AI'S NEXT WAVE

Radical Thinking

PARASVIL PATEL

It is difficult to overstate the potential of artificial intelligence. Alphabet CEO, Sundar Pichai, searching for equivalent comparisons, equates AI to fire and electricity: "Like that, but even more profound." But before AI transforms the trajectory of civilization as fire once did or becomes ubiquitous like electricity, it will first go through differing waves of adoption.

Given the disruptive promise of AI, it is easy to lose sight of the fact that it remains a nascent technology, with only a fraction of enterprises actively deploying AI today.[1] At Radical Ventures, we have seen hundreds of startups looking to accelerate its adoption and shape AI's future. This experience informed our framework for categorizing the different waves of AI adoption. To understand where the technology is going, it is worth considering first how we got to this moment and how startup founders today are thinking about the next generation of AI technologies.

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[1] Loukides, M., "AI Adoption in the Enterprise 2022," March 31 2022, O'Reilly, https://www.oreilly.com/radar/ai-adoption-in-the-enterprise-2022/

Researchers have been working on various flavours of AI for the last six decades.[2] After multiple 'AI winters,'[3] the 2012 ImageNet competition marked the start of the 'AI spring'. A team under deep learning pioneer Geoffrey Hinton won the competition and set the technology on a course to outperform humans when it came to image identification. At this time, commercial AI activity was research-driven. Most well-known AI startups in the early 2010s focused on taking research out of university labs and continuing it in a commercial environment. As a result, the founders were mainly those with strong academic pedigrees and research experience — for example, Demis Hassabis and Shane Legg, who founded the research-focused DeepMind in 2010. The companies remained focused on innovating on deep learning architectures and algorithms that could, in theory, be applied to solving multiple enterprise problems. A lack of knowledge around AI led to long sales cycles, and a lack of pre-existing data infrastructure resulted in long deployment cycles. In the end, many of these startups were 'acquihired' for their talent and early technology breakthroughs rather than becoming self-sustaining product companies.

The activity that followed from the mid-2010s to the present is best characterized as a wave of scalable applied AI innovation. The R&D focus shifted to developing scalable machine learning (ML) infrastructure and using that to apply AI across industries. During the research-driven phase of AI innovation, large technology firms such as Google, Uber, Airbnb, and Facebook (as well as research institutes) built in-house tools to develop, deploy, and manage data pipelines and ML models. Open-sourcing was a common strategy with tools like Tensorflow, Michelangelo, Airflow, and PyTorch to increase the adoption of their frameworks and attract the right talent. Several startups, such as OctoML (based on Apache TVM), commercialized these product breakthroughs using an open-source software-based business model.

A vital feature of this current wave of applied and scalable AI innovation is AI talent moving away from the resource-rich hyperscalers to build their own AI startups.[4] Many teams that created AI tools in-house at large tech companies left to create better versions of those

[2] "The 1956 Dartmouth Workshop and its Immediate Consequences: The Origins of Artificial Intelligence," March 2001, Computer History Museum, https://computerhistory.org/events/1956-dartmouth-workshop-its-immediate/.
[3] "AI Winter," Wikipedia, accessed June 9 2022, https://en.wikipedia.org/wiki/AI_winter.
[4] "AI gurus are leaving Big Tech to work on buzzy new start-ups," CNBC, accessed June 10 2022, https://www.cnbc.com/2022/06/10/ai-gurus-are-leaving-big-tech-to-work-on-buzzy-new-start-ups.html.

products as independent startups. The team behind Michelangelo started Tecton AI. Natural Language Processing platform Cohere was founded by ex-GoogleBrain researchers who worked on transformers and the BERT large language models (Cohere is a Radical Ventures portfolio company). Simultaneously, a group of startups began developing specialized hardware to address the paucity of options for training and serving ML models, including companies like Nvidia and Untether AI (another Radical portfolio company).

With several startups building specialized AI infrastructure tools, other companies focused on using these tools to solve vertical or function-specific problems. This focus made it easy for applied AI startups to build domain-specific data pipelines (i.e., integrations into other systems commonly used in that vertical and getting access to early training data). Companies like Ada Support, Birch AI (Radical portfolio company), and Tractable, are now leveraging their domain expertise to create products that are easy to deploy across specific industry or function verticals.

The next wave of AI innovation will see the technology move from novelty to ubiquity – an ambient tool embedded in most technologies.[5] While applied AI applications and infrastructure startups will continue to emerge, over the next decade, AI will go from being a buzzword and a top-level domain to a must-have for every software product. This evolution will be similar to the development of SaaS businesses and cloud infrastructure over the last two decades. When Salesforce started just over a couple of decades ago, they had to educate their customers on why an application hosted on the cloud would be a better option than one hosted within a data centre on the customer's premises. Now, most software applications follow a SaaS business and delivery model. 'Cloud hosted' and 'SaaS subscription' are table stakes for most modern software businesses.

Similarly, cloud infrastructure has matured to a point where most software developers without expertise in setting up infrastructure can successfully build and deploy a cloud-hosted application. In 5 to 7 years, AI-driven innovation will be as accessible today as cloud technology. Anyone with basic software development experience will be able to use off-the-shelf infrastructure to develop AI-driven applications. For example, the current

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[5] "Ambient Intelligence," March 2008, *IEEE Intelligent Systems,* https://www.computer.org/csdl/magazine/ex/2008/02/mex2008020015/13rRUxlgxZP.

wave of AI-first drug discovery startups are considered novel in their application of AI as most biotech startups spun out of research labs have used traditional trial and error approaches. However, as we enter this third wave, the use of AI in the entire drug development pipeline will become normalized. From identifying targets to designing drugs, identifying patients for clinical trials, and manufacturing, AI will be just another tool in the toolkit.

As expected, it is almost impossible to neatly delineate these innovation waves and classify startups as falling into one bucket. There are still sub-areas of AI going through the first wave of innovation (e.g., AI for self-driving), while others have started maturing into the third wave (e.g., image recognition). However, the broad trends point towards AI moving from a research novelty to an ambient feature in all technology.