

EDUCATION

California Institute of Technology || Physics B.S. + Computer Science Minor || Sept. 2016 – Dec. 2021

Computer Science coursework: Algorithms [CS38], Computer Architecture [CS24], Computability & Complexity [CS21] Quantum Computation [Ph/CS219], Quantum Cryptography [Ph/CS120], Functional Programming [CS4]

Other Relevant Coursework: Statistical Physics [Ph127], Computational Physics Lab [Ph20 + 21], Some EE work [Ph5], Economics courses (Intro, Behavioral, Environmental) [Ec11, 140, 108, and BEM/Ec/ESE 119], Discrete Math [MA/CS6], Error Correcting Codes [EE/MA/CS/IDS127], Differential Topology [MA109], Quantum Field Theory [Ph205], Probability and Statistics [MA3], Information and Logic [IST4]

Languages: Python, C++, Java, Latex

Skills: NumPy, SciPy, Pandas (some familiarity), ROOT, x86 Assembly, Linux distros + Unix Bash shell on Windows, shell scripting, LAMMPS, Maestro, MPSim, LabView, basic SQL, Mathematica, Excel, TensorFlow

EXPERIENCE

Topdeck.ai --- AI-powered construction site monitoring Aug 2020 - Jan 2021

Software Engineering Intern/Contract Employee

- developed algorithms for image similarity detection in Python, leveraging TensorFlow ML, Scikit-Learn
- developed and implemented methods to quantify image blur using local phase coherence of the Fourier transform
- worked both independently and as part of a 10-member team

Caltech + John Stauffer Charitable Trust Jan 2019 – Aug 2019

Summer Undergraduate Research Fellow (SURF) w/ Prof. William Goddard

Materials Science, water simulations + Protein Folding

- implemented simulations for protein folding and femtosecond polymer-like behavior in water in C++, Python, quantified + visualized orientation correlation between molecules
- modeled the kinematics of molecules in C++ and contributed to larger codebase (mainly for energy optimization for proper side chain positioning)
- relied heavily on data visualization for interpretation, compared to other group's results

SURF (w/ Prof. Maria Spiropulu) Jun 2018 - Aug 2018

High Energy/ Particle Physics – increasing WZZ coupling signal to background ratio

- performed data analysis on big data sets (terabytes) from particle detectors in C based programming environment + Monte Carlo (MC) generated data
- applied signal processing techniques to detect presence of W and Z bosons in noisy data
- proposed using ML techniques to increase efficacy

Jet Propulsion Laboratory (JPL), Pasadena CA Mar 2018 – Jun 2018

Study and identification of hot Jupiter exoplanets, under the guidance of Dr. Yasuhiro Hasegawa

analysis of astrophysical data in Python and Excel using literature review to guide design of analysis

SURF (w/ Prof. Ryan Patterson) Jun 2017 - Aug 2017

High Energy/ Particle Physics – Neutrino Physics

- tested handles for determining wrong-sign component of anti-neutrino beam using MC simulated and real data + statistical methods (eg. chi-squared analysis to determine efficacy)
 - proposal used by the Hixon Writing Center as example of good scientific/technical writing
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OTHER PROJECTS + RESEARCH

Cohomology of Kontsevich graph complexes and relations to Feynman rules Aug 2021 – present
Algebraic Topology, Graph Theory, QFT

Has ties to graph theory with mathematical applications to quantum theory, currently investigating ways to utilize original paper's insights to compute permutations of Feynman diagrams.

Quantum Cryptography

Conducted a review of papers proposing theoretical quantum blockchain frameworks and P2P verification protocols for a distributive voting protocol (final for quantum cryptography class)

Most interesting part of the main algorithm I discussed was an encryption matrix that allowed for instant tallying of votes only after all were submitted.

Information Processing

Placed 2nd in an IST4 class competition developing the fastest algorithm to determine word edit distance using a dynamic programming approach exploiting several cases of symmetries which I identified in binary strings

MORE EXPERIENCE

Summer of 2015 – Mentorship in Nuclear Physics at Old Dominion University (Norfolk, VA).

- Performed data analysis similar to that in the high energy work above but all work was done in Excel
- Studied + visualized rate of energy loss of a particle passing through various materials both experimentally and analytically

OTHER WORK EXPERIENCE

Caltech Y archivist • archiving images from Caltech's history including writing some short programs solve the matter of sorting through thousands of scanned and annotated images (2021)

Sherman Fairchild Library Circulation Desk (2016-2018)

Part time private high school math and science tutoring (Spring 2018 and present)

LEADERSHIP AND OUTREACH

Mu Alpha Theta (HS math honor society) president (2015-2016) – most enjoyed planning a math fun day for elementary school students

Physics Club founder (HS) (2015-2016)