GENERATIVE ARTIFICIAL INTELLIGENCE: THE NEXT DISRUPTIVE TECHNOLOGY

REGIONS
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Introduction

Due to the rapid pace at which generative artificial intelligence (AI) is being adopted across all industries, it is being compared to other disruptive technologies such as the advent of the internet in the early nineties or the introduction of the iPhone in 2007. Companies are abuzz with it and have mentioned AI in their latest earnings calls. Since its release in November 2022, ChatGPT (Generative Pre-trained Transformer, an example of a generative artificial intelligence chat bot that can take input in plain English and produce human-like responses) has caught everyone's imagination. In this piece, we will explore this new potentially disruptive technology, the difference between predictive and generative artificial intelligence, and its implications.

Generative AI

Artificial intelligence is the field which trains machines, mainly computers systems, to perform tasks that normally require human intelligence for problem solving. Historically, AI has been viewed as a predictive tool, where computer systems identify patterns in data and use statistical analysis to predict future outcomes. Generative AI, on the other hand can create new content. As mentioned in the introduction, ChatGPT can take input in plain English and produce human-like responses. It can write original stories and poetry. Artwork generated by generative AI has won awards at art competitions. Countless personalized original content has been published on social media using ChatGPT. Students are using it for homework help. In fact, Chegg, the online education platform company which offers homework help, saw its stock price drop 50% when it stated during its earnings call on May 2, 2023 that its new account growth rate had declined since the release of ChatGPT.

There are several key differences between predictive AI and Generative AI, and we will explore those now.

1. *Output*: Predictive AI algorithms recognize patterns in historical data and use statistical analysis to predict specific predictions based on input data. On the other hand, Generative AI, as its name suggests, can generate new content. To do so, Generative AI depends on neural networks and deep learning techniques. The two most common deep learning techniques are Generative Adversarial Networks (GAN) and transformer models. A GAN network contains a generator node as well as a discriminator node. The generator node is trained on large data sets to create a wide variety of outputs. The discriminator node is trained to distinguish between real output and AI generated output. This process is finetuned until the generative node output is recognized as distinct from the original content by the discriminator node. Transformer models are machine learning models that also involve encoder-decoder blocks where the encoder takes the input and breaks it down to tokens. The decoder uses these tokens along with attention mechanisms to generate the output. Attention mechanism assigns importance to few words that form the gist of a sentence. Transformer technology allows AI to learn relationships between words and sentences to form sentence patterns. This allows for quick training and reduces the need for structured data sets. Transformers are used to generate textual output while GAN is used to generate visual and multimedia outputs.

2. *Training:* To get the desired output, machine learning algorithms in AI have to be trained using large datasets. Training datasets include input as well as desired output data sets. Predictive AI models use supervised learning[1] where input data set is labeled. This always involves human supervision. Generative AI uses semi supervised or unsupervised learning[2], where the input data set is either partially labeled or not labeled. It uses machine learning algorithms to identify hidden patterns in the input data set with minimum or no human intervention. While supervised training is typically more accurate than unsupervised training, it is also more time consuming to label vast amounts of input data sets.

ChatGPT is an example of generative AI, which uses natural language processing, neural networks, and deep learning techniques to generate new and original content. It was developed by OpenAI, a nonprofit AI company. OpenAI has also created other generative AI tools like DALL-E, which can create images and art from a text prompt. There are many companies working on generative AI products from text to audio to 3-D models. It is also being used to predict protein structures for scientific research (Table 1)[3.]

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Table 1: Some Examples of Generative AI Models[3]

	Text	*Image*	*Audio*	*3-D*	*Video*	*Scientific Research*
Open AI	GPT-4	DALL-E2	Jukebox	Point D		
Meta	LLaMA	Make a Scene	AudioGen	Builder Bot	Make a Video	EMS Fold
Alphabet	LaMDA	Imagen	MusicLM	DreamFusion	Imagen Video	Alpha Fold 2
Amazon	Lex		DeepComposer			
Microsoft			VALL-E	Rodin Diffusion	Godiva	MoLeR

Investment Case

Generative AI is expected to touch all parts of the economy from advertising, to search, medical research, cybersecurity, supply chain management, and human resources. Most experts agree that generative AI will increase productivity by reducing time and effort needed to create new content. It is expected to automate routine tasks to streamline business. According to Goldman Sachs, generative AI can potentially raise global GDP by almost $7 trillion or 7% while raising productivity by 1.5% over a 10-year period [4]. Generative AI market size, which is estimated to be about $14B in 2023, is expected to grow by 31% CAGR to approximately $152B by 2032[5] (Figure 1).

Leading technology companies like Microsoft (MSFT), Meta (FB) and Alphabet (GOOG) are extremely focused on AI and mentioned it about 50 times each in their latest earnings call. While these technology leaders have announced cost cuts due to macroeconomic conditions, they are increasing their investments in generative AI. MSFT has been the most aggressive and announced, in January 2023, a multiyear multibillion dollar in OpenAI. This is in addition to its $1B investment in 2019. MSFT commitment is speculated to be about $13B or 45% of OpenAI's current valuation [8]. FB, GOOG and Amazon (AMZN) are developing their own generative AI models. Venture capital firms have also increased their investments in generative AI from $1.59 B in 2020 to $4.58B in 2022. $1.7B deals were made while $10.68B deals were announced but not completed in the first quarter of 2023[6]. Most of the generative AI pure play companies are private with OpenAI as the leader in valuation (Table 1)[8].
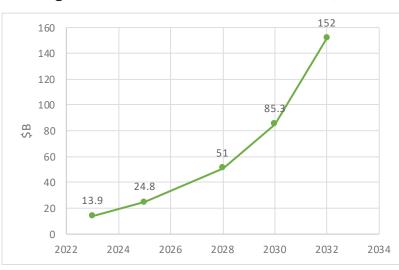
Figure 1: Global Generative AI Market ($B) [5]

Investing in generative AI can be also achieved as follows:

1. *Computation*: It is obvious that generative AI tools use a lot of computing power. Generative AI models have to be trained on vast amounts of data and need significant amount of fast processing capabilities for its algorithms. For example, Chat GPT was trained using 10,000 GPUs (NVDA, A100) and is eventually expected to need over 30,000 GPUs. Nvidia (NVDA) is the market leader in graphic processing units (GPU) with an estimated 95% of the market share for GPUs used in machine learning. NVDA's latest GPU, H100 which is 3x faster than A100. Generative AI is creating demand from Cloud service providers (CSP) like MSFT, GOOG and Amazon (AMZN), consumer internet companies like FB and enterprises like financial, healthcare, automotive and telecom companies. Along with its GPUs, NVDA also has the latest software and cloud-based services to train neural networks in generative AI. In April 2023, NVDA released its software, NeMO Guardrails, to prevent errors in chatbots like ChatGPT. There is some speculation that MSFT is also working with Advanced Micro Devices (AMD) for developing GPUs for generative AI.

Table 2: Largest Generative AI Companies[8].

Company	Focus Area	Products	Valuation Estimates, Company Status
Open AI	Content generation, editing	ChatGPT, DALL-E	$29B, private
Hugging Face	Generative AI forums, open-source AI model development	BLOOM	$2B, private
Cohere	Natural Language processing and scaling, enterprise conversational AI	Cohere Embed	$6B, private
Anthropic	Content generation, editing, text summarization, customer support	Claude, Claude Instant	$5B, private
Jasper	Language modelling, content generation	Jasper Art, Jasper Chat	$1.5B, private
Glean	Cognitive enterprise search, knowledge management	Glean search, Glean Work Hub, Glean Knowledge Management	$1B, private

2. *Search*: Internet search is expected to be an early beneficiary of generative AI. Search engine algorithms have not changed since their introduction in the 1990's. These algorithms give users lists of websites that contain relevant information. Search is monetized by advertising which is estimated to be $200B, or about 40% of digital advertising. With over 80% of market share, Alphabet (GOOG) has been the undisputed leader of search. Every percent of market share gain in search results in approximately $2B revenue opportunity. Generative AI is expected to revolutionize search by delivering answers and not just websites for any query. With its collaboration with OpenAI, MSFT is making a big push to gain search market share. In February 2023, MSFT announced that its search engine Bing was integrated with Chat GPT. Page visits to Bing increased by almost 16% whereas GOOG search was down 1% over the same period [7]. Along with a more comprehensive search, Bing is also expected to give a better chat experience which in turn can fine tune search results. In March 2023, GOOG also announced its own generative AI tool Bard, which is linked to its search engine.

3. *Software*: Generative AI is expected to advance software applications in multiple areas. Software companies that have the most installed base for their software applications will have access to large amounts of data which is needed for accurate training of generative AI. These are expected to benefit the most. Front end applications like marketing campaigns , customer analytics and advanced chatbots are expected to be some of the early uses of generative AI. According to Gartner Research, by 2025, 30% of marketing content will be created by generative AI compared to 2% in 2022 [9]. Salesforce (CRM) has one of the largest installed bases for its customer relationship management offerings. Generative AI can also be used to write code which should benefit MSFT and Oracle (ORCL). In desk top applications, Generative AI is being used for creative content, data analytics as well as process automation. Adobe (ADBE), Dropbox (DBX) and Intuit (INTU) are some of the companies that will be the early beneficiaries.

Summary

Since its release in November 2022, ChatGPT (Generative Pre-trained Transformer), a generative AI chat bot, has caught everyone's imagination. Unlike traditional/predictive AI, generative AI can create original content. It is considered a disruptive technology similar to the advent of the internet in the early 90s and the introduction of the iPhone in 2007. It has the power to change the way we work and is expected to affect all parts of the economy. It has the potential to increase in the global GDP by 7% over a ten-year period and the investment opportunities are numerous.

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