From Hype to Reality: The Impact of Generative AI

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Anu Rajakumar:	Over the past year, artificial intelligence technology, also known as AI, has dominated front-page news as innovations continue to storm the marketplace. Consumer curiosity is leading to the quick adoption of these new capabilities. And Forbes advisor estimates that 64% of businesses expect AI to increase overall productivity. How far could the impact of AI extend beyond the realm of technology and what industries could it significantly impact? And finally, how does AI technology continue to evolve? My name is Anu Rajakumar, and today I welcome to the show Daniel Flax and Jamie Zakalik, research analysts with Neuberger Berman's equity research team to explore the ever-evolving world of AI technology and its potential to revolutionize various industries. Daniel, Jamie, thank you for joining me today.
Jamie Zakalik:	Great to be here, Anu. Thanks for having us.
Daniel Flax:	Thanks, Anu.
Anu:	So now as we open, we'd love it if we could start off with an overview of what's happening in the technology space, um, particularly because we had some pretty exciting stuff happening earlier this year. Maybe Dan, why don't you kick us off.
Daniel:	Anu, what we've seen over the past several years are that a lot of the forces driving the growth in cloud and artificial intelligence have been building very steadily. What we've seen this year though, is really an explosion into the collective consciousness of artificial intelligence and the power of it. What's going on is really a democratization of the capabilities. So anyone can access ChatGPT as one example. You can ask it questions about drug discovery, your homework, how to get from A to B with several interesting stops on the way. And so what we're seeing is that technology, a lot of what might be considered nerdy or geeky kinds of engagements with the computer or the cloud are really going mainstream. Everyone is a programmer. Anyone can access it very, very easily. So it's a very interesting, exciting, and groundbreaking period.
Jamie:	Right. Yeah. And I would just add on, you know, AI is not new. If you think about your Spotify account or your Netflix account, when you watch a show it recommends other shows or other songs that you should listen or watch and, you know, that is AI. But the difference this year is really what people are calling the ChatGPT moment, which is in December of last year ChatGPT came on the scene. It exploded in popularity. Everyone had a chance to really get hands-on exposure to what's called generative AI, or an AI that can really act like a human being on the other side. And it's created this urgency to invest from a lot of different companies to figure out how they can use this technology to create efficiencies in their business. And so that's really what we've seen over the last year.
Anu:	Yep. Absolutely. It's been incredible to see the growth. And I will admit that ahead of this podcast episode, I did use ChatGPT, I used the prompt, I am interviewing two technology research analysts, what questions should I ask them about artificial intelligence? And it's always interesting to see what comes back. But, you know, as you said, I think the difference is this is become mainstream. There's this democratization. You know, I recall that a few years ago the Metaverse was coined as the next big thing and it didn't have the same impact, right? Didn't have the same collective uptake, it didn't have the same market reaction that we've seen this year from the latest AI technologies. But I'm curious, A, why have we seen that big difference? Right? Is it because it's just the Metaverse is too nebulous and no one quite understands what it is? And then sort of related to that, have we seen the hype peak already? Is the hype cycle over for ChatGPT or is it the beginning of a new revolution?

Jaime: The Metaverse is an application, it's a workload, but it doesn't necessarily enable the breadth of technologies or the breadth of workloads that artificial intelligence can. And so the difference there is we've seen actual spending come behind this AI theme. Metaverse, you know, you had some companies change their name, you had investment in that space.

But what you're seeing this year, and it's really been reflected mostly in one of the companies I cover, which is Nvidia is billions and billions of dollars being put to work to build out artificial intelligence infrastructure. And so that's really been the big difference. Metaverse, you did not have the same level of urgency to invest in that sort of theme.

In terms of whether we're at the peak of the hype, obviously there's always hype around these new themes. I do think that maybe some of the excitement from even May and June of this year has subsided, but the investment is still happening. And so maybe it's less relevant in media and in retail investment excitement. But I do think the investment is still happening and we're very early days in this investment cycle. And so I think it'll be an exciting one for many years to come.

Daniel: If we think about one of the challenges in the Metaverse, the technology itself around the silicon as one example isn't really mature yet. And so I would expect the Metaverse or these worlds of augmented and virtual reality to get better and better later this decade. And so there's opportunities. And you are seeing the use of goggles or different kinds of physical technology tools in certain environments. But it's going to take a little bit of time.

If we step back and think about the hype that's surrounding generative AI at the moment, if we think all the way back to Y2K, the big build-out of tech, birth of search, social media, new business models, we saw it with Uber, we saw it with Airbnb. What's happening is that this technology, these new business models are getting launched into the world and they're gonna play out over years, really decades.

And so there is certainly a level of hype and excitement around ChatGPT, the power of AI. And what we see when we talk to customers and buyers of technology, is that they can visualize applications, this is more within the enterprise, but it's gonna take some time for it to really get built out and ultimately harnessed.

If we look in cloud environments though, what Google or Amazon and others are doing, there's real benefit today, and that's what's helping and really incentivizing them to spend incremental billions of dollars on their infrastructure because they're realizing a return on that investment in relatively short order.

Jaime: And I think Dan just made a very good point when you think about the difference between Metaverse and AI. Another difference is, every single enterprise around the world is looking at AI right now and trying to figure out how they can use AI to create efficiency in their business.

You didn't have that same catalyst with Metaverse. It wasn't as broad of a use case. So that is another reason why this seems to be sticking around a bit longer than the Meta hype from a couple of years ago.

Anu: Yeah, totally. That's great. You know, you both mentioned the massive investment by so many organizations around the world. Dan, you just mentioned, you know, the real benefit today. Let's dig into that just a little bit, focusing on the sectors that you cover in technology. What are some of the implications of these developments on the technology industry, for example?

Daniel: The changes that are underway now with the advancements in silicon, the clear use cases with a return on the investment that we have today are driving massive investments or incremental investments in these cloud architectures and the broader infrastructure. The reason is that we've already had a significant number of workloads and IT processes and applications move to the cloud, but it's still relatively early innings. People go there because you're able to harness the compute, the analytics, the artificial intelligence, with a flip of a switch.

If we think about the world a long time ago, people used to have power plants. Now you just assume that you're gonna plug a lamp into the wall and get your electricity. And so it's the same idea now in terms of clicking in into the cloud and being able to use that infrastructure. When we talk to customers, even those with multi-billion dollar budgets, a lot of them have emphasized that many of these new capabilities, they're going to look to harness and leverage them in the cloud. And so we expect to see a significant amount of growth and incremental investment in the cloud.

The other big opportunity, and this will build up over time, it's already underway today, is this idea of the edge. While many applications are being done in big data centers in the likes of Google or Amazon or Microsoft, many of the applications and uses for all of us happen in different environments. Think about in your car, in factories, think about all of these different use

cases where artificial intelligence can help you make better decisions in a particular environment. And so we see this growth opportunity at the edge as being something that's going to become even bigger over the next several years. And I suspect, Anu, one day we'll even wanna have a podcast around that too.

Anu: [laughs] We'll put it in the pipeline.

Jaime: Yeah. You know, when I think about the sector I cover, semiconductors. So semiconductors are the building blocks behind the infrastructure that supports artificial intelligence. And without getting too technical, the infrastructure that you need for AI is very different than the infrastructure you needed for more traditional types of compute and types of workloads.

So the biggest differences we're seeing today are these large cloud companies, and even some smaller companies, are trying to retrofit or invest in new infrastructure that can support artificial intelligence. And that really has driven significant demand for certain types of semiconductors. For example, accelerators are a type of component that you didn't really need or you needed less in more traditional workloads, but they are critical for artificial intelligence.

The prime example is the GPU and that's why Nvidia has been the biggest beneficiary to date. But there are plenty of others, and there's a lot of different pieces of the infrastructure that are going to change with AI. And so this inflection in investment from all these different companies and organizations has only been happening for the last couple of quarters. Again, we're in super early innings.

It's a very exciting time for the semiconductor industry. And because they're the building blocks behind what supports AI, semis are gonna be one of the first industries to really see this investment more substantially than others. But, again, it's still very early innings.

Anu: Yeah. I think to that point it is incredible to see how industries shift and change just as our life and new technologies come on board. It really is incredible. What are some other industries that you think will also see large shifts or changes or kind of benefit from these technologies?

Daniel: I think, Anu, that one of the most interesting developments as we look at the balance of the decade and really the next decade is this penetration of technologies into all of the other industries. As technology investors, we've been focused on the changes inside the tech industry for decades. And of course it's going into other industries, retail, automobiles, as two examples.

But if you think about the power of AI to change healthcare, as one example, think about leveraging the silicon, the analytics, the software to speed up drug discovery. If you can discover drugs much faster, at lower cost, personalize those drugs more, that has significant implications. We've obviously seen, over the past three to four years, just how important healthcare and new drugs and vaccines are to the broader society. So I think artificial intelligence has an even bigger role to play there over the next several years.

Think about other areas like financial services where fraud detection, as one example, can be improved through the use of artificial intelligence. Academics, architecture, a whole host of industries are gonna see artificial intelligence change how we think about it. And I would add that if we consider what's happened, I'll use Google and search as one example, we all saw the benefit of it when it first emerged two decades or so ago, but these have continued to change and to evolve.

And as all of us in the workforce today, the ability to harness these technologies to increase our productivity I think is incredibly important and powerful. And so there might be questions over time, can AI or technology replace individuals in the workforce in certain capacities? What I suspect we'll see is that over time, many, many more jobs are going to get created by using the technology, by building on the tools, the ChatGPTs that are out there, and enabling people to do new, creative, and exciting things, and move even faster. So I see a tremendous amount of opportunity given-given all the new tools that we have available.

Jaime: And beyond what we can see already, I think what's interesting is when you think back to the early 2000s and when smartphones were coming on and 4G LTE connectivity, no one really could imagine the impacts that social media would have on the world. It didn't exist. So I think there will be applications and workloads that we can't even imagine yet that AI is going to transform and deliver significant innovation.

Anu:	Well, and to that point, you know, we've talked about the power of AI to revolutionize so many aspects of our life, many for the positive. On the flip side of that, let's talk a little about limitations and challenges. What do you foresee are some of the aspects of this technology that folks should be aware of?
Jaime:	I think in the near term, one of the biggest challenges is finding ways to take this technology and create value for companies. Because you can't just invest, invest, invest and not see returns. So it's gonna be monetizing AI and figuring out how to use the technology to create value. I'd say longer term, there's a lot of concerns about how this technology can be used for, I'll say, for good and for evil.
Anu:	[chuckles]
Jamie:	So there will need to be ways to control the technology and make sure that it is used in responsible ways. And those are conversations that are ongoing at the highest levels of government and industry.
Daniel:	I think the issues we've seen around data security, privacy, who owns the data, who monetizes the data, how much transparency is there for users around how their data is getting used, I think all of that intensifies in the years ahead with this explosion of artificial intelligence.
	The other piece is around the regulatory frameworks. And so, governments, regulatory bodies around the world are trying to think through how best to manage this and ensure that the regulatory environment helps keep everything broadly on track while not quashing the innovation, the growth and really the potential economic benefit from this.
	If we step back and think about what's happened over the last couple of decades, and with certainty for the decades ahead, there are ramifications and implications across the economic, geopolitical, trade, social, academic environments. For example, we've seen the geopolitical challenges, the trade tension impact, how the US and China engage with one another. But in all scenarios, all sides are going to look to invest aggressively and likely develop different regulatory frameworks.
	The challenge for companies and really, individuals is trying to think through how they can harness this, how they can get a return on their investment, how they can keep their proprietary data secure, but still leverage it in a way that enables them to gain a level of competitive advantage. But most importantly, in all scenarios, the technology itself, in my view is going to advance incredibly rapidly. And so challenges, for example, around hallucinations, some of that will get solved. And as we think about the world ahead, it's going to be who can move quickly, thoughtfully, and really deliver valuable products and services to their customers.
Anu:	Absolutely. I think as I listening to both of your comments here on some of these challenges and risks ahead, I'm reminded of the famous words of Uncle Ben from *Spider-Man,* "with great power comes great responsibility," right? [chuckles] You've talked a little bit about the outlook and kind of what you think about the technology going forward.
	I'd love actually just to hear about how each of you are using the technology in your day-to-day roles as research analysts. Have you found any new ways that you are doing the work that you were doing a couple years ago, more efficiently? Any kind of use cases that you'd like to share?
Jaime:	I think right now there are still a lot of restrictions around how much you can use the technology just because of proprietary information. But for things like transcript summary, I think that is an awesome feature. We listen to 30, 40 earnings calls every earnings season. If you have three at the same time, you can get a transcript summarized in a minute from ChatGPT that saves a lot of time. So right now it's really around driving efficiencies and a lot of the activities that just are time consuming.
	Longer term it could be feeding models into ChatGPT and instead of going in and searching for, you could say, oh what was this gross margin line in 2011? And the model can just respond to you. So it's almost having a personal assistant. I think that's the longer term implication. But in the immediate term, I think for me it's been just driving efficiencies in a lot of those day-to-day activities.
Daniel:	What I've found interesting, and a lot of what we do is really building a mosaic and developing investment frameworks and really trying to come up with a differentiated view relative to the market about how we think about the growth and potential of a specific company. And so being able to augment our research process with finding information very, very quickly, especially as a lot of the opportunities extend, as we've talked about into other sectors. And so being able to draw on insights, sources, references, knowing it could be a hallucination is of course a factor, but being able to get to that very quickly is helpful.

And then longer term, when I think about how this technology will develop, there's a lot of innovation that happens in private companies and universities in many different environments that might not be as readily known about or accessible or publicized as some of the things might be in a given Wall Street earnings call or a conference. And so the ability to tap into that incredibly quickly and derive a level of insight there, I think will be very valuable to all of us.

Anu: Lovely. Thank you very much. Would love to end with hearing from both of you, what are your final thoughts? What are you most looking forward to? What are things that you'd like to leave our listeners with today?

Jaime: I think that it's just a really exciting time to be covering the technology industry. We have seen, as I mentioned, a couple quarters of real excitement around this, but I think this is a technology that is going to create significant value across the sectors that we cover, across the entire economy. And it's just a really interesting time to watch it evolve in real-time.

And I think we'll all look back at this ChatGPT moment in 10, 20, 30 years and think about all that has changed from that moment on. It's very early innings and that's something that people sometimes forget that, there's been a lot of investment already, but there's still so much to determine how this technology will be used. And I'm just really looking forward to seeing how things evolve and watching companies innovate and that's really what I'm most looking forward to.

Daniel: We've seen an extraordinary confluence of events over the last several years, on the healthcare front clearly with the pandemic, inflation's on the rise, interest rates are higher, geopolitical tension, war. There's a lot going on. And then you can now apply artificial intelligence at scale to try to make sense of the world and think about what are the opportunities to harness this technology and hopefully improve society in some places?

What I'm particularly excited about is some of the revolutionary advancements in healthcare is one example. If you can save people's lives, make them healthier, enable them to live a better quality, perhaps a longer life too, I think that's incredibly important. When I think about my kids and really the generations to follow, they are growing and changing quickly in this world of artificial intelligence, helping them to think through what are some of the pitfalls here? What are some of the ethical considerations that have to be thought through?

In many cases there's no right answer, there's no silver bullet, and the question I think more broadly as a society is whether we're gonna be able to develop frameworks, policies that are living, breathing, and enable our communities, our society, countries really, to coexist, advance, in key areas like trade. Clearly, the geopolitical dynamics are gonna remain fluid.

But I'm optimistic that there's a significant amount of opportunity and change that lies ahead and what we're focused on and what I think about is, how do we leverage a lot of this technology and try to use it for good and try to create additional opportunities while at the same time looking to keep our society and our communities safe and certainly aware of the challenges? But overall, Anu, I think it's a fascinating and very exciting time.

Anu: I absolutely agree with you. Thank you so much both of you for these terrific comments. I know this is something that everybody is thinking about, talking about, so I know our listeners will be thrilled to hear today's conversation. My final question is the bonus question, we talked a little bit about how you use artificial intelligence in your professional day-to-day, what is a use case of how you have used ChatGPT, for example, in your personal life, if you don't mind sharing a case study?

Jaime: Yeah. So this past summer I went on a trip to Italy, and when I was trying to think about where to go and what to do, I went to ChatGPT in the Spring and I said, "Okay, I have 10 days in Italy. I would like to do these sort of activities, make me an itinerary." And ChatGPT told me, you know where to go, gave me recommendations of where to stay, activities to do, restaurants. It basically was a personal travel agent for free, [laughter] which was really awesome and very helpful.

Anu: Great. Lovely, thank you.

Daniel: For me it's around my two daughters who are five and seven and trying to think about activities on a rainy day, help them find shows that are appropriate for them to watch on YouTube Kids where they seem to wanna spend all of their time. And they also like to bake. And so when we're looking for interesting concoctions, ChatGPT and other models and applications are very valuable. And so, it's changed my family life, that is for sure, Anu, but to the good so far.

Anu: Great. Thank you, again, both of you for those comments. We spoke about a lot of different topics today. While the hype may have settled from earlier this year, the massive investment continues from a number of organizations all around the world. I think society as a whole has recognized the power of AI to revolutionize industries. But of course, folks are gonna need to

think through and debate and discuss how to monetize, create value and also keep our society safe. And that's gonna need deep collaboration from both industry and government. But I think both of you have shared your optimism for what lies ahead. So we really appreciate you coming on the show and sharing those thoughts today.

Daniel: Thanks, Anu.

Jamie: Thank you so much for having us.

Anu: And to our listeners, if you've enjoyed what you've heard today on *Disruptive Forces,* you can subscribe to the show via Apple Podcast, Google Podcast, or Spotify, or you can visit our website, www.mb.com/disruptiveforces for previous episodes as well as more information about our firm and offerings.