

An Analysis of Applications and Limitations of ChatGPT

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ABSTRACT

ChatGPT, the Generative Pretrained Transformer developed by OpenAI, has the potential to impact various fields. It is a robust language model that could significantly change how humans communicate with technology. ChatGPT rapidly became well-known for its thorough responses and well-spoken comments in a variety of subject areas. Text completion, text generation, and language translation are just a few among the many different natural language processing tasks which ChatGPT can be used for. The applications of ChatGPT are explored in this paper. The benefits and limitations of Chat GPT are also examined in this paper.

Keywords: Chat GPT, Natural language processing, OpenAI.

I. INTRODUCTION

A more innovative and complex technology for creating digital material, such as generative artificial intelligence, has emerged as a result of recent developments and expansion in machine learning.

Generative modelling artificial intelligence (GAI) is an unsupervised or partially supervised machine learning framework. There are two major generative AI – Generative Adversarial Network (GAN) and Generative Pre-trained Transformer. GAN uses two neural networks (i.e., generator and discriminator networks).

The discriminator network assesses the authenticity of the content to determine if it is authentic or fake after the generator network generates synthetic data (such as a face image) (e.g., whether the image of the human is real or fake).

In order to read and produce text that is similar to what a human would write, Generative Pre-trained Transformer (GPT) models use a significant amount of publicly available digital content data. These models can also demonstrate creativity in writing anything from a single paragraph to a full research article that is convincing on almost any topic.

These models can even interact with customers in human-like conversations, like chatbots used for customer care or video game characters.

Recently, a more advanced Generative Pre-trained Transformer (GPT)-3 was created. GPT-3 was created using 175 billion parameters to increase task agnosticism and even compete with earlier state-of-the-art fine tuning techniques. GPT-3 is ten times more than any previous non-sparse language model. ChatGPT has drawn interest from a multitude of sectors, including but not limited to those in education, engineering, journalism, economics, and finance.

II. WHAT IS CHAT GPT?

One of the most intriguing developments in the field of artificial intelligence is ChatGPT, a cutting-edge big language model developed by OpenAI. It is highly suited for jobs like conversation generating and question answering because it is built to reply to complicated questions and generate humanlike prose depending on a given context. It has the capacity to hold spontaneous, open-ended discussions about a variety of subjects. Natural language processing tasks like text completion, dialogue development, language translation, and music composition can all be done with it. Even creative writing, poetry, and even code can be produced using it.

ChatGPT has already had a big influence and is anticipated to advance quickly in the years to come. A week after ChatGPT's initial release into the public domain on November 30, 2022, it had more than a million subscribers.

The way we engage with technology stands to be completely changed by ChatGPT. Our model has been trained on a vast quantity of data, enabling it to produce human-like prose with astonishing accuracy and a deep comprehension of a variety of topics and linguistic nuances. ChatGPT can produce writing that is frequently difficult to tell apart from text written by a human thanks to this pre-training. In a variety of applications, it has the potential to enhance natural language processing (NLP) and natural language understanding (NLU). Virtual assistants, chatbots, and other conversational interfaces can all run on ChatGPT-3.

ChatGPT was trained utilising reinforcement learning from user feedback in a conversational fashion. In order to improve the model, humans give feedback (i.e., rewards) by rating the quality of machine responses. ChatGPT is able to respond to follow-up enquiries, acknowledge mistakes, refute false premises, and reject inappropriate queries as a result of the new development methodology. ChatGPT provides "more imaginative" responses in comparison to other AI language models.

Because of its capacity to produce high-quality conversations, ChatGPT has taken off in the society since its release. High-quality conversation, complicated reasoning, chain-of-thought (CoT), zero/few-shot learning (in-context learning), cross-task generalisation, and code understanding/generation are just a few of the emergent skills that ChatGPT acquires.

GPT-3" stands for "generative pre-trained transformer," version 3. ChatGPT (Chat Generative Pre-training Transformer) engages in chat interactions with users. The GPT system is an artificial intelligence tool that is available online for free usage by anyone and can produce unique, occasionally inventive, and oftentimes engaging literature on (nearly) any topic. Actually, GPT "composes" brand-new, oddly sensible sentences in response to human input. It is capable of writing in a range of tenses and styles.

III. HOW DOES CHATGPT WORK?

ChatGPT primarily gains from large language models (LLMs), which train enormous neural network models with big amounts of data using language models (LMs). LM, a self-supervised sign in text, attempts to anticipate the likelihood of the subsequent words based on the context given above. Large amounts of textual data are available on the Internet, therefore pre-training the model using LM is a logical option. Current research demonstrates that performance improves as model size and data volume grow. As the scale of the model and data reaches a particular level, the models acquire emergent abilities. However, LLM training takes a lot of time and effort.

GPT-3 is pretrained on 45 TB of text data with supercomputers (285 000 CPUs, 10 000 GPUs), costing 12 million dollars. In tasks requiring zero-shot learning, GPT-3 significantly improves performance and has contextual learning capabilities not present in small models.

Then, other techniques are applied to enhance reasoning, long-range context modelling, and task generalisation, including code pretraining, instruction, and reinforcement learning from human feedback (RLHF).

The transformer architecture, a class of neural network that has proven to be particularly successful for tasks involving natural language processing, is the foundation of ChatGPT. It learns to produce content that is comparable to the content it was trained on after being exposed to a big dataset of text, including books and articles. The model processes the input and produces a response in response to a prompt or context. The model predicts the subsequent word based on the input and the words it has already generated. The response is generated one word at a time. The model makes use of attention mechanisms to concentrate on the input's most important elements and produce a response that is logical and pertinent to the situation. By giving the model task-specific examples and refining the model based on this data, the model can be fine-tuned on a specific task such as question answering or dialogue generation after the training. By adjusting the model on the multilingual dataset or by giving the model the language code, it may also produce text in multiple languages.

IV. FEATURES OF CHATGPT

Generalization: ChatGPT creates responses with many turns that correspond to the user's purpose. The user experience in conversational interaction mode is considerably improved by ChatGPT's ability to capture previous dialogue contexts to address specific hypothetical inquiries. ChatGPT is improved using RLHF and instruction tuning so that it may learn to generalise tasks and respond to input from people.

Correction: ChatGPT is capable of openly acknowledging its errors. If users point out its errors, the model adjusts the response in light of their suggestions. Moreover, ChatGPT can debate faulty questions and then provide an effective guess.

Safety: With the consideration of ethical and political concerns, ChatGPT is good at rejecting problematic queries or producing safe answers. The model is informed by supervised instruction tweaking of which responses are more plausible. Also, the explanations are included with the response, making it simpler for users to accept the outcomes.

Creativity: In creative writing assignments, ChatGPT performs well and even has the ability to refine its work. These writing assignments include brainstorming, coming up with stories or poems, coming up with speeches, and many others.

V. APPLICATIONS OF CHATGPT

Education

The educational sector has the potential to benefit greatly from ChatGPT. Students can receive individualised instruction and feedback via ChatGPT based on their unique learning requirements and development. According to a study by Chen and colleagues (2020), a conversational agent based on a generative model (ChatGPT) can offer pupils individualised arithmetic instruction, leading to better learning

outcomes. The study demonstrated that the conversational agent was capable of tailoring its explanations to students' assumptions and adapting to their level of comprehension.

Essay grading can be delegated to ChatGPT, freeing up teachers' time to concentrate on other facets of teaching. It has the ability to recognise crucial components of well-written essays and was successful in producing feedback that was comparable to that of human graders. A wider audience can access instructional resources by using ChatGPT to translate them into several languages. It can accurately translate sentences from one language into another while comprehending their meaning in the original language.

Students can engage in verbal interaction with a virtual tutor using ChatGPT to design interactive learning experiences. It has the capacity to comprehend students' inquiries and offer pertinent and suitable answers. It is possible to develop adaptive learning systems using ChatGPT that change their instructional strategies in response to a student's development and performance. It could offer students studying programming more efficient help, leading to higher success on programming tests. It has the capacity to recognise students' prior knowledge and modify the level of difficulty of the problems it created accordingly.

By offering individualised tutoring, automated essay grading, language translation, interactive learning, and adaptive learning, ChatGPT has the potential to be an effective tool for enhancing education and learning.

ChatGPT as a search engine

One of ChatGPT-3's primary characteristics is its capacity to serve as a search engine, enabling users to enter questions and obtain precise and pertinent results in return. The ability of ChatGPT-3 to comprehend and reply to natural language questions is one of the search engine's key benefits. By doing this, users can enter inquiries without having to use specific words or phrases, just like they would when asking a person a question. For many people, this can make the search process more simple and user-friendly.

The capacity of ChatGPT-3 as a search engine to deliver data that's relevant to the context is another benefit. ChatGPT-3 can comprehend the purpose behind a query and deliver information that is specifically relevant to the query being asked, as opposed to just returning a list of links. By giving consumers the information they require more quickly and effectively, this can save them time. ChatGPT-3 is a potent tool for content generation because it can also produce new text. Businesses and organisations trying to develop interesting and educational content for their websites or social media platforms may find this to be particularly helpful.

Coding

One of the major advantages of using ChatGPT-3 for coding is its capacity to comprehend natural language inputs. This allows developers to input code snippets or specific commands in the same way they would ask a question to a person, rather than needing to use specific keywords or terms. ChatGPT-3 is an effective tool for code generation because it can also produce new code. As a result, engineers working on complicated projects can produce boilerplate code or automate tedious operations with relative ease.

Detect security vulnerabilities

The potential to aid in the discovery of security flaws is one of ChatGPT-3's primary advantages, making it a useful tool for security experts and researchers. The capability of ChatGPT-3 to comprehend inputs in natural language is one of its key features for security vulnerability detection. The capability of ChatGPT-3 to give contextually pertinent information is another benefit for the discovery of security vulnerabilities. ChatGPT-3 can comprehend the purpose behind a query and deliver information that is specifically relevant to the

vulnerability being searched. The time that security professionals would otherwise spend getting the information they require could be saved.

Social media

One of the primary aspects of ChatGPT-3 is its capacity to assist with social media activities, making it a significant tool for marketers, organisations, and individuals. One of the key advantages of adopting ChatGPT-3 for social media is its ability to read natural language inputs. This can make the process of creating content more simple and efficient.

By giving marketers the information they require more quickly and efficiently, ChatGPT-3 can save them time. Moreover, ChatGPT-3 has the ability to produce fresh material, making it a potent tool for developing interesting and educational social media postings. Businesses and organisations trying to produce social media content that appeals to their target audience may find this to be of special use.

Integration with other technologies

Integration with other AI systems like computer vision and robotics is one of ChatGPT's most exciting future directions. We can develop intelligent and conversational AI systems that could fundamentally alter how humans interact with technology by fusing ChatGPT's conversational capabilities with the physical and visual capabilities of computer vision and robotics. Imagine being able to communicate in natural language with your smart home system in the future to control the lighting, temperature, and other appliances, or with a robot that can help you with chores like cleaning or grocery shopping. Better natural language generation and a more smooth, user-friendly experience for users will result from this development in communication.

Increased Personalisation

More personalisation and customisation through learning from user interactions and preferences is a fascinating potential for ChatGPT. In order to produce more individualised and accurate responses, ChatGPT can learn about users' language, tone, and style through continued user interaction. As a result of ChatGPT's ability to be trained to more effectively recognise and cater to each user's unique requirements and preferences, this greater level of personalisation can also result in better customer service and education.

VI. LIMITATIONS

Despite its strong conversational capabilities, ChatGPT has a few drawbacks.

Accurate logic issues are difficult for ChatGPT to handle (e.g., math or first-order logic). Frequently, ChatGPT gives the wrong solutions to mathematical or logical issues that have definite rather than probabilistic solutions. ChatGPT continues to produce biased or inaccurate factual responses. Although generative AI models have an inherent problem with this, ChatGPT performs around averagely in this area. The veracity of the information generated remains a crucial tenet for such generative chatbots.

ChatGPT is unable to do real-time website searches to find out new information. Therefore, it is challenging to replace the knowledge contained in the model. The model stores the information obtained from the extensive corpus in distributed representations, which are opaque, difficult to manipulate, and difficult to understand.

Whilst ChatGPT is strong in delivering safe and harmless responses, the system may still be vulnerable to attacks, including instruction attack (having the model obey a false order to do something unlawful or unethical) and prompt injection.

Because ChatGPT-3 can't yet fully comprehend the subtleties of human language, it might not always give the most accurate or helpful information. Moreover, it cannot process some requests, such as those requiring mathematical calculations.

Because ChatGPT-3 is still developing, it may not always offer the most accurate or helpful information regarding security issues. Moreover, some types of inquiries, such reverse engineering or virus analysis, cannot be handled by it.

Limited Understanding: Because they are trained on statistical patterns in the data, generative models lack a meaningful knowledge of the ideas they are supposed to assist students learn. When it comes to giving explanations or feedback that are specific to a student's requirements and misconceptions, this may be a drawback. According to a study by Wang and colleagues (2020), a teaching system based on generative models was unable to offer explanations that were specific to students' assumptions.

Bias in Training Data: Since generative models can only be as good as the data they are trained on, they will be prejudiced if the training set contains biases. A model may not be able to accurately assess essays submitted by students from other demographics, for instance, if it was trained on a dataset of essays that were largely written by students from one particular population. In a study published in 2016, Bolukbasi and colleagues found that a generative model that had been trained on a significant volume of online content had gender bias in its language creation.

Lack of Creativity: The creativity and originality of the responses may be constrained by the fact that generative models can only provide answers based on the patterns in the data they have observed during training. A generative model-based music composition system had a limited capacity to produce unique and varied tunes, according to a study by Ziegler and colleagues (2019).

Dependency on Data: The quantity and quality of the data used to train generative models play a significant role in the model's performance. The model won't function as well if the data is insufficient or irrelevant. A generative model-based question-answering system performed poorly when the training data was unrelated to the task at hand, according to a study by Kocaguneli and colleagues (2019).

Lack of Contextual Understanding: The inability of generative models to comprehend context and situation can result in improper or irrelevant responses. A generative model-based dialogue system had a limited capacity to comprehend and generate contextually relevant responses in a conversation, according to a study by Gao and colleagues (2019).

Limited ability to personalize instruction: ChatGPT and other generative AI models can offer advice and broad knowledge, but they might not be able to tailor lessons to each student's unique needs. (Ribeiro and Vala,2020).

Privacy: The use of ChatGPT and other generative AI models in education raises issues of privacy and data security.

VII. CONCLUSION

The future of ChatGPT will also heavily depend on the continuing improvement of language model performance via improved training algorithms and more datasets. These models' precision and capacity to

comprehend and reply to complicated issues will keep getting better as more data is fed into them. This could result in novel and creative applications in industries like healthcare and finance, where the capacity to comprehend and analyse vast amounts of data is essential. Additionally, the creation of fresh and cutting-edge language-based applications in fields like game design and creative writing is an intriguing prospect that may have a big influence on how we engage with technology.

As ChatGPT and big language models go into the future, there are a lot of promising opportunities for this technology to improve our lives and alter how we engage with technology. In order to improve education and support students' learning, policy officials, academics, educators, and technology experts might collaborate and start discussions on how these growing generative AI tools could be utilised securely and constructively.

There are many exciting opportunities for this technology to improve our lives in meaningful and beneficial ways, from the interaction with other AI technologies to the potential for enhanced personalisation and customization to the ongoing improvement of language model performance. But, while embracing these technologies' potential to improve our lives, it is up to us as a society to thoughtfully assess and address the ethical and societal ramifications of them.

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