

From Academia to Industry

a shortened story of my academic path, what I do now,
and some things I learned moving to industry

Before we start

- I've been asked to talk a little about my academic experience and what it was like transitioning into industry.
 - I will talk a little about the projects I worked on, no great detail — if interested, please ask.
 - I am now a Data Scientist at a private mortgage insurance company.
- This is a disclaimer — this is just my experience.
 - some of my advice may not work for you, or hear differing advice — that is OK.
- Everyone has a different path.
- This is text heavy, apologies in advance.
- I'd rather this be more of a conversation than a formal talk, if you have questions please stop me.

Part I: Academia

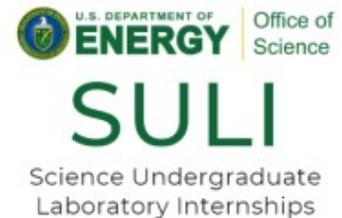
Academic Path

- Attended SUNY at Albany, undergrad in physics.
- Graduated in 2017.
- Worked on small projects on ATLAS.
 - e.g. validation projects, learning ROOT.
- Advisor was Vivek Jain (now working on DUNE in ND-Gar group?).



Academic Path

- Interned in the Science Undergraduate Laboratory Internships (SULI) program summers 2016 and 2017.
 - A great program, definitely recommend!
- 2016, project on tau neutrino optimizations for DUNE.
 - configure LBNF target complex so to maximize ν_τ appearance at Far Detector.
 - **Project helped me realize I wanted to go to graduate school.**
- 2017, worked with Mary Bishai on DUNE and MicroBooNE.
 - Studied signal strength in the final wire plane by analyzing data from alternative anode plane voltages of the detector.
- Worked with Mary Bishai, Xin Jian.
- Great experiences, learned more ROOT, computing/HPC specifics, and lots of physics.



Brookhaven
National Laboratory

Academic Path



- Attended Tufts for physics PhD — 6 years in total, graduated 2023.
- Research in experimental neutrino physics.
- Worked on different projects within NOvA and GENIE.
- Hugh Gallagher was my advisor.
- Worked closely with Jeremy Wolcott.
- Both were great advisors.

Academic Path

Years 0-1



- GENIE, a neutrino interaction simulator, has many different physics models.
 - I worked on improving one specific model relating to nuclear effects for neutrino interactions.
 - Learned more meaningful intro to C++, thinking about software, and more HPC experience.
 - Was also an opportunity to learn/work with others outside my “immediate circle” — always a plus.
- For my physics development, this project was a real boost.
 - Having a deeper understanding of the models that experiments employ has real value, and helps to understand some of the physics uncertainties the big experiments grapple with, like DUNE, NOvA, μ BooNE, and more.
 - Helped to prepare for working on NOvA.

Academic Path

Years 1-2



- NOvA (like many others) requires service work to be a member.
- Early on, I was asked to help with NOvA production.
- Doing the production work, while still getting to know NOvA, was a great experience.
 - Learned more about NOvA while also learning even more computing/HPC skills, and also how NOvA logistically operates.
 - Service role was for ~1.5 years.
- **Would recommend this**, a great way to get started learning about an experiment while also doing meaningful work.

Academic Path

Year 3



- Worked on a Final State Interactions (FSI) project.
 - Tuned an FSI model to better agree with pion scattering data.
- Was a combination of GENIE and NOvA-specific project.
- Tuned model was used in the NOvA Monte Carlo campaign.
 - Learned more C++, python, and computing.
- Strengthened my understanding of interaction models used in neutrino experiments.

Academic Path

Years 4-6



- Ready to start thesis project.
- Because of modeling focus in past projects, wanted to make use of that for thesis.
- My thesis was to use the NOvA Near Detector & far Detector data simultaneously to constrain the oscillation parameters & uncertainties, using Bayesian inference.
 - And because there is so much more ND stats than FD, the interaction models would constrain the MC directly.
- Learned a lot of statistics (Bayesian), more C++, and computing.
- During this time I began to think the Professor path was not what I wanted.
 - My plan was to apply to both jobs and postdoc positions.

My Journey



Year 1

- Worked as a postdoc at Wichita State University for ~ 2 years.
- Involved in NOvA reconstruction, DUNE TMS and DUNE computing.
- Worked with Mathew Muether (working on DUNE TMS and Computing).
- NOvA reconstruction was using Machine Learning (ML).
 - I wanted to get involved in a ML project, and was able to do that in this position.
 - Really interesting, and also a very marketable skill, even outside academia, so I prioritized that.
 - Revived a ML network to locate 1D neutrino interaction vertex to learn the 3D vertex location, used a convolutional neural network.
- Also convened the NOvA production group — my production service work helped here.
- Worked with graduate students in their own thesis projects — very enjoyable and rewarding.

My Journey



Year 2

- Continued both the ML work & the Production convening on NOvA.
- Moved onto DUNE involvement.
 - Got involved in The Muon Spectrometer and DUNE Near Detector computing for a number of months.
- Postdoc was only 3-year term, so at year 2 I began applying to industry jobs.
- I had seen the challenges other had applying to Staff Scientist & Professor positions, that it made my decision easier to move to industry.
- Acknowledge it was difficult to do both things at the same time — somewhat unavoidable.
- Around March/April I accepted an offer at an insurance company.

Part II: Industry

What worked for me **radian**

- To help de-mystify the hiring process, there were several reasons why I stood out as a candidate (learned from the hiring committee later):
 - a PhD in physics — can think about complex problems in a unique way.
 - knowledge in coding (python & C++).
 - statistics knowledge — in this case there was some Bayesian element to the job.
 - ML knowledge — dept wanted to begin implementing ML solutions.
 - Linux/bash knowledge — not a skillset industry generally has.
 - computing knowledge — “what made me stand out”.
 - collaboration experience — working with so many people on experiments like DUNE is a great advantage, be sure to sell that.
- **You all have these skills too at one level or another.**

Current work



- Now I work at Radian, since April 2025.
- Radian is a private mortgage insurance (PMI) company.
 - Private Mortgage Insurance — insurance to protect the lender against a homebuyer default.
- Radian sells insurance to lenders, i.e. banks & credit unions, and homebuyer generally pays the premiums of the insurance in installments in their mortgage payment.
- **How it works:**
 - When giving a down-payment to buy a home, PMI is required by the lender (generally banks or credit unions), if the down-payment is < 20% of the home value.
- The homebuyer can discontinue the PMI once they have attained 20% equity in the home.

Current work



- Office is in Midtown, Manhattan NYC.
- Job title is a Data Scientist — part of the Quantitative Analytics department.
- The QA dept oversees much of the risk of the company.
- ~ 25 or so members of the QA department.
- Teams sizes are ~5.
- QA dept works closely with the Pricing department.
- QA employs and owns models:
 - to determine company investment portfolio & capital allocation.
 - simulate macro/micro-economic scenarios.
 - return on equity & new insurance written.
 - **model how to price our insurance products given competitor price constraints.**

Current work



- Use Machine Learning and “classical” fitting methods to determine optimal prices for different credit attributes.
 - For example, in a Metropolitan Statistical Area (MSA) — similar to a zip code.
- Lots of python, lots of computing (this time with AWS), lots of statistics.
- We get new data all the time — and the economics are changing all the time.
 - Requires frequent training & validation of our modeling.
 - Heavy usage of AWS computing clusters (very similar to Fermilab GPVMs).
 - Extensive model validation, backtest our models on months of past data.
- More specifically:
 - use SAS/SQL to prepare & incorporate new datasets into our model — the data is messy, requires substantial cleaning, and often very ambiguous data.
 - develop our computing infrastructure for scheduled model training.
 - develop & improve model fitting.

Current work



- I work on a team of 4, in a snapshot:
 - a physics PhD (a postdoc) - Data Scientist.
 - develops algorithm to “expand” our optimized prices to any future, unseen loan.
 - a math PhD - Data Scientist.
 - validates & creates diagnostics at different stages of our model fitting.
 - a Masters in business — Quantitative Analyst.
 - work on the Extract, Transfer, Load (ETL) pipeline for data into our model & validate data during those steps.
- Teams really work as a team.
 - there are lots of hand-offs of work — within a team & across teams.
- Work is fast-paced.
- Goals/objectives change often, with & without warning.
- Overall, the work is very interesting — I enjoy the same problem solving elements that I enjoyed in physics.

Part III: Transitioning into Industry

Transitioning to Industry

- For me, I realized early on that Data Science was the field I wanted to go into.
- I enjoy the problem solving elements, and like working with ambiguous data.
- As a grad student & postdoc I tried to develop skills that were useful in the industry.
- I had also talked to other ex-Fermilab and ex-Tufts students about their experiences in industry — talk with your peers!
- This are many types of jobs in the big data industry:
 - Data Engineers, Data Analysts, Software Engineers, Machine Learning Engineers, DevOps Engineers.
 - These all require skills/knowledge you all have experience in.
 - And there are great opportunities for all these careers in academia now.
- The big data field is growing.

Transitioning to Industry

Inform yourself on the field

- It can seem very daunting. It's a big change.
- Start small: Some things I did, and I recommend:
 - talk with your friends, colleagues, and former-students — they can give the most unfiltered information.
 - stay informed about what companies are hiring data scientists.
 - sign up for email updates on your favorite places or companies you know that hire data scientists.
 - create, e.g., Indeed/LinkedIn to get updates for jobs in a field.
 - The key is not to apply right now, but learn the profile the job is looking for (e.g. statistics, computing, C++, machine learning, etc).
 - Start on on this process early, its fairly easy and a passive task:
 - slowly accumulate an understanding of the common skills required for the job you are looking for.

Transitioning to Industry

Preparing your resume

- You are Masters, PhDs, and postdocs, your resume *can* be more than 1 page — you've done a lot.
 - But it must be focused, with specifics.
 - It should *not* be a CV.
 - Include the job title on your resume.
- Write, re-write, and re-write your resume.
 - It should be **concise**, and should highlight the skills you have from that work, not just focus on physics.
 - It can be helpful to include specific names of software/packages used, for example.
- Be your own advocate.
 - All of the work you've done is significant, BUT the “outside” world does not understand what you've done, nor how difficult it is — you have to explain that part too.

Transitioning to Industry

Preparing the hard skills

- Be comfortable with python.
 - pandas, numpy, and matplotlib/seaborn, are the first three to start with.
 - being proficient with virtual environments is a useful plus*.
- Familiarize yourself with SQL.
 - Industry heavily uses SQL/SAS and databases for its data storage.
 - I took a SQL bootcamp, it was very helpful.
 - the syntax is weird, but otherwise it's fairly logical.
- Nearly all of you have intermediate-advanced Linux OS and bash scripting knowledge.
 - This is a major advantage in industry — lean into this — it is an attractive skill in the job market.

Transitioning to Industry

Preparing the hard skills

- ML knowledge is of course an advantage.
- From my experience, the ML used in neutrino experiments is very sophisticated and use-case specific.
 - This is an advantage! Lean into this.
 - Have familiarity with standing up a custom-made (not out-of-the-box) ML solution is very marketable.
- Also, my perspective, industry often uses off-the-shelf ML/fitting techniques, from packages like scikit-learn.
 - It might be beneficial to be familiar with some of these out-of-the-box models too.
- In ML, the field is growing so fast and there are so many techniques.
 - It seems best to focus on one specific area and learn it well.

Transitioning to Industry

Artificial Intelligence

- AI is a great tool, but should be used carefully.
- In my company, and others' companies, there is a push to use AI chatbots to help with efficiency.
 - It is a helpful tool when I have a syntax problem, or forget a method name, but it's only as good as the user — **only you can fully understand the context of your work.**
- Even more, understanding the basics is critical to articulate what you need help with from a chat bot.
- Using chat bots does not replace the value of the fundamentals.

Some things I wish I knew earlier

- Be prepared to move quickly — business moves significantly faster than academia.
 - Turn-around for tasks can be quick, faster than I was accustomed to in academia.
- Be prepared for your boss'-boss'-boss to tell you to stop working on a project.
 - External constraints are a much bigger factor in industry — company may change directions.
- There is less documentation in the business world.
 - The fact that grad students & postdocs spend so much time writing documentation is important — lean on that.
 - Taking notes for yourself is a good way to address lack of documentation.
 - If notes aren't an option, asking the right person the right question can be key.
- The business world is biased towards networking — if there are connections you have in industry, talk with them.
 - Get their advice, their perspective — maybe they can recommend you.
- There are smart people in industry too — there is a lot to learn in whichever industry you choose.

Thank You

- Thank you to Shivam and the FSPA for inviting me.
- I hope my story serves as a “data point” for you in your journeys.
- Feel free to reach out if you have questions, offer advice, discuss something, mike.dolce8@gmail.com
- Or send a **LinkedIn** invitation, if you prefer.
- Lastly, enjoy your time in academia & at Fermilab — it’s a great place filled with great & smart people!