NATHANIEL TAGG

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DATA SCIENTIST AND PHYSICIST
Programming | Statistics | Mathematics | Data Analysis

➔ Co-recipient of 2016 Breakthrough Prize in Fundamental Physics
➔ >100 scientific papers published in peer-reviewed journals
➔ https://github.com/nathanieltagg

SKILLS

Technical: Data visualization via web-based and 3d technologies, UNIX systems and sysadmin, web technology (full stack), data acquisition, data monitoring, Git/Subversion/CVS, Google/Azure APIs. AWS. SSH. Grid computing. ROOT. Database access and table design (MySQL, Postgres, SQLite, MongoDB), parallel processing. Expert with Monte-Carlo simulations. **Hardware:** Expert on photomultiplier and related optical sensors, scintillators, liquid argon time projection chambers, radiation counters, basic analog/digital circuits, and microprocessors.

Programming: Expert in C/C++, JavaScript, HTML/CSS, Python, Perl, bash, FORTRAN.

Scientific: Particle physics. Understanding of statistics and data analysis of large data sets (particularly multivariate fits and uncertainty estimation), detector calibration, data reconstruction, blind analysis techniques, successful grant writing, and technical writing.

Interpersonal: Years of experience mentoring, teaching, advising, collaborating long-distance, and leading groups within large multinational scientific collaborations.

CAREER SUMMARY

Senior Robotics Software Engineer, Mobile Industrial Robots, North Reading, MA   **Oct 2021 – present**
- Server Software team, resolving issues with first generation AutoGuide product software, and also took on DevOps support roles. (2021-2022)
- Authored obstacle detection stack for Gen-2 tugger system with 3D LiDAR, ToF cameras, and stereo cameras. (2022)
- Lead data scientist and programmer on Data Engineering team responsible for generating high-quaility truth data to train ML. Built software and hardware to use a Motion Capture System to annotate RGB camera images with truth information to pixel-level accuracy. Worked with ROS, IceORYX, GRPC, Realsense cameras, and Motive software.   Worked in C++, python, and javascript. (2022-present)

Data Engineer, FORD MOTOR COMPANY, Dearborne MI (Remote)   **July 2021 – Oct 2021**
- Database load/transform/extract with Hive+Hadoop high-performance computing cluster to manage data flow for data analytics. Used Alteryx, pyspark and other tools to validate data.

Software Developer, UNIVERSITY OF WISCONSIN, Madison, WI (Remote)   **2021**
- Development of full-stack database interface software for DUNE experiment construction and QA databases

Professor of Physics, OTTERBEIN UNIVERSITY, Westerville, OH   **2008-2021**
Roles: Professor, 2019-March 2021; Associate Prof., 2013-2019; Dept. Chair, 2014-2018; Assistant Prof. 2008-2013

Key responsibilities: Completed all teaching and mentoring duties associated with being a full-time tenured professor while also carrying out an ambitious research agenda that involved collaborating with hundreds of scientists remotely.

Key personal accomplishments:
- Earned promotion to full professor 2 years early; earned tenure 2 years early.

- Secured continuous funding from the National Science Foundation, with each of my 4 grants being successful on their first application. This funding supported myself and my students.
- Concurrently served as Department Chair for 4 years. Handled issues external to the department, managed the departmental budget, planned course schedules, and overhauled the curriculum.
- Wrote educational software that facilitated rapid-feedback assessment and grade distribution.
- Built a web application that allowed for easy navigation of course and student-level academic data. Widely lauded as an important tool by administrators and faculty for advising and scheduling.

Key research accomplishments (most involving collaborations with 100+ scientists and training undergraduate students):
- Proactively identified issues and needs for quality data-taking and rapidly created solutions.
- Constructed tools for data extraction and organization that ensured reliable data operations with large detectors taking physics data.
- Developed web-based data visualization tools that offered fast and intuitive access to data and simulations; tools are used by researchers and for outreach/education.

—Please keep reading for additional project highlights and achievements—

PRIOR SCIENTIFIC EXPERIENCE

Visiting Scientist, TUFTS UNIVERSITY, Middlesex County, MA, 2005-2008
- Led and coordinated the Calibration Group for the MINOS experiment, consisting of ~10 postdocs and grad students. Wrote the software platform to incorporate 8 different data studies into the same framework.

Research Assistant, BROOKHAVEN NATIONAL LABORATORY, Upton, NY, 2006-2008
- Contributed to early design conversations for the Daya Bay experiment and adapted database software.

Postdoctoral Research Assistant, OXFORD UNIVERSITY, Oxford, UK, 2001-2005
- Constructed and integrated systems on the international MINOS experiment and published results.

EDUCATION AND PROFESSIONAL DEVELOPMENT

Ph.D. Physics, UNIVERSITY OF GUELPH, Ontario, Canada, 2001
- Completed a thesis on the Sudbury Neutrino Observatory, an experiment that won the 2015 Nobel Prize.

M.Sc., Physics, UNIVERSITY OF GUELPH, 1996
B.Sc., Physics, UNIVERSITY OF LETHBRIDGE, Alberta, Canada, 1993
"Machine Learning" (course via Coursera.org), STANFORD UNIVERSITY, 2021

SELECTED PROJECTS *(solo developer or team lead)*

Motion Capture System To Annotate ML Training Data (2022-20223): I developed and built a system that could use an OptiTrack motion capture system to track the pose of both camera and subject, and developed methods to calibrate, and map them so that the subjects could be annotated in the camera view in real time to pixel-level accuracy. **Impact:** System was used to generate and validate >500k images used to train an ML pose estimate model; this allowed our robot to successfully dock with pallets.

Construction database application (2020-2021): Authored a web application and RESTful interface for storing data related to DUNE experiment construction, including QA, QC, inventory, component relationships, checklists, and work instructions. **Impact:** Team adopted my solution rather than invest in $70K work instruction software.

Online monitoring tool (2013-present): Authored a system to continuously sample and monitor from the MicroBooNE data stream, providing interactive graphic display of high-volume data; tens of thousands of plots updated in real-time. **Impact:** Sole on-call support for this system, which had > 99% uptime 24/7 for 6 years.

Physics simulations for education (2013-2021): Wrote several JavaScript-based websites for teaching various physics properties including a dynamic, responsive system for diagramming electric field lines in 2D, an animated EM wave, a simulation of linear polarizers, and a full 2D wave simulation by differential equations that runs via WebGL on the client GPU. **Impact:** Tools are publicly available; used in all Otterbein physics courses.

Field Code Changed

WebGL event display visualization for imaging detectors (2013-2019): Authored a web application for visualizing neutrino data from high-resolution liquid argon time projection chambers. **Impact:** The app is used for data monitoring, education, outreach, and reconstruction evaluation.

Web-based event visualization (2008-2013): Authored script-based web application that used a C++ backend to serve data from the distributed storage system to a browser-based event viewer, allowing users to see live or reconstructed data from the MINERvA experiment. **Impact:** Allowed difficult analyses to be done easily and was used to create every event image ever published by the experiment. Tool still in heavy use by outreach groups.

TAKEAWAY

Comfortable working with teams and in large collaborations, I use software to simulate, calibrate, control, and acquire data from hardware (such as massive, complex particle detectors). I am expert with data analysis, data acquisition, databases, and visualization. I have created everything from hardware interfaces to web applications, both close-to-the-metal resource-intense computing and high-level GUIs. Adept at mastering new systems and technologies, I learn quickly, am an expert teacher and presenter, and excel at engaging all kinds of audiences.