Luke Trujillo

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Education

Harvey Mudd College Graduated: December 2020
Bachelors of Science in Mathematics *Claremont, CA*
Major GPA: 3.68
Math Courses: Graduate Analysis, Topology, Galois Theory, Differential Geometry, PDEs, Probability
CS Courses: Intro. to CS (Python), Principles of CS (Python/Java), Discrete Differential Geometry (Javascript)

Technical Skills

Languages: Python, C, C++, Javascript, MySQL, HTML/CSS, Zsh, TEX/LATEX
Operating Systems: Red Hat Enterprise, Kali Linux, Mac OS
Developer Tools: Git, Vim, Tmux, Oh-My-Zsh, Black (Python), PyCharm, CLion, Visual Studio Code

Work Experience

Manifold Technologies January 2021 – Present
Software Engineer *Remote (COVID-19)*

- Duties include system designing, testing, documenting, and development of Python-based high frequency quantitative trading software and complex data pipelines.
- Additionally perform backend and API development (Django, React), database management (MySQL), and server management (Red Hat Enterprise).
- Development is done via SSH protocols on Red Hat Linux machines with Git and Github for version control.
- Primarily use computational and low level Python libraries including NumPy and Multiprocessing, and Pytest for unit testing.

Research Experience

Georgia Institute of Technology May 2020 – July 2020
Undergraduate Researcher *Remote (COVID-19)*

- Studied algebra, topology, operad theory and monoidal category theory to extend Joyal and Street's work for braided monoidal categories, and to generalize quasitriangular Hopf algebras to singular cases
- Used Python to implement categorical and linear algebra calculations to find a singular knot invariant.

Mathematical Sciences Research Institute June 2018 – July 2018
Undergraduate Researcher *Berkeley, CA*

- Studied novel algorithms of persistence homology, an area of applied topology, to characterize intrinsic geometry of raw time series data, and classification and clustering techniques of machine learning.
- Utilized GUDHI, NumPy, Pandas, and TensorFlow Python packages to implement a ECG time series preprocessing and classification pipeline.
- Classification accuracy via topological features compared to and exceeded research projects from 2017 PhysioNet Computations in Cardiology Challenge. Work resulted in a published machine learning paper.

Teaching/Tutoring Experience

Casa de Amistad September 2021 – Present, October 2015 – May 2016
Volunteer Tutor and Mentor *Solana Beach, CA*

- Currently tutor and mentor high school students through a program that connects volunteers with Solana Beach students, many of which are first generation students like myself.

Harvey Mudd College May – June 2019, May – June 2018
Summer Math Tutor and Grader *Claremont, CA*

- Graded and tutored for Harvey Mudd's intensive 3 week Summer Math undergrad program for two years in a row. Topics included advanced linear algebra, multivariate calculus, and differential equations.

Ivy Focus Education August 2016 – May 2019
Mathematics, Physics, English Tutor *Claremont, CA*

- Tutored international South Korean students aiming for higher education in the United States.

Claremont Tutors August 2016 – May 2017
Mathematics, Physics, English Tutor *Claremont, CA*

- Tutored for a program connecting local Claremont high school students with Claremont College students.

Uncommon Good Tutoring September 2017 – May 2018
Volunteer STEM Tutor for middle school students *Claremont, CA*

- Volunteered with Harvey Mudd's tutoring program that hosts middle school students on campus and provides them homework help.

Free Tutoring August 2015 – June 2016
Independent Free Tutor for Low-income San Diegans. *San Diego County*

- While in high school, I posted Craigslist ads advertising free academic tutoring for low-income students. I covered my own expenses from a minumim wage job I had.
- In cafes and libraries I tutored middle and high schoolers, college students, adult students, nursing students, and Mexican immigrants trying to work on their English grammar.

Projects

TikzPy March 2021 – Present

- I created and maintain a Python package with documentation for Ti*k*z graphics code generation because using Ti*k*z is very slow and tedious. This allows one to efficiently design and create complicated, high quality mathematical drawings.

DES Encryption Algorithm September 2021

- Implemented the DES encryption algorithm in Python via Bruce Schneider's *Applied Cryptography*. Created a blog post detailing the algorithm procedures and the corresponding Python code.

Hobby Curve Drawing Algorithm September 2021

- Created separate Python, Javascript, and C++ implementations of John Hobby's curve drawing algorithm.

Category Theory for Pure Mathematics: With Examples and Exercises. August 2019 – March 2021

- Wrote an advanced mathematics textbook on Category Theory (413 pages) while an undergraduate.

TikZ Drawer for LaTeX. December 2020 – February 2021

- Created an interactive web application using `d3.js` to make a drawing tool that generates Ti*k*z graphics code.

Interactive 3D Associahedra Viewer. October 2020 – November 2020

- Used `three.js` libraries and Python to create a 3D interactive web app of the first 10 Associahedron polytopes. Published on the Higher Category Theory wiki nLab under the Associahedron page.

Publications

Classification of Single-Lead Electrocardiograms: TDA Informed Machine Learning. Paul Samuel Ignacio, David Uminsky, Christopher Dunstan, Esteban Escobar, Luke Trujillo. 18th IEEE International Conference On Machine Learning And Applications.

Conferences Attended

3rd Conference on Operad Theory and Related Topics September 18, 2020
Online (COVID-19)

Applied Category Theory Session, AMS Western Sectional Meeting November 9 – 10, 2019
University of California, Riverside

Joint Mathematics Meetings January 16 – 19, 2019
Baltimore, MD

SACNAS Conference October 10 – 12, 2018
San Antonio, TX