Opportunities and Challenges of ChatGPT in Academia: A Conceptual Analysis

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Abstract

ChatGPT, also known as GPT-3, is an AI-based natural language model that has gained a lot of attention in recent times due to its potential applications in various sectors including academia, health, and the like. This AI model is able to offer various automated tasks in the academic sector which were traditionally performed by humans consuming a huge time and effort. This short communication aims to explore the possible opportunities and challenges of ChatGPT in the academic domain. To attain this objective, data are collected from online resources and analyzed following the noticing-collecting-thinking model. As outcomes, the opportunities and challenges of this AI model are described into four concerns of academic domain including research, education, personal skill development and social.
SHORT COMMUNICATION

Opportunities and Challenges of ChatGPT in Academia: A Conceptual Analysis

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Summary
ChatGPT, also known as GPT-3, is an AI-based natural language model that has gained a lot of attention in recent times due to its potential applications in various sectors including academia, health, and the like. This AI model is able to offer various automated tasks in the academic sector which were traditionally performed by humans consuming a huge time and effort. This short communication aims to explore the possible opportunities and challenges of ChatGPT in the academic domain. To attain this objective, data are collected from online resources and analyzed following the noticing-collecting-thinking model. As outcomes, the opportunities and challenges of this AI model are described into four concerns of academic domain including research, education, personal skill development, and social.

KEYWORDS:
ChatGPT, GPT-3, academia, challenges, opportunities, conceptual analysis

1 INTRODUCTION

ChatGPT (Chat Generative Pre-trained Transformer), also known as ChatGPT, is a Natural Language Processing (NLP) model based on deep learning algorithms. This model was developed by San Francisco-based Artificial Intelligence (AI) research and deployment organization OpenAI. The objective of developing ChatGPT was to assist users as a dialogic agent in natural language providing helpful and accurate information like customer service, chatbot, and alike. For this, ChatGPT was trained with a massive dataset sourced from the internet. This dataset includes a wide range of text genres, such as news, articles, scientific papers, social media posts, etc. in different topics and languages. The exact size and composition of the training dataset can be estimated to be on the order of hundreds of gigabytes or more. The goal of the training process is to learn patterns and relationships within the text data that allow the model to generate human-like responses to various questions and prompts.

The working procedure of ChatGPT can be described briefly through Figure 1. The working process can be divided into two types: Query and Response. The device behind the ChatGPT is an artificially intelligent super-computer. This computer is trained on a massive dataset with numerous parameters. This supercomputer is unsupervised learned to identify the patterns of input data by determining the statistical structure within the data. Generally, a user can make a Query to the ChatGPT. This query is directly sent to the super-computer. Now, the query is processed by the super-computer. The output generation circuitry generates the probable outputs and then the output data are fine-tuned. After that, ChatGPT is instructed to respond. Finally, ChatGPT, the conversational interface, interacts with a human by providing a human-like response.

ChatGPT can perform a wide range of functions in the academic sector, for example, automated essay writing based on the context and mode (formal, informal, etc.), providing instant feedback to any text leading to enhancing the quality and accessibility of education. On the other hand, ChatGPT can create some challenges in the academic sector also including...
generating biased output, difficulties to ensure academic integrity, diminishing individual writing skills, etc. So, to understand the implications of ChatGPT in the academic domain as well as to improve the quality of education with effective and efficient use of this AI model, it is necessary to explore the opportunities and challenges of this AI model in academia. Therefore, the objective of this research is to explore the challenges and opportunities of ChatGPT in academia.

Some challenges of using ChatGPT in the academic sector include the potential for biased output, limitations in its abilities, and issues with ensuring academic integrity. Additionally, there may be concerns about reducing personalization and the potential for job loss among human teachers and tutors.

2 METHODOLOGY

To explore the opportunities and challenges of ChatGPT in academia, the related online resources (news, reports, etc.) and published articles were searched and selected via Google and Google Scholar. The selected literature was then reviewed and analyzed following the noticing-collecting-thinking model. This data analysis model is generally used for the complex and rigorous practice of qualitative data analysis into three phases - noticing, collecting, and thinking.

In Noticing phase, the selected literature was meticulously reviewed and tried to notice if any concern is related to the opportunities and challenges of ChatGPT in the case of academia. In Collecting phase, all the noticed concerns (opportunities and challenges) were collected and organized in a tabular format. Finally, in Thinking phase, all the listed concerns were analyzed and synthesized to highlight the opportunities and challenges and grouped into four themes (research, education, personal skill development, and social). This process was iterated several times unless the authors reached a consensus level about which information (opportunities and challenges) can be considered final.

3 OPPORTUNITY

In the field of academia, ChatGPT may have several potential opportunities and applications. These can be divided into four broad categories:
(a) **Research:** Since ChatGPT is a highly advanced AI language model, it can make significant contributions to the research domain by assisting researchers in various tasks and by facilitating new discoveries. For example,

- Facilitate NLP: ChatGPT can be used as a tool for NLP researchers to test and upgrade the state-of-the-art in language understanding, generation, translation, classification, and categorization, etc. This model is also able to identify different parts of speech, entities (like a person, organization, location, etc.), and sentiment (positive, negative, neutral) for a sentence.

- Promote creativity and innovation: By automating the repetitive and troublesome tasks, ChatGPT can assist the researchers as such ChatGPT may assist to collect data, reviewing the literature, and synthesize data that prompts the researchers to contribute more in creative and higher level tasks. In turn, this model can also offer a more cost-effective and efficient solution in some cases.

- Improve data analysis and interpretation: The text summarizing capability of ChatGPT can help researchers with a better understanding of existing knowledge on a specific topic. ChatGPT can analyze large data sets refined from a large number of texts without human involvement which in turn may produce interesting patterns that can be difficult to reveal through traditional approaches to data analysis.

- Provide additional resources: ChatGPT can provide users with additional relevant information and resources on a particular topic which may benefit in pursuing academic research and projects.

- Support research in an emerging technology: ChatGPT can provide up-to-date information on emerging technologies and their applications, making it easier for individuals to conduct research in these rapidly changing fields.

(b) **Education and Knowledge Retrieval:** ChatGPT can be used as an educational tool to assist students as well as teachers in retrieving knowledge and information:

- Enhance collaboration and peer learning: ChatGPT’s sophisticated language processing abilities can facilitate cross-field collaboration that may enable students from diverse disciplines to communicate and collaborate more effectively. The model’s ability to answer questions and provide information can encourage knowledge sharing and peer-to-peer learning among students. ChatGPT’s language generation features can aid in better communication, promoting the exchange of ideas and knowledge, resulting in more productive collaboration and peer learning.

- Support needs for special education: ChatGPT has the capacity to address a broad spectrum of disabilities, including difficulties with reading, writing, and communicating. High-quality education for people with disabilities can be achieved through the implementation of inclusive education practices, the provision of assistive technology and accommodations, and the training of teachers and staff to support students with disabilities. ChatGPT can allow students to access educational resources like a wide range of subjects, study materials, and online courses. This can help students from low-income, rural, and remote communities and provide them with the same educational opportunities as their peers.

- Provide personalized tutoring: Since ChatGPT can reply to user questions, it can offer students a personalized learning experience in their own learning styles and pace. This model is designed to answer the questions asked of it. If any answer is not understood, this model also supports asking again or regenerating the answer. Also, ChatGPT is also able to offer resources for the professional development of the teachers.

- Build ethics and social responsibilities: ChatGPT allows the user access to information related to ethical and socially responsible practices. This will help individuals understand the significance of these practices and how they can apply them in their personal and professional lives.

- Automate assessment: ChatGPT is able to grade and generate feedback on a given text which can be utilized as automated scoring and feedback on student assignment and other writings. This will save time for the teachers and students both by providing instant feedback on student assignments.

- Improve exam performance: ChatGPT can help students to prepare better for their examinations by exploring a number of related practice problems and solutions.

(c) **Personal Skill Development:**
Figure 2 The opportunities of ChatGPT in academia

- Improve language skills: ChatGPT can play a significant role to improve individual language skills. This model is able to perform machine translation to overcome language barriers and make information more accessible. Again, this model can improve users’ language proficiency by answering questions and providing practice (speaking and writing) sessions in real time.

- Enhance content creation: Since ChatGPT can provide feedback and suggestions on a given text, this feature can improve individual content creation. ChatGPT can generate written content on a specific topic, helping content creators save time and effort in writing articles, blog posts, and other written materials.

- Provide language translation: ChatGPT can translate text from one language to another, providing real-time translation services and improving communication between individuals using different languages. Moreover, ChatGPT can aid human translators by offering alternate phrasing, defining uncommon terms, and enhancing the accuracy of the translation process.

- Improve critical thinking skills: ChatGPT can improve critical thinking skills by providing access to information and generating new topics as well as debates, encouraging reflection and analysis. Individuals can broaden their knowledge, and evaluate information critically with improved mathematical reasoning and computational skills, leading to more informed decisions.

- Reduce digital illiteracy: ChatGPT can reduce digital illiteracy by accessing and utilizing technology, and providing individuals with information and support in using it. This helps to increase individuals’ technology skills and
confidence, reducing barriers and providing greater opportunities for accessing information and participating in a tech-driven world\textsuperscript{22}.

- Develop professional skills: ChatGPT can offer additional resources for a specific topic which can be beneficial for career development and job training\textsuperscript{14}. This model can improve professional skills i.e.: project management and teamwork skills by providing relevant information and support to individuals, helping them to understand project management methodologies, best practices, and strategies; presentation skills by giving access to information on effective presentation methods, providing constructive feedback and recommendations\textsuperscript{23}.

(d) Help and Support:

- Provide student service: ChatGPT allows for quicker and more efficient support to students by offering pre-written responses to common questions\textsuperscript{24}. This model is able to answer Frequently Asked Questions (FAQ) to support students and teachers effectively while accessing any online portal related to education\textsuperscript{25}.
- Offer multi-lingual support: ChatGPT can generate text in multiple languages, making it accessible to a wider audience across language barriers\textsuperscript{20}.
- Assist programming projects: ChatGPT is able to provide code snippets and suggestions, generate documentation and commenting, and help to find solutions to problems\textsuperscript{13}.
- Providing 24/7 support: ChatGPT can be used as an online tool making educational resources and support available to students immediately during not only regular business hours but also at all times\textsuperscript{19}.

4 | CHALLENGES

Though ChatGPT is a powerful tool with numerous potential benefits, there are some challenges that may arise with its use. The challenges can be categorized into four major categories:

(a) Research:

- Inconsistent performance: Being an AI model, ChatGPT gives machine-generated replies. Though this model is trained on huge datasets, there is a chance of containing biased data which may generate biased output\textsuperscript{26,19}. Again, this model may generate different replies on the same question when asked separately\textsuperscript{22}. Moreover, the decision-making process of AI models is not explored clearly. As such, ChatGPT may lead to outline inconsistent performance which in turn may affect the reliability and validity of research findings.
- Difficulty to adopt new models: ChatGPT can be integrated to develop a new system. But usage and integration of this model with existing ones can be complex and difficult. Since all queries to this model are stored and used to train this model further, there is always a data privacy and security concern which may make students adopt ChatGPT\textsuperscript{17}.
- Sudden rise of technical issues: ChatGPT is an AI model having limited understanding and background information. So, sudden technical issues such as compatibility issues with existing systems, software bugs, or hardware malfunctions, may occur\textsuperscript{17}.

(b) Education and Knowledge Retrieval:

- Spread misinformation: ChatGPT is trained on a huge but limited data set up to 2021. In 2023, there is a chance to provide incorrect information as well as results through this model\textsuperscript{19}.
- Misinterpret student understanding: Incorrect assessment of student understanding may happen if ChatGPT is not able to properly account for different learning styles or prior knowledge and experience\textsuperscript{27}.
- Reduce personalization: ChatGPT basically generates responses based on the patterns found in training data. The generated response may not be aligned with the individual’s specific needs or choice which may lead to the lack of personalization in query response\textsuperscript{28}.

(c) Personal Skill Development:
Figure 3 Threats of ChatGPT in academia

- Reduce ethical concerns: ChatGPT is able to provide different types of aids related to research and studies. This may reduce ethical concerns for the students. Again, students may make a wrong usage of ChatGPT to complete their assignments, online quizzes, etc. pretending that they have done it on their own. These may affect their ethics as well as personality.

- Reduce ability to handle complex scenarios: ChatGPT is operated based on algorithms and pre-existing knowledge, rather than human insight and critical thinking which may reduce compatibility in academia. This can result in limitations in the ability to cope with complex and new situations, or consider multiple perspectives.

- Weaken content creation ability: Since ChatGPT is able to assist both teachers and students with their writing, regular work, study, and research, some users may become too dependent on this AI model. This may weaken individual critical thinking skills reducing productivity to create innovative and new content.

(d) Social:

- Reduce reliability: Since ChatGPT can generate inconsistent and incorrect information related to a topic, it may lead to reduced reliability. This may discourage users to adapt this model for their study and research purpose.

- Provide Inadequate user support: ChatGPT is able to provide user support for any topic but there is a chance to generate incorrect and incomplete information providing inadequate user support.

- Increase unemployment: ChatGPT can automate tasks that were previously performed by human workers that result in reduced workload as well as manpower. In turn, it is also possible to create job replacements for human teachers and tutors.
ChatGPT is an AI model which is already used by millions of users. This short communication article highlights the possible opportunities and challenges that could arise due to the innovation of ChatGPT in academia. Although the challenges of ChatGPT include inaccuracy, fairness, ethical issues, and the like, these can be addressed by improving the effectiveness and responsible usage of this model. Again, the conversations with every user are stored and used further to learn the model (ChatGPT) for improving its accuracy to provide better user support. So, for the time being, the opportunities of ChatGPT will increase while the problems raised due to ChatGPT will decrease. As such, the implementation of ChatGPT may impact very positively all concerns related to academia in near future.

The challenges of ChatGPT depicted in this research may facilitate to outline of the areas of growth and help students to cope with the usage of emerging technologies. Another implication of this research can be the identification of the sectors to improve further in ChatGPT; for example, knowledge gaps, ineffective principles, inefficient procedures, and the like. Future studies may focus to address these issues to ensure improved quality education. However, since AI technology is a rapidly growing area of computer science, potential measures must be taken to address all the challenges that may arise in the future.

This research has a few limitations as well. This study reviewed and analyzed the limited online and published resources that were available till mid-February 2023. Again, the methodology adopted for analyzing the data is qualitative in nature, which mostly depends on the analyst/researcher’s skill and experiences. Finally, only the academic domain was considered to explore the opportunities and challenges of ChatGPT.

Financial disclosure

None reported.

Conflict of interest

The authors declare no potential conflict of interests.

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