

The AI revolution. And the sense of déjà vu. Where next for 2023's hottest investment trend?

What does nearly a decade of experience in the area of robotics and automation tell us about what might be in store for the field of AI? Three things come to mind.

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In December 2015, the famous Chairman of the World Economic Forum, Klaus Schwab wrote in Foreign Affairs Magazine that:

*"We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before."*¹

Just 6 weeks prior to his article, management consultancy firm McKinsey had published a quarterly titled 'Four fundamentals of workplace automation' where they heralded IBM's Watson, Rethink Robotics' Baxter and Google's driverless cars as 'spectacular demonstrations' of 'advanced robotics' and asked, 'Should we fear threats to jobs, disruptions to organisations, and strains on the social fabric?'².

Investors who are long in the teeth are likely feeling a sense of 'déjà vu' as similar predictions are now being made and questions being asked on Artificial Intelligence.

Amara's law cautions that 'we tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run'³.

This law has been nicely encapsulated in visual form thanks to Gartner's yearly Hype Cycle which shows that new technologies often experience a 'peak of inflated expectations' and then a 'trough of disillusionment' on the way to real productivity⁴.

Indeed, McKinsey's chosen examples of 'advance robotics' are a case in point.

Watson failed to live up to the grand vision IBM had for the technology, leading the New York Times to write an article titled 'What ever happened to IBM's Watson' in the summer of 2021⁵. Rethink Robotics' industrial robot Baxter that aimed to 'revolutionise manufacturing' was ultimately discontinued in 2018 following underwhelming sales⁶.



¹Source: <https://www.foreignaffairs.com/world/fourth-industrial-revolution>

²Source: <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/four-fundamentals-of-workplace-automation>

³Source: <https://thevirtulab.com/what-is-amaras-law/>

⁴Source: <https://www.gartner.com/en/research/methodologies/gartner-hype-cycle>

⁵Source: <https://www.nytimes.com/2021/07/16/technology/what-happened-ibm-watson.html>

⁶Source: <https://www.engineering.com/story/rethink-robotics-shuts-down>

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And while Google's driverless car has racked up double-digit millions of autonomous miles, it still only operates in 2 US cities nearly a decade on⁷. *What does nearly a decade of experience in the area of robotics and automation tell us about what might be in store for the field of Artificial Intelligence?*

Three observations come to mind:

1. The initial hype may subside before adoption really starts to take hold
2. The most exciting breakthroughs sometimes come from the least obvious of applications
3. While big tech incumbents are expected to drive innovation in the short-term, this shall pave the way for small company success stories in the medium-term

1. The initial hype may subside before adoption really starts to take hold

While the long-term opportunities related to AI are significant and far reaching, there are always risks that the hype associated with the underlying technologies subsides before those same technologies are widely adopted.

The newsflow surrounding Generative AI and Large-Language Models in the first half of 2023 has been unrelenting and the speed at which the associated acronyms have become a mainstay in seemingly every corporate earnings call, no matter the industry or sector is astounding.

There is clearly a huge amount of upstream AI infrastructure investment taking place, as evidenced by Nvidia's doubling of revenue in just 12 months, which is almost unheard of for a company of such a size⁸.

⁷Source: <https://waymo.com/faq/>

⁸Source: <https://www.bloomberg.com/news/articles/2023-08-23/nvidia-gives-rosy-outlook-in-sign-ai-spending-remains-insatiable?sref=jalMV164>

⁹Source: <https://www.bloomberg.com/news/articles/2023-05-05/ai-scores-as-hot-topic-on-earnings-calls-as-interest-deepens>

¹⁰Source: Microsoft & Snowflake corporate earnings calls, July 2023

↑159%

Increase in AI mentions on conference calls from S&P 500 companies between Q3 2022 and Q2 2023⁹

But it will take time for upstream capital expenditure to be converted into durable company profits for a whole ecosystem. Downstream applications or adoptions of AI, even the first-movers, are not currently expected to contribute materially before the second half of 2024 or the first half of 2025 at the earliest, as CFO Amy Hood said of Microsoft's AI services and co-pilots such as Azure AI. Mike Scarpelli of Snowflake explained to analysts at their Q2 earnings call "It's going to take some time for AI [...] people are still struggling to get GPUs and there is a time lag between when a chip manufacturer sells the chips to [when] it gets built into the hardware that actually gets deployed on the rack, in a data centre, and actually gets deployed to customers"¹⁰.

Nevertheless, this hasn't stopped the share prices (and valuations) of a number of downstream players from sky-rocketing in the first half of 2023, as investors make bets on what 'could be' tomorrow rather than what 'is' today.

The challenge for these firms is three-fold: Will the fundamentals ever be able to match their elevated valuations? Once monetisation takes hold, will they be able to recoup their initial capital outlay and turn a profit? And how sustainable will those profits be once the mainstream catches up and the use of AI becomes ubiquitous?



So the expectation that a GPU purchased today will turn a profit tomorrow is a stretch to say the least. And the realities of what the margin of that profit will be are extremely difficult to predict at such an early juncture.

Nevertheless, over the longer run, the potential is undeniable. This is, in part, due to a democratization of future innovations and applications that is made possible thanks to generative AI's ability to converse in human language. Technical know-how is no longer a prerequisite for creative ideas or clever use-cases, anyone with a computer and a laptop can now write code, build apps, direct movies or compose a novel. And neither is technical hardware such a barrier to entry for new ideas as, thanks to cloud hosting, AI applications will be able to run on existing devices whether laptops, tablets or smartphones.

2. The most exciting breakthroughs sometimes come from the least obvious of applications

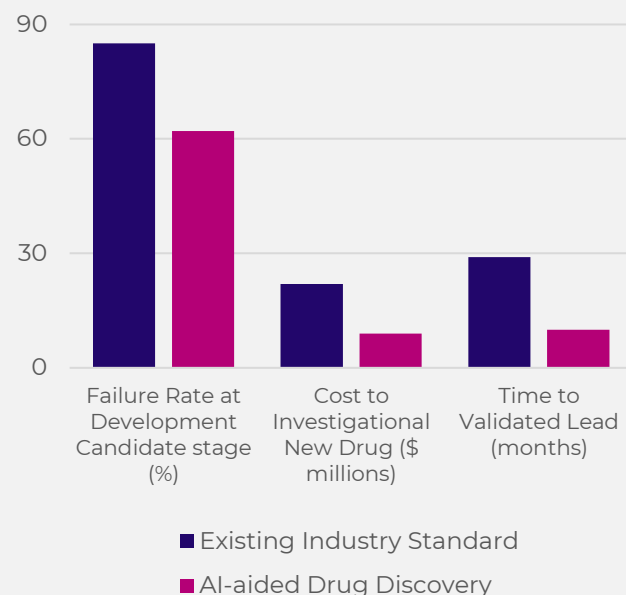
It's often the most creative and fantastical applications of AI that make the headlines, such as the potential of Generative AI to create personalised movies, with the ability for audiences to pick their own actors or even insert themselves into the storyline¹², or AI powered robotic bees that could support pollination and crop development to help stem biodiversity loss against a backdrop of declining honey bee populations¹³. But behind the headlines, AI is being put to work in areas such as drug development and chip design.

In November 2020, Google DeepMind's AI technology AlphaFold was recognised by a community forum of scientists as having found a solution to a 50-year old biology problem¹⁴.

For decades scientists had been trying to devise a method to reliably determine how the attraction and repulsion of amino assets leads to seemingly spontaneous protein structures with intricate curls and loops, called protein folds. The AI model that DeepMind developed, using the same foundational techniques that powered AlphaGo to victory against the legendary Go player Lee Sedol in 2016, is able to accurately predict the 3D structure of protein folds. AlphaFold's updated database, that today contains over 200 million structures was made freely available to the world in July of 2022¹⁴.

Thanks to AI innovations like AlphaFold, companies are now able to sift through billions of different molecules to simulate and understand how various drugs interact with the human body on a molecular, cellular or even genetic scale. This has the potential to significantly reduce drug development timeframes, improve success rates and ultimately reduce costs.

The Benefits of AI-aided Drug Discovery



Source: Recursion Pharmaceuticals as at 30/06/2023

¹¹Source: <https://jobs.netflix.com/>

¹²Source: <https://www.forbes.com/sites/kalevleetaru/2019/04/23/could-ai-replace-hollywood-with-personalized-movies/>

¹³Source: <https://isr.umd.edu/news/story/autonomous-drones-based-on-bees-use-ai-to-work-together>

¹⁴Source: <https://www.deepmind.com/research/highlighted-research/alphafold>



AI is also being used by the same chip designers, such as Nvidia, AMD and even Alphabet, whose processors are the workhorses of Large Language Models and Machine Learning systems, be it graphic processing units (GPUs), that are particularly good at parallel computing, data processing units (DPUs), which manage data transfer, encryption and compression in data centres or Application Specific Integrated Circuits (ASICs), that are complex processors designed for specific workloads.

A single printed circuit includes a raft of very small and very complex components, with many thermal and electromagnetic exchanges between them. Optimizing their placement involves simulating their interactions, which is a very iterative process. For example, physical implementation and verification which were long & delicate processes performed by humans for months, can now be accomplished by AI in a matter of hours. What's more, AI models learn and build upon all previous designs and make rapid simulations to come up with new chip architectures that are even more efficient and can be tweaked along the way by engineers.

US-based Cadence Design Systems' latest innovation for example has helped increase a chips power, performance area (PPA) by as much as 20% using generative AI design¹⁵.

"Our customers are realizing transformative results with our broad Generative AI portfolio [...] for instance, customers have seen up to 60 percent improvement in timing [and...] up to 10x increased engineering productivity."

Cadence's General Manager of Strategy and New Ventures claimed during a conference call in June.

3. While big tech incumbents are expected to drive innovation in the short-term, this shall pave the way for small company success stories in the medium-term

Experience teaches us that when a breakthrough technology emerges, a flurry of new start-ups, spin-offs or company pivots follow. However, given the investment needed in infrastructure, it will likely take time before we see a wave of disruptive innovations emerge outside of the incumbent tech firms. Foundational models, those with hundreds of billions of parameters, require significant 'compute' power and typically cost over \$50 million to build and train such models¹⁶.

Nevertheless, just as in the historic metaphor, popularised by Isaac Newton "If I have seen further, it is only by standing on the shoulders of giants", smaller and more nimble firms will be able to leverage the work of incumbents and build smaller and more specialised models.

These smaller and less power-hungry models could be trained on 1st party company or industry-specific data, with very specific applications. This would ultimately enable them to be deployed on 'edge devices' such as smartphones. This process is called 'knowledge distillation', where the knowledge from a large unwieldy model or set of models flows to a single smaller model that can be practically deployed under real-world constraints.

Indeed, platforms of distilled knowledge in the form of open-source models and datasets are already cropping up. Franco-American start-up Hugging Face offers both foundational and distilled models ranging from image classification and object detection to speech recognition and summarisation¹⁷.

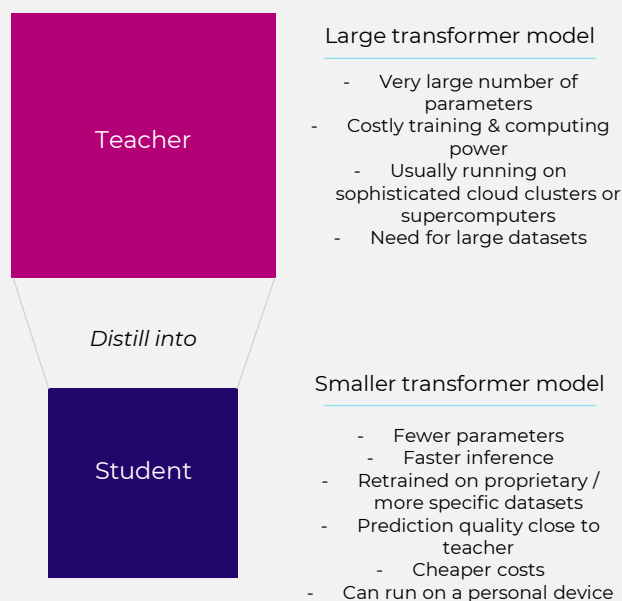
¹⁵Source: <https://www.forbes.com/sites/karlfreund/2023/06/13/cadence-ai-can-increase-chip-designer-productivity-by-over-10x>

¹⁶Source: Thematics AM, August 2023

¹⁷Source: <https://huggingface.co/>



Model Distillation or Compression Process



Source: Deepset.ai as at 14/04/2022

An interesting illustration of the knowledge distillation process, though paradoxically this time in reverse, is Nuance Communications. Since the late 90s, Nuance Communications have been developing and refining voice recognition systems. One of the company's first applications, called Dragon, was a pre-cursor to the virtual assistants we see in smartphones and smart-TVs today. Nuance's automatic speech recognition and speech to text technology has been adopted in healthcare, allowing doctors to dictate patient notes, in finance, enabling fraud prevention through speech recognition, and in retail, where their messaging apps can deliver personalised customer engagements through automated chat-bots.

Microsoft completed the acquisition of Nuance Communications in July of 2022 for \$17.2bn, a 23% premium to its closing price the day prior to announcement on April 12th 2021²⁰.

The deal has allowed Microsoft, who also owns a stake in OpenAI, to combine Nuance's expertise with OpenAI's GPT4 model and compute power.

This has already led to some impressive innovations in the medical field, with doctors able to reduce the burden of managing their patients electronic health records thanks to the combined technologies, helping reduce the administrative paperwork and increasing the time spent on patient care²¹.

So what are the take-aways for investors?

The field of Artificial Intelligence has been an exciting place to be for investors in 2023 and we expect similar spikes in enthusiasm in the future as new innovations akin to ChatGPT make headlines and grab the attention of the general public.

Although there will also be periods where seemingly very little progress happens, or where potential roadblocks emerge, one has to keep in mind the exponential nature of developments in the field, as illustrated overleaf by the graphic mapping the rise of AI over eight decades.

In a very dynamic and rapidly evolving investment opportunity set, investors have the challenge and the opportunity of identifying the long-term winners early on but, more importantly, avoiding "over-hyped" areas of the market that could be materially detrimental to performance (a distinction not offered via passive exposure of course).

It is likely that the winning strategies of tomorrow will be those that maintain consistent and long-term exposure to the most attractive opportunities in the universe, while adopting a strict valuation discipline to help smooth the inevitable ups and downs along the way. Indeed, we believe that the true value lies in the enablers of artificial intelligence rather than the adopters, for these are the companies that are poised to benefit from the continued exponential advancements in the field that we've witnessed since the 1940s²².

²⁰Source: <https://www.bloomberg.com/news/articles/2021-04-11/microsoft-is-said-to-be-in-talks-to-buy-nuance-communications>

²¹Source: <https://www.nuance.com/index.html>

²²Source: <https://ourworldindata.org/brief-history-of-ai>



And, in addition to using the last decade of robotics and automation as a lens to look at what the future might hold for AI, combining these two areas can present a novel opportunity-set for investors that not only balances two fields at different stages of their development and adoption (as well as with different cyclicity and valuations) but two fields with a myriad of mutual and self-reinforcing benefits.

Just ask IBM who launched, on August 28th 2023, a new advertising campaign (re)introducing their Jeopardy winning supercomputer under the new name Watsonx.ai, “A next generation enterprise studio for AI builders”. Included in its package are “selected open-source models” from Hugging Face²³, who just might help the tech giant’s Watson see further this time around. ■

The exponential rise of artificial intelligence since the 1940s

Although there will also be periods where seemingly very little progress happens, or where potential roadblocks emerge, one has to keep in mind the exponential nature of developments in the field of AI.



Source: OurWorldinData.org, <https://ourworldindata.org/brief-history-of-ai>, CC-BY, Original authors Charlie Giattino, Edouard Matthieu, Max Roser. Changes Made: Original title replaced and source extracted and displayed separately from image.

²³Source: <https://www.ibm.com/products/watsonx-ai>

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