit-learn, Matplotlib, Seaborn, machine learning (data preprocessing, hyperparameter tuning, visualization)
- **Computational**: Molecular Dynamics & Monte Carlo simulations, forward-flux sampling, umbrella sampling, oxDNA, Hidden Markov Modeling
- **Molecular Biology**: PCR, gel electrophoresis, DNA purification & quantification, plasmid cloning
- **Interests:** Bouldering, Cooking, Reading, Japanese, Piano

OTHER 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)