

Artificial Intelligence and Needham Funds' Investments

“Artificial intelligence like ChatGPT will change our world and make it far more efficient.” – Bill Gates¹

The Explosion of AI on the Scene

During Microsoft’s (MFST) Q4 2022 earnings conference call, CEO Satya Nadella said, “the next big platform wave...is going to be AI” and that “a lot of the enterprise value gets created by just being able to catch these waves.” Artificial intelligence (AI) has been in the background of our lives for some time. The voice recognition of Siri, Alexa and Hey Google are based on natural language processing, an AI application. Social media platforms leverage AI to categorize images in order to uphold standards.

Recently, AI grasped the world’s attention with the November 2022 public release of ChatGPT. Within five days, over one million users tried it. In January 2023, Microsoft invested \$10 billion in OpenAI,² the company behind ChatGPT. Microsoft plans to utilize ChatGPT as the engine behind Bing search and as a key part of their Azure cloud, consumer and corporate products.

Not to be outdone, on February 6, 2023, Google (GOOGL) announced Bard, an experimental conversational AI service based on their LaMDA (Language Model for Dialogue Applications) technology. Meta (META), Twitter, Salesforce (CRM), and Apple (AAPL) all have initiatives of their own. All of these companies are laying the groundwork for a quickly evolving AI landscape.

In this Growth Factor, we highlight AI applications as predicted by NVIDIA’s (NVDA) 2023 AI Preview³ and how some of Needham Funds’ portfolio companies are currently providing technology for advanced semiconductors and servers needed for AI processing.

What is ChatGPT?

“ChatGPT is an AI model developed by OpenAI that can respond to natural language prompts and generate human-like text based on the input it receives. It uses a type of AI called deep learning, which involves training the model on a large dataset of texts so that it can recognize patterns and generate its own responses.

Think of it like a smart chatbot that can answer your questions and even have a conversation with you, but with a higher level of intelligence and understanding of language. It’s used in a variety of applications, including customer service, language translation, and even creative writing.”

Written by ChatGPT, February 2023

NVIDIA Predictions for AI in 2023

In December 2022, NVIDIA AI experts published their 2023 predictions for AI.³ We were struck by the number of our portfolio companies that may be positively impacted by these predictions.

1. “Digital Twins Get Physical: We will see large-scale digital twins of physical processes that are complex and multi-scale, such as weather and climate models, seismic phenomena and material properties. This will accelerate current scientific simulations as much as a million-x, and enable new scientific insights and discoveries.” - Anima Anandkumar, Director of ML Research, NVIDIA, and Bren Professor at Caltech

- Needham Funds’ Potential Impact: Altair Engineering, Inc. (ALTR), ESI Group (ESI-PAR), Lam Research Corp. (LRCX), Applied Materials, Inc. (AMAT) and Vishay Precision Group, Inc. (VPG)

2. “Biology Becomes Information Science: Breakthroughs in large language models and the fortunate ability to describe biology in a sequence of characters are giving researchers the ability to train a new class of AI models for chemistry and biology. The capabilities of these new AI models give drug discovery teams the ability to generate, represent and predict the properties and interactions of molecules and proteins — all in silicon. This will accelerate our ability to explore the essentially infinite space of potential therapies.” - Kimberly Powell, Vice President, Healthcare, NVIDIA

- Needham Funds’ Potential Impact: Bruker Corp. (BRKR)

3. “RAN [radio access network] in the Cloud: Network operators around the world are rolling out software-defined virtual radio access network 5G to save time and money as they seek faster returns on their multibillion-dollar investments. Now, they’re shifting away from bespoke L1 accelerators to 100% software-defined and full-stack, 5G-baseband acceleration that includes L2, RIC, Beamforming and FH offerings. This shift will lead to an increase in the utilization of RAN systems by enabling multi-tenancy between RAN and AI workloads.” - Ronnie Vasishtha, Senior Vice President, Telecoms, NVIDIA

- Needham Funds’ Potential Impact: Cambium Networks Corp. (CMBM)⁴

4. “AI Becomes Cost-Effective with Energy-Efficient Computing: In 2023, inefficient, x86-based legacy computing architectures that can’t support parallel processing will give way to accelerated solutions that deliver the computational performance, scale and efficiency needed to build language models, recommenders and more.” - Charlie Boyle, Vice President, DGX Systems, NVIDIA

- Needham Funds’ Potential Impact: Super Micro Computer, Inc. (SMCI) and Vicor Corp. (VICR)

5. “Moore’s Law on Life Support: As CPU design runs up against the laws of physics and struggles to keep up with Moore’s law — the postulation that roughly every two years the number of transistors on microchips would double and create faster, more efficient processing — enterprises increasingly will turn to accelerated computing. They’ll use custom combinations of CPUs, GPUs, DPUs and more in scalable data centers to innovate faster while becoming more cloud oriented and energy efficient.” - Kevin Deierling, Senior Vice President, Networking, NVIDIA

- Needham Funds’ Potential Impact: ASML Holding NV (ASML), AXT, Inc. (AXTI), Entegris, Inc. (ENTG), FormFactor, Inc. (FORM), MKS Instruments, Inc. (MKS), Nova Ltd. (NVMI), PDF Solutions, Inc. (PDFS)

6. “The Network as the New Computing Platform: Just as personal computers combined software, hardware and storage into productivity-generating tools for everyone, the cloud is fast becoming the new computing tool for AI and the network is what enables the cloud. Enterprises will use third-party software, or bring their own, to develop AI applications and services that run both on-prem and in the cloud. They’ll use cloud services operators to purchase the capacity they need when they need it, working across CPUs, GPUs, DPUs and intelligent switches to optimize compute, storage and the network for their different workloads. What’s more, with zero-trust security being rapidly adopted by cloud service providers, the cloud will deliver computing as secure as on-prem solutions.” - Kevin Deierling, Senior Vice President, Networking, NVIDIA

- Needham Funds’ Potential Impact: Equinix, Inc. (EQIX) and Akamai Technologies, Inc. (AKAM)

What does AI mean for the Needham Aggressive Growth Fund and Needham Growth Fund?

AI applications are likely to have significant impact across many industries. The Needham Aggressive Growth Fund and Needham Growth Fund are invested in many companies that enable the development and applications of AI models:

- Altair Engineering, Inc. and ESI Group S.A. provide physics-accurate modeling software used to create digital twins.

- Vicor Corporation's power conversion devices are used with NVIDIA and other AI processors.
- Taiwan Semiconductor Manufacturing Co., Ltd. (TSM) is the dominant manufacturer of leading-edge semiconductors used in AI processors. Its technology suppliers include ASML Holding NV, Entegris, Inc., FormFactor, Inc., MKS Instruments, Inc., Nova Ltd., and PDF Solutions, Inc.
- Super Micro Computer, Inc. servers are used in data centers by the largest internet companies, such as Amazon (AMZN) and Google, to run large AI models. The company has seen 100% year-over-year growth for the last few years, given the high demand and growing adoption of AI.

Conclusion

AI applications are poised to have a significant impact on numerous industries. The Needham Aggressive Growth Fund and Needham Growth Fund have invested in a number of companies that provide the necessary tools and technology to enable AI. We are optimistic about the potential of AI and anticipate further developments from our portfolio companies.

[1] <https://www.cnn.com/2023/02/10/bill-gates-says-ai-like-chatgpt-is-the-most-important-innovation.html#:~:text=Artificial%20intelligence%20like%20ChatGPT%20will,health%20care%2C%20and%20in%20education>

[2] <https://chat.openai.com/>

[3] <https://blogs.nvidia.com/blog/2022/12/13/2023-ai-predictions/#:~:text=Some%20of%20NVIDIA's%20experts%20in,any%20enterprise%2C%20application%20or%20budget>

[4] <https://www.cambiumnetworks.com/blog/cambium-networks-new-one-network-for-enterprise-and-msps-simplifies-operations-improves-efficiency-and-enables-delivery-of-outstanding-online-experiences/>

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Portfolio holdings are subject to change. Needham Growth Fund's ownership as a percentage of net assets in the stated securities as of 12/31/22: MFST: 0.00%, GOOGL: 0.37%, META: 0.00%, CRM: 0.00%, AAPL: 0.92%, NVDA: 0.00%, ALTR: 0.00%, ESI-PAR: 0.00%, LRCX: 0.87%, AMAT: 0.73%, VPG: 0.26%, BRKR: 0.43%, CMBM: 1.69%, SMCI: 3.92%, VICR: 3.57%, ASML: 1.02%, AXTI: 1.22%, ENTG: 5.39%, FORM: 2.20%, MKSI: 1.62%, NVMI: 3.05%, PDFS: 8.02%, EQIX: 0.00%, AKAM: 2.31%, TSM: 0.00% and AMZN: 0.00%.

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