



ChatGPT, Large Language Models, and Generative AI as Future Augments of Surgical Cancer Care

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Released in November of 2022 as a public and free research preview, ChatGPT rapidly brought OpenAI's work with autoregressive large language modeling based on Generative Pretrained Transformers (GPT) into the mainstream.¹ Users from around the world were able to easily interact with the ChatGPT model through a simple web interface (chat.openai.com). This model has now been used to generate scholarly content, take board exams, and write discharge summaries.^{2,3} Less than 2 months from public launch, ChatGPT had more than 100 million active users and OpenAI.com became a top 50 most-visited websites in the world.⁴ The best explanation about why there was such rapid adoption and popularity might be directly from the source:

Author Prompt: "Why did ChatGPT become so popular?"

ChatGPT Response: "As an AI language model, ChatGPT became popular because of its impressive ability to understand and generate human-like language. It was trained on a massive amount of text data, using state-of-the-art machine learning techniques, which enables it to provide accurate and relevant responses to a wide variety of questions and topics... ChatGPT's ability to understand and respond to natural language queries makes it an attractive solution for businesses and individuals looking to automate customer support, personal assistants, and other applications. Furthermore, the availability of ChatGPT as an open-source tool makes it accessible to a wide range of developers, researchers, and enthusiasts who can use and improve upon the technology to create innovative applications. Overall,

*ChatGPT's popularity is a result of its advanced technology, versatility, and accessibility, which make it a valuable resource for a wide range of users and applications."*⁵

What immediately stands out when retrieving a response from OpenAI's consumer interface is the quality of the language, complexity and apparent nuance of the response, and ability to flexibly respond to a variety of input prompts. For those without significant experience with large language models, generative artificial intelligence (AI), and/or conversational AI, the first few moments interacting with the ChatGPT model can feel like magic.

GPT models are OpenAI's solution for several natural language processing tasks, including copywriting, parsing, classification, and summarization. ChatGPT is a fine-tuned model using GPT-3.5; its training framework includes Reinforcement Learning from Human Feedback (RLHF), which provides some human supervision.⁶ The model is trained using >400 billion tokens of internet content (100 tokens = approximately 75 words) to predict what comes next in the dataset: for example, completing a sentence.⁷ The final product is a model that allows a user to provide a dialogue-based instruction (input) and be provided a conversational response (output).

This type of AI-based chatbot, on its own, is not that new. There are numerous examples of failed attempts, including Meta's Galactica, which was released only 2 weeks before ChatGPT and shut down in less than 72 hours after it was found to frequently have incorrect, discriminatory, and offensive responses.⁸ However, where these others fell short is where ChatGPT has excelled by showcasing the capabilities of AI in understanding and responding to natural language. While there remain key shortcomings with ChatGPT, there is no arguing that OpenAI galvanized the pace of development and financial investment in conversational AI. Since the release of ChatGPT, Microsoft expanded its partnership with OpenAI through a multiyear, multibillion-dollar investment, Google released Bard, a conversational

AI chatbot founded on their Language Model for Dialogue Applications (LaMDA), and Meta announced their own new language model: LLaMA. The ability to access and fine-tune these models will provide a framework to create new and innovative solutions for real world problems. This includes considering ways to improve patient care through language-driven processes, such as provider documentation, patient education, written instructions, care coordination, and supporting clinical decision support. Keeping up to date with this rapidly changing field is challenging, and several groups, including our own (www.anailab.com/generative-ai), now keep track of higher-quality applications with domain-specific relevance.

Large language models are examples of generative AI—a discipline characterized by the use of foundation models to facilitate adaptation to a series of generative tasks that include the creation of text, images, music, and video.⁹ Despite the excitement and enthusiasm surrounding generative AI, effective use of these tools requires an understanding of their foundation models. To accomplish this, dedicated interdisciplinary groups are being formed to advance the science of foundation models through evaluating biases, identifying limitations, providing transparency, and forecasting misuse before deployment at scale.¹⁰ As generative AI moves to privacy-sensitive domains, including medicine and surgery, understanding data handling and processing is paramount. As with the adoption of any new technology, responsible integration of generative AI into clinical care will necessitate careful stewardship. Capitalizing on practical training opportunities in informatics, collaborating with developers, and establishing research priorities can equip surgical oncologists with the tools to assess the safety and utility of these products.

This includes recognizing the potential harms that could come with incorporation of generative AI models into surgical practice. Because generated content is dependent on the data used during model training, it will reproduce the biases, stereotypes, and toxicities present in the training data. This could lead to the perpetuation of harmful discrimination, unjust representation, and inequitable practices when these models are implemented.¹¹ Another area of concern is when humans directly engage with generative AI models through web-based interfaces, chatbots, or other types of conversational agent systems. By anthropomorphizing AI systems, human users could be exploited to divulge private information or even be nudged into certain behaviors. A specific risk associated with large language models, including ChatGPT, is the potential to create plausible sounding, but factually incorrect statements. This can result in dissemination of misinformation and incorrectly advising users with false information.¹² Especially vulnerable are users who do not have the necessary expertise to critically appraise the accuracy and context of generated material. Each of these concerns

are even more important in settings where the stakes are high and there is no tolerance for misuse, such as surgery.

Still, it is difficult not to get excited about the potential impact of generative AI, especially when speculating on products that extend beyond text generation. Disciplines with large amounts of underlying data that facilitate the development of foundation models and their fine-tuning for specific use cases, such as oncology and surgery, are ripe for disruption. This has already started. Absci, a drug creation company, is using generative AI to design new antibodies against common targets to rapidly accelerate the pace of pharmacologic development.¹³ Subtle Medical is using generative AI to improve radiographic imaging (including preoperative images) by speeding acquisition and standardizing quality.¹⁴ Other areas of growing interest in the application of generative AI include treatment selection, therapy sequencing, drug discovery, and operative planning, to name a few.¹³ These examples emphasize how the first ways AI will improve surgical oncologic practice will not be through replacement, but instead through augmenting and teaming with users.

Prompting the ChatGPT model with a question and getting back a fluent, cohesive, and (usually) accurate response makes these often-promised applications of AI for precision oncology appear much more achievable.

Author Prompt: “How does ChatGPT think generative AI will change surgical oncology?”

ChatGPT Response: “Generative AI has the potential to significantly improve the accuracy, efficiency, and precision of surgical oncology, leading to better patient outcomes and a more personalized approach to cancer treatment.”⁵

ChatGPT is, of course, not magic. It is the product of careful and iterative deployment that is supported by rigorous research, pilot use cases, and frequent review of misuse. Understanding the model’s history and how generative AI is growing as a field is crucial for responsibly using these technologies in cancer care moving forward.

DISCLOSURE ChatGPT was only used where directly quoted in the body of the article and otherwise not used in the writing process for this article.

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