From Physics to AI: Myths and Truths of a Career in Industry
Outline

• My Career Path
• What is Artificial Intelligence?
• AI in Medical Imaging
• Searching for a job AI - Common Myths
• Landing a job in AI - Lessons Learned
• Discussion
Personal Career Journey

Defended PhD work on “IceCube Neutrino Observatory” from Wisconsin in 2010

Postdoc with UPenn working on Sudbury Neutrino Observatory 2011-2014

Lead AI Scientist at Proscia, 2021 - present
What is Artificial Intelligence?

Artificial Intelligence: The field defines itself as the study of “Intelligent Agents”: Any Device (software or hardware) that perceives its environment and takes actions that maximize its chance of success at some goal.

Machine Learning: Machine learning provides computers with the ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can teach themselves to grow and change when exposed to new data.

Deep Learning vs Machine Learning

Machine Learning

Input → Feature extraction → Classification → Car/Not Car

Deep Learning

Input → Feature extraction + Classification → Car/Not Car
What Artificial Intelligence Really Means

- A “job in AI” typically means one works in one-or-more of these areas
- Professionals in the industry communicate/network via the models and data they work with

- Computer Vision
- Natural Language Processing
- Speech Recognition
Artificial Intelligence vs Data Science

- There is overlap between careers in AI and Data Science

**Data Science** combines programming, machine learning, statistics, and visualization to collect, process, model, and visualize data to create data products that address business questions.

- The primary (but not exclusive) difference between AI roles and Data Science roles is the use and development of deep learning algorithms on a daily basis.
Examples from Computer Vision
Image Classification

- The rise in popularity of neural networks is due in part to image classification.
Facial Recognition with Deep Learning
Meta’s DeepFace

Convolution+  Rectified Linear  Convolution+

Max pooling
Locally Connected+  Rectified Linear

Led by Yann Lecun (Facebook & NYU)
97.5 accuracy in face detection
4 million images, 4000 identities
Self-Driving Cars - Object Detection
Examples from Natural Language Processing
Chatbots

i have some blueberries, milk, and eggs. what should i eat for dinner?

You can make blueberry egg pancakes with them.

what if i dont want to make blueberry egg pancakes? what else can i make with the ingredients?

You can make scones with the ingredients.

what is the first step of making scones?

Beat the butter and sugar until creamy.

what's next?

Add the eggs, vanilla, and milk.

what's next?

Mix in the flour, baking powder, and salt.

GPT-3 architecture
Language Translation / Autocompletion

Google Translate

Autocompletion
Protein Folding

[Diagram showing the process of AlphaFold for protein folding, including MSA embedding, sequence-residue edges, residue-residue edges, confidence scores, structure module, pairwise distances, and 3D structure.]
Examples from Speech Recognition
Mainly Voice Assistants

Timeline of Mainstream Voice Assistants

- Apple Siri (October 2011)
- Google Now (May 2012)
- Microsoft Cortana (April 2014)
- Amazon Alexa (November 2014)
- Google Assistant (November 2016)
Speech Recognition System

Analog Signal

Signal Level:
- Extracting only speech segments
- Feature Extraction
- User/Environment adaptation
- Deep Learning or MFCC to extract features

Acoustic Level:
- Classification of the different sounds
- Adding contextual information on top of the sounds
- Deep Learning used for acoustic classifications

Language Level:
- Combining sounds into words
- Combining words into sentences
- Deep Learning used to generate the different models

Transcription
Examples - Combining Computer Vision and Language
AI-Art Generation

DALL-E 2

DALL-E 2 is a new AI system that can create realistic images and art from a description in natural language.

Generated from phrase “Teddy Bears working on new AI research underwater with 1990s Technology”
Generating AI Art

Generated from the Phrase:
“Astronomers celebrating in an atrium after a seminar in watercolor style”

Try it yourself!
https://www.craiyon.com/
https://huggingface.co/spaces/stabilityai/stable-diffusion
Join us, as we change the way the world practices pathology.
Proscia’s AI Vision

Deliver purpose-built AI products, designed to marry quality and state-of-the-art technology with the power of human cognition, guiding and enabling pathology practices to deliver efficient, superior care that manifests in improved patient outcomes.
Motivation

• 106,000 out of 5 million skin cancer diagnoses is Melanoma

• 5-year survival rate of patients with metastatic malignant melanoma is less than 20%

Our main objective was to develop a system that prioritizes detecting melanoma cases and improving turnaround time - thus improving survival rates of melanoma patients
Pathology Deep Learning System (PDLS)
Myths about the AI job search
Myth 1: “I’m at a disadvantage compared to Computer Scientists...”

1. Most computer scientists don’t have experience with real data. (Don’t underestimate this...)
2. Physicists & astronomers often have to self-teach a wide variety of skills. (Programming, electronics, statistics, etc.)
3. Core qualities of successful AI scientists include:
   • A knack for critical thinking and a passion for problem solving
   • Attention to detail in order to discover nuances in data
   • Excellent communication skills to explain technical findings to non-technical business partners and great collaborative spirit
   • Business acumen to understand non-technical challenges and perspectives
Myth 2: “I like the freedom of Academia. I won’t fit in a corporate-structured environment”

• In Academia - you have the freedom to pursue only what your grant says you can pursue

• Some scientists are concerned they’ll surrender the joy of learning something new at an industry job.
  • AI changes so rapidly, you need to keep learning in order to perform well.
  • “Retrospectives” for project deep dives, similar to academic lab meetings
  • Journal Clubs
  • Many companies have “Learn@work” programs

• Corporate Culture varies wildly, even in big companies - it can depend on your team in a place like Microsoft, LinkedIn, Meta.

• Startups have an “elastic” culture/environment you can help shape.
Myth 3: “I want to make a positive impact – making money for a company seems like a conflict of interest”

• OpenAI, inventor of GPT-3 language model, began as a non-profit
• Government Agencies. (Largely Healthcare & Defense)
• Healthcare, hospital operations. (Healthcare companies, consulting, local hospitals.)
• Education
• White House’s “AI roadmap”: https://www.whitehouse.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf
Myth 4: “The GAFAM Giants Rule Everything”

![Graph: Percentage Point Change in CR4 to Percentage Change in Startups in the High-Tech Sectors: 2002-2017]

- Small (1–100 employees)
- Medium (101–999 employees)
- Large (1,000+ employees)
- No preference
Ok, but what is an AI Job in industry actually like?

Yann LeCun
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Scientist at startup = demos, product development, fighting for survival.
Scientist in engineering division of large firm = product development.
Scientist at industry research lab = research, technology transfer.
Your mileage may vary.
Lessons learned from my industry job search
Lesson #1: Show that you “want it”

1. Put effort into your resume.
   • A Resume is NOT a CV. One page, maximum.
2. Show some understanding of the company and their area
3. Network. It’s important.
   • Stay in touch with your friends/colleagues
   • Take advantage of career services
   • Meetups can be useful - many companies use meetups for recruiting
   • Professional Social networking (like LinkedIn) has worked for people
4. A personal portfolio of relevant example work (for example on GitHub) shows that you’re serious
   • This used to not be true, but demonstrating at least Machine Learning foundations is currently important to break in to the field.
Lesson #2: Fill in gaps in skills and nomenclature

• **Python** is the default programming language in the field
• **Learn** about Neural Networks
  • Jeremy Howard’s free fast.ai course is excellent - [https://www.fast.ai/](https://www.fast.ai/)
  • Kirill Eremenko’s Udemy course
  • Andrew Ng’s Coursera course
  • For the data scientists among you, Stanford’s online ML course is good [https://www.coursera.org/learn/machine-learning](https://www.coursera.org/learn/machine-learning)
• **PyTorch** and **Tensorflow** are the two primary deep learning frameworks
  • PyTorch is more common, but both are valuable
• Depending on the role, some software engineering knowledge (particularly around cloud computing and containerization) would be very helpful
Lesson #3: Draw parallels between academic work and industry work

- **Interviewing** is a skill
  - Live virtual coding challenges
  - Solution whiteboarding the final interview stage
  - [https://github.com/yangshun/tech-interview-handbook](https://github.com/yangshun/tech-interview-handbook)
- **Connect** work and skills to job description
- **Demonstrate** that you
  1. Are intelligent, can work independently, and self teach
  2. Can solve a business problem quickly
Lesson #4: What kind of company are you looking for?

What is your priority?

Corporate Culture

Benefits & Lifestyle

Cutting Edge Tech

Domain Expertise
Lesson #5: Your first industry job will not be your last...

- Industry will be a new experience
  - Some folks would find the transition easy, others challenging
  - It’s ok to not be fully clear about the pros and cons of different companies and opportunities

- The right manager and/or team can make the transition easier
  - Industry is more about the way of working, thinking, and style than it is about specific tasks

- Job transitions are extremely common and expected

- Your first job will give you a baseline to analyze pros and cons, your next position will be a lot easier
Thank You!