



Not just for bots: The changing career landscape in AI

Artificial intelligence (AI) is impacting science in new and exciting ways as researchers are using it to better understand society and find solutions to problems across diverse disciplines. And as the application of AI expands, so too do the career opportunities.

By **Alaina G. Levine**

Artificial intelligence (AI) is an exploding discipline, and the race is on to deploy it to make products and services smarter, faster, and able to accomplish tasks that humans simply cannot do. With this ultramarathon of investments in AI across many sectors around the globe, including academia, comes new career opportunities.

There is a growing realization that as AI expands, certain jobs will die out. But on the other side of this (bit) coin, there is an increasingly urgent need for experts to help build AI models, and for domain experts who are strategic and creative enough to envision ways to use AI in their specialty. In fact, the World Economic Forum reports that the fastest growing skill on LinkedIn is AI.

So what exactly is AI? **Zhi-Hua Zhou**, professor and head of the Department of Computer Science and Technology at Nanjing University in Nanjing, China, and dean of the university's School of AI, puts it simply:

"AI researchers are trying to invent/develop techniques and tools that are able to help people to do work that requires some intelligence. With the help of these techniques and tools, people will find life easier and more enjoyable because more time and energy can be used to do interesting rather than boring things. AI can be analogous to steam power: Steam power helped humans to do manual labor, while AI will help humans to do intellectual labor."



Maggie Johnson

Wanted: Domain experts

In the dynamic world of AI, where data science, deep learning, and machine learning are being used to improve products and outputs in fields as far apart as astronomy, health care, transportation, security, and banking, scientists and engineers are finding that their skills are highly prized in multiple career tracks and sectors, says **Maggie Johnson**, vice president of Education and University Programs for Google, where she manages technical education for all Google staff. In a firm like Google, she notes, there are those with Ph.D.'s in highly technical AI-adjacent areas, such as computer science, statistics, mathematics, and data science. "They are defining the actual algorithms and what the models look like," she says.

As the models have become more sophisticated, these technical AI experts have found professional paths in R&D divisions, where they conduct ongoing research as "consultants"—helping different arms of their company with AI needs, and most interestingly, working in product teams across entire organizations.

This fanning-out of AI expertise among various enterprises has naturally led to another path for Ph.D.'s: as domain experts who comprehend AI well enough to successfully apply its models to improving systems in their discipline, notes Johnson. They need to have programming skills and knowledge of computer languages, such as Python, for instance—but it's more critical for them to be able to see the potential for advancing products that incorporate AI. Take for example, a project at Google, where employees are aiming to use AI in the health care space to diagnose disease through retinal scans.

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"We actually hire doctors," says Johnson. "We bring in physicians and scientists because we can't understand the datasets, but they do."

And Google is not the only firm that sees the value of hiring scientists and engineers for AI-innovation roles. If you have a doctorate in niche areas such as epidemiology, materials science, physics, plant sciences and agriculture, or industrial engineering—among others—chances are there is a company that can utilize your knowledge as they build AI-centric products. At Hitachi Limited, the Tokyo-headquartered multinational conglomerate with interests in construction machinery, railway systems, elevators, health care, banking, and government systems and infrastructure, Fellow **Kazuo Yano** (whose doctorate is in physics) leads AI investigations.

Yano sees his role as both strategic and tactical. "I am writing code for AI as well as talking to customers," he says. "The customers don't know what AI is or what it can provide for them. I understand the very real requirements of the customers and the market."

But for the product teams, it is imperative to have highly educated domain experts, adds Yano. "We have a lot of researchers and engineers who are domain specialists, such as railway experts and finance experts who joined the AI team to make those systems smarter," he says.

In fact, **Avik Sarkar**, officer on special duty and head of the data analytics cell for the National Institution for Transforming India (NITI Aayog), a government-focused think tank based in New Delhi, believes that domain specialists are the future of AI. "Become a domain expert," he says. "The wonders and magic of AI only work when you know your domain very well."

At 3M, the powerhouse materials science company based in Minneapolis-St. Paul, Minnesota, **Jennifer Schumacher**, whose varied background includes a Ph.D. in neuroscience, cofounded and leads research in the AI Cluster in the Corporate Research Systems Laboratory (CRSL).

Schumacher and her team can contribute to any of 3M's diverse products and businesses; most recently, the team has incorporated AI and data science solutions into digital displays, traffic signs, HVAC filters, digital oral care, and even Post-it notes. **Yixiong Chen**, senior product engineer in 3M's CRSL in Shanghai, aims to do the same for 3M's clients and interests in Asia. He graduated with a Ph.D. in control theory and control engineering only four years ago from the Chinese Academy of Sciences. "We are trying to find opportunities in our organization to deploy this technology and introduce AI-related knowledge to 3M China," he says. "This is a growing team."

Deep learning in academia and industry

Scientists who like the culture of academia and the impact of industry may be interested to know that it is possible to craft a career in AI that spans both, as **Joelle Pineau** has done. She is a professor of computer science at McGill University and the leader of the Facebook AI Research team in Montreal. "When it comes to working in AI, there is a huge spectrum of positions," says Pineau, adding that more universities are open to this type of job model.

Joshua Bloom is another example—he holds a professorship in the astronomy department of the University of California, Berkeley, while working at GE Digital as vice president for data



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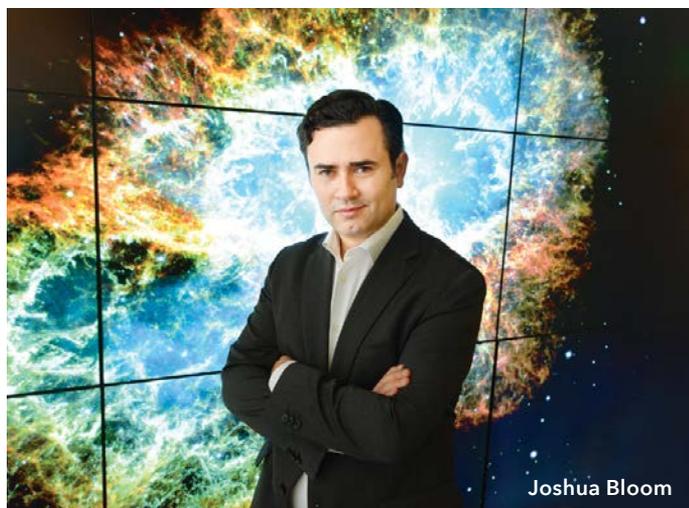
analytics (which includes AI-related projects). "I am more aware of joint appointments in faculty and industry than I was five years ago," he shares.

He came to his dual career when, as a university researcher, he saw a huge uptick in the volume of astrophysical data and no way to parse and understand it in a reasonable amount of time. He not only devised solutions for astronomy, but ended up using his machine-learning knowledge to cofound a company, which was then acquired by GE Digital. His new "mothership" was quite happy for him to continue his scholarship in academia while contributing to their data science and AI interests within the context of the company.

Because the potential for AI applications is seemingly limitless, the career opportunities are growing like gangbusters. "There are no defined [career] ladders, but one can surely move step-by-step in order to adopt an influential career in AI," says **Komal Sharma Talwar**, cofounder of an intellectual property and technology analytics tool, XLPAT, and founder of TT Consultants (headquartered in Chandigarh, India, with offices in Taiwan and the United States). "Once you know about data science, machine learning algorithms, and models, your next career choice is deciding what job you really want," she notes. "However, the path does not end there. To be successful in the AI domain, one should continue to learn higher-level algorithms and how to apply them for different functions."

The code to career opportunities

Recruiting for AI roles in industry, in both the R&D and domain divisions, can be "unconventional," says Yano. For AI researchers who want to build the "engines" of AI, a strong theoretical physics or mathematics background is useful, he says, pointing to one of his colleagues who joined Hitachi recently with a background in theoretical particle physics after having spent a decade in academia. Pineau looks for people with very strong mathematical and programming skills, but also those **cont.>**



Joshua Bloom

who “have a spark and are hungry to learn, who have initiative and curiosity, who want to jump in and learn and exercise autonomy.” **Pete Warden**, technical lead of Google’s Research Machine Intelligence Division in Palo Alto, California, adds that “the single biggest skill we look for is the ability to experiment and be able to work through problems in a disciplined way.”

To recruit AI professionals who can “apply state-of-the-art technology to the real world,” says Yano, you have to think outside the box. “The field is changing so much that [candidates] have to be flexible . . . and need experience with real-world data.” This is key, adds Bloom. “Get real-world experience,” he echoes. “That means owning something and building something that someone uses and contributes to.”

For recruitment purposes, Warden relies on competitions that allow individuals to show off their programming skills. Google runs its own set of open-source data science competitions, called Kaggle competitions, which serve as a metric and a credential for would-be engineers interested in gaining an advantage in the AI marketplace. Hackathons, where computer programmers get together [either virtually or in real life (IRL)] and collaborate to develop a usable product, can also serve this purpose.

However, there is disagreement as to the virtues of these online competitive programming events. Bloom says that you need to have experience scaling-up your work. “There is a wide gulf between people who win Kaggle competitions and those who can build code that can be robust and trustworthy in production . . . it’s as big a gulf as you can imagine. Given the brittleness of AI, the attention to that kind of detail, and [the fact] that what you build is only going to be a larger part of a machine, you can’t teach that,” he says. “We look not only for experience in programming and AI, but also for people who have lived the pain of seeing it through to production.”

This “pain” can be experienced through an internship, something that Talwar highly encourages. “For those about to graduate, they should try their hands at real data through internships in order to be well acquainted with AI algorithms and how to apply them,” she stresses.

Daniela Rus, director of the Computer Science and Artificial Intelligence Laboratory (CSAIL) as well as the Andrew (1956) and

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3M
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Computer Science and Artificial Intelligence Laboratory (CSAIL), Massachusetts Institute of Technology
www.csail.mit.edu

Facebook AI Research
research.fb.com/category/facebook-ai-research

GE Digital
www.ge.com/digital

Google AI
ai.google.com

Hitachi Limited
www.hitachi.com

McGill University
www.mcgill.ca

Nanjing University
www.nju.edu.cn/en

National Institution for Transforming India–NITI Aayog
niti.gov.in

University of California, Berkeley
www.berkeley.edu

University of Oviedo
www.aic.uniovi.es

XLPAT
www.xlpat.com

Erna Viterbi Professor of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology (MIT) suggests doing internships at startups—or it could also mean learning about many of these concepts on your own. “Academic institutions like MIT offer a lot of their courses online, including ones aimed at working professionals who want to build their knowledge in big data, cybersecurity, and the Internet of Things,” she says.

In addition to online platforms like those at MIT, there are many others, such as Coursera, where one can take courses and learn these skills. There are also intensive fellowships where Ph.D. scientists and engineers get to address real-world problems presented by partner companies. The Insight Data Science Fellows Program is one example that continues to expand.

“Just do it. Jump in,” says Schumacher. “If you are not formally trained, there are publicly available ways to prove you have these skills—so leverage all the resources [you can] online.”

The future of AI careers

The future is bright for STEM-educated pros from all fields to work toward a career in AI. As **Beatriz Remeseiro**, assistant professor in the computer science department at the University of Oviedo, Spain, shares, “AI experts have become some of the most in-demand and best-paid talent in today’s technological marketplace.” Talwar agrees, adding, “The world is moving toward automation at a fast pace, and so is the demand for AI skills.”

Zhou notes that now is an especially exhilarating time to be in AI, both from the perspective of enjoying its technical challenges and because of its job outlook. “AI is beginning to change our lives and the world, and it is exciting to get involved,” he says. “It is a young but flourishing field, where there are many interesting and challenging problems waiting to be conquered. Furthermore, the world has a serious shortage of AI experts, and a big job market is waiting for people who pursue these careers.”

Alaina G. Levine is a science writer, science careers consultant, professional speaker, and author of *Networking for Nerds* (Wiley, 2015).

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