Jack Lawrence

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Objectives

Astrophysicist and machine vision engineer looking to outperform the current generation of engineers by applying a physics-based mindset to novel machine learning applications, optical systems, and research.

Skills

Programming:	C/C++, Python, PyTorch, Tensorflow, Qt, Arduino, LaTeX, MATLAB, Mathematica, Teach Pendant
Software:	Autodesk Inventor, OnShape, *mvme*, Microsoft Office, Google Suite, Atlassian Suite, Adobe Photoshop, Connected Components Workbench, waveSharp (RegiStax6)
Experimental:	γ-Ray Spectroscopy, HPGe Detector Upkeep & Maintenance, Solar Telescope Configuration & Maintenance, Background Subtraction and Signal Tuning, Data Acquisition System Development, NIM/VME System Design, Vacuum and Cryo System Design
Other:	Computational Image Processing, Signal Tracing, Supervised and Unsupervised ML Construction, Monte Carlo Simulation, Dead-time Measurement, Electrical Fault Diagnosis and Repair, 3D Design and Printing, PLC Configuration

Experience

Vision Technician **Nov 2023 - Present**

UnitX Labs Santa Clara, CA, USA

- Develop and manage over 19 unique machine vision solutions for customers across manufacturing industries (eg: automotive, medical, semiconductor, etc.)
- Design and build imaging and lighting systems with robotic arm (Fanuc) and PLC integration for automated assembly
- Train neural networks (AI) for defect detection with custom integrated image pre-processing and post-processing scripts
- Create deep clustering algorithms for improved defect detection
- Build custom image preprocessing scripts (ie filtering, sharpening, computational stacking) to optimize inspection
- Conduct HIL tests on custom integrated solutions
- Test lenses, filters, and wavelengths for optimal image capture
- Troubleshooting communication between software, light controllers, and PLCs
- Create CAD of machine visions solutions including custom components for camera and light fixturing and prototype printing

DAQ System Developer - SULI Sponsorship **May 2023 - Sept 2023**

Lawrence Livermore National Laboratory - Nuclear Criticality Safety Division Livermore, CA, USA

- Utilized custom neural networks trained with real and simulated data for accurate dead-time corrections and background subtraction
- Developed DAQ system with reduced dead-time and live data-analysis capabilities
- Configured DAQ software with PLC and irradiated sample transport system for time-synced spectroscopy
- Designed unique experiments with radiation detectors, scintillators and PMTs for DAQ system validation
- Maintained and repaired detectors and vacuum equipment
- Cooled detectors with liquid nitrogen daily to maintain a noise-free signal environment
- Kept detailed notes of all tasks performs to track issues and changes, as well as increase project reproducibility
- Compiled DAQ system development and experiments into a detailed report submitted to the DOE through SULI
- Attended weekly lectures from research groups around the laboratory

Astronomy Instrumentation Engineer - Undergrad Research **Oct 2022 - April 2023**

Morehead Planetarium & Science Center Chapel Hill, NC, USA

- Stationed an H-Alpha telescope on planetarium roof-deck to allow Morehead Planetarium to sponsor stellar research
- Constructed plastic and aluminum telescope enclosure with servo-controlled hood for protection from the environment
- Designed custom circuitry and servo system for remote telescope etalon tuning
- Implemented a Raspberry Pi and virtual desktop to remote control image capture, stacking, and filtering to produce consistently high resolution images of the Sun

DAQ Software Developer - DSTI Sponsorship **May 2022 - Aug 2022**
Lawrence Livermore National Laboratory - Nuclear Criticality Safety Division Livermore, CA, USA

- Developed DAQ system with reduced dead-time and live data-analysis capabilities
- Improved detector readout capability through added spectroscopy windows
- Increased DAQ system flexibility to streamline the unification of multi-detector systems
- Cooled detectors with liquid nitrogen daily to maintain a noise-free signal environment

Bakery Sales and Service Lead **Jan 2022 - May 2022, Aug 2022 - February 2023**
Great Harvest Bread Co. Chapel Hill, NC, USA

- Managed opening, midday, and closing shifts, including daily cleaning, register and tip count, ingredient inventory tracking, to ensure a smooth transition between shifts and optimal hygeine
- Prepared bakery and deli ingredients, mixed recipes, kept regular attention ovens, proofers, refrigerators, and freezers in adherence with health codes to deliver fresh goods
- Baked cafe treats in accordance with company standards to ensure repeatability in the product
- Developed a reliable customer base and ensured a positive, welcoming environment for Great Harvest patrons and team members

DAQ Software Developer - Undergrad Research **Jan 2021 - May 2022**
Triangle Universities Nuclear Laboratory - LENA & The Tandem Laboratory Durham, NC, USA

- Developed open-source DAQ software to improve flexibility and usability for TUNL research projects
- Performed comparative dead-time tests on various DAQ programs and which led to the lab-wide adoption a new DAQ software for nuclear experimentation
- Became the TUNL point of contact for modern nuclear DAQ software as older programs were phased out
- Constructed efficient, clock-synced data streams from detectors to NIM modules to software

Education

Bachelor of Science, Astrophysics*, University of North Carolina at Chapel Hill **Aug 2019 - May 2023**

*minor in English

Training & Certification

DOE Certificate of Core Radiological Training **May 2021 - May 2025**
Radiation Worker I

DOE Certificate of Core Radiological Training **May 2023 - May 2025**
Radiation Worker II

Machine Learning, Stanford University & DeepLearning.AI (ID RTBETC4ZVQL1) **Jan 2025**
Supervised Machine Learning: Regression and Classification (ID ECE4CZYJPANU)
Advanced Learning Algorithms (ID BQMYKWB6MF9B)
Unsupervised Learning, Recommenders, Reinforcement Learning (ID FLWZPO1N9WEY)

Publications

1 J.Garcia-Duarte, Y. Mishnayot, A. S. Tamashiro, **J. R. Lawrence**, and J. T. Harke, "Innovative dead-time correction and background subtraction for neutron multiplicity measurements using neural networks", Scientific Reports 14, Available online (here), 7579 (2024).

Affiliations and Volunteering

OutLoud Sports, Player, Volunteer **Aug 2023 - Present**
An LGBTQ+ sports league that fosters a safe community for queer athletes and hosts charity events for underprivileged members of the queer community

Platelet Donor at UNC Hospitals, Volunteer **Oct 2021 - May 2023**
30+ platelet (and plasma) donations to the UNC Hospital Surgical Center (I was chiefly motivated by emails following my appointments, described the patients who benefited from my donation!)

UNC Physics Foundations Seminary, External Liaison **Jan 2021 - Jan 2022**

A student-led organization hosting faculty and guest speakers to teach foundational physics topics, promoting understanding and engagement for both majors and non-majors

UNC Visibility in Physics, Student Member **Jan 2020 - May 2023**

An organization that aims to provide resources, advice, and an encouraging social atmosphere for underrepresented minorities and allies in the field of physics

UNC Society for Physics Students, Student Member **Jan 2020 - May 2023**

A chapter based society that exists to help students transform themselves into contributing members of the professional Physics community

UNC Running Club, Member, Travel Coordinator **Aug 2019 - May 2023**

A student-led club affiliated with the National Intercollegiate Running Club Association that connects a community of student runners, providing training and registration resources for affiliate and non-affiliate races