John Mastroberti

Resumé

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Education

2016–2019 **B.A., Cornell University**, *College of Arts and Sciences*, Ithaca, NY, *GPA: 3.932*.
Majors: Physics (Magna Cum Laude), Math (Cum Laude)

2020–2021 **M.S., Indiana University**, *Department of Physics*, Bloomington, IN, *GPA: 4.0*.

2021–present **Ph.D. student, Indiana University**, *Department of Physics*, Bloomington, IN.
Concentration: experimental neutrino physics

Work Experience

Software Development

2020–present **Neutrino Detector Simulation**, *Rex Tayloe, Dan Salvat*, Center for Exploration of Energy and Matter, Bloomington, IN.

Key technologies: C++, Make, Git, Geant4, ROOT

In my current position, I work on the development of my research group's simulation software. Our detectors measure the elastic neutrino-argon scattering cross section as part of the COHERENT collaboration. The simulation software I work on is written in C++ and makes use of Geant4, a semi-modern C++ library commonly used for particle physics simulations. We also make use of the C++ library ROOT for data serialization and analysis. This program is used by several researchers in the collaboration, and Git is used for version control. Simulation runs are primarily performed on computing clusters to take advantage of parallel execution.

I am primarily responsible for maintaining, modernizing, and adding new features to our simulation program. One of the large projects I have worked on was to modernize how the detector geometry is specified. I added support for GDML geometry specification, where an XML-like file containing the detector geometry is loaded at run-time. Previously, this information was hard-coded into the simulation executable and any changes to the detector required recompilation. I am currently working on updating the scintillation physics engine to support xenon doped liquid argon. I am also implementing a regression testing system so that refactoring and modernization projects can be undertaken with greater confidence. This project has given me great experience working on a moderate size code-base that was written by someone other than myself.

2019–2021 **Positron Converter Simulation and Modeling**, *Jim Shanks, David Sagan*, Cornell Lab for Accelerator based Science and Education (CLASSE), Ithaca, NY.

Key technologies: C++, CMake, Subversion, Geant4, GSL

This project focused on developing simulation and modeling software for positron converters. These particle accelerator components are used to produce positrons for use in electron-positron colliders. I wrote this software from scratch using C++17. The simulation component made heavy use of Geant4, and the modeling component used the GNU Scientific Library for data analysis and fitting. I also wrote the user manual for this software, as well as a paper to be published in a peer reviewed journal. This software is packaged as part of the Bmad library of accelerator simulation software, which uses a CMake-based build system and Subversion for version control.

2019–2020 **Tao GUI Development**, *David Sagan*, CLASSE, Ithaca, NY.

Key technologies: Python, Fortran

Tao is Cornell's Tool for Accelerator Optics, a program used around the world for modeling particle accelerators written in Fortran 95. I worked on developing a GUI for Tao using python. We also developed a general purpose scripting interface for the program.

2019–2020 **Conservative Machine Learning**, *Veit Elser*, Ithaca, NY.

Key technologies: C, Machine Learning

My advisor and I explored an alternative machine learning algorithm referred to as conservative learning. Unlike stochastic gradient descent, which is almost universally employed in today's machine learning algorithms, conservative learning aims to take the smallest step size possible when updating the weights of the neural network.

2017 **Potentially Hazardous Asteroid Interception**, *Louis Rubbo*, Conway, SC.

Key technologies: MATLAB

During the summer of 2017, I worked at Coastal Carolina University on this personal project. We analyzed interception techniques that could be employed to reach and deflect potentially hazardous asteroids. Most of this work was done using MATLAB to model orbits and compute interception trajectories.

Side Projects

2018–present **Linux Tinkering**.

Key technologies: Linux, Shell scripting, GNU Core Utilities

I have been using GNU/Linux as my primary operating system since 2018. I am passionate about free software and try to use it in place of proprietary software whenever possible. This hobby has made me very proficient at the command line. I consider my self well versed in shell scripting and basic UNIX-like utilities, and I am very comfortable with Linux system administration tasks. These are skills that add to my strengths as a software developer.

2020–present **Personal Website**.

Key technologies: Javascript, Node.js, HTML/CSS, MySQL, Linux

I run my personal website, `johnmm.xyz`, on a Linux VPS hosted with Vultr. I host a basic HTML and CSS site using NGINX, and have a personal email service running on the server as well. This web-server also hosts a simple web app for chore tracking that I developed using client and server side JavaScript. This service also uses MySQL for database management.

Teaching

2020–2021 **Physics Associate Instructor (TA)**, *Indiana University Bloomington*, Bloomington, IN.

As an associate instructor, I taught weekly discussion and lab sections for IU's general physics courses. I also graded lab reports, quizzes, and exams, proctored exams, and held office hours.

2017–2019 **MATH 1120 Course Assistant**, *Cornell University Math Department*, Ithaca, NY.
As a course assistant, I was responsible for grading the homework from one to two sections of MATH 1120 each week. I also held a study group session each week where students worked together on their homework and asked course assistants for help if necessary.

2015–2016 **Private Tutor**, *Self Employed*, Conway, SC.
While I was high school senior, I worked as a private tutor for several students at Coastal Carolina University. Most of these students were taking introductory physics or calculus, though I did find some work tutoring upper-level physics courses as well. This experience helped me learn a great deal about being an effective tutor and teacher.

Other

2016–2017 **Special Collections Processing Assistant**, *Cornell University Division of Rare and Manuscript Collections*, Ithaca, NY.
My primary role as a processing assistant was to convert existing paper and index card catalogs to Excel spreadsheets. This occasionally required me to examine and label each item in a collection, many of which were from the 19th century or earlier.
During my time as a processing assistant, I also developed a python script for automatically converting between human readable date formats (e.g. November 7, 1950) and machine readable date formats (e.g. 1950-11-07). This allowed date conversion to be done quickly, whereas this task previously needed to be done by hand.

2011–2015 **Professional Musician**, Myrtle Beach, SC.
I worked as a professional musician over the summers throughout middle and high school. My family's band played hundreds of jobs each summer, both at resorts in Myrtle Beach and at private parties and events. I also took private bass guitar lessons and was exposed to a wide variety of music genres.

Computer skills

Programming Languages

- Modern C++
- C
- Python
- MATLAB
- JavaScript
- Shell scripting (bash, POSIX sh)

Markup Languages

- HTML/CSS
- LaTeX

Other Technologies

- Linux
- GDB
- Git
- CMake and Make
- Node.js
- SQL

References

Name	Email	Relationship
Rex Tayloe	rtayloe@indiana.edu	Research Advisor
Dan Salvat	dsalvat@iu.edu	Research Advisor
David Sagan	david.sagan@cornell.edu	Research Advisor
Jim Shanks	shanks@cornell.edu	Research Advisor

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February 27, 2022

Dear Sir or Madam,

I am writing to apply for the Software Engineer position with the Center for the History of Music Theory and Literature. I have several years of experience writing software in C++ and Python and a strong desire to learn new skills, and I feel that I would be a great fit for the position.

As my resumé shows, my degrees are in physics and mathematics. However, I do have several years of experience as a software developer through my involvement with several research teams, and through my personal projects. I feel that this professional experience has given me strong software engineering and related skills that make me a great fit for your open position. In addition, my background in physics and math has given me excellent analytical and problem solving skills. These skills are essential in the software development field, and I believe that my background sets me apart as a unique applicant.

I am most proficient and comfortable writing C++. Most of my professional software development experience has involved writing C++, and I am familiar with a variety of C++ programming styles, both old and new. I also have substantial experience with Python development and some experience with front and back end web development which I feel would be valuable in this role.

In addition to my software engineering experience, I have held other professional roles that make me particularly qualified for this position. My work as a special collections processing assistant at Cornell University is highly relevant to this position, as my primary duties for that role were the digitization and cataloging of rare and manuscript items. I also have a strong music background, as I was a professional musician for several years in middle school and high school. I played hundreds of jobs over the summer in my family's band (which included my brother, a current Jacobs School of Music student).

I hope that you will consider me for your team, and I look forward to hearing from you. Thank you for your time.

Sincerely,

John Mastroberti