

ChatGPT: a promising AI technology for psychoradiology research and practice

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Psychoradiology is a new interdisciplinary field that uses neuroimaging to study the brain mechanisms of psychiatric disorders (Lui et al., 2016). With the rapid advancement of artificial intelligence (AI) machine learning models, psychoradiology has moved beyond traditional case-control clinical designs that search for abnormal patterns in neural images. Advanced applications of AI models that leverage multisite data may provide better clinical decision support for diverse neuropsychiatric disorders.

In Issue 2, the June 2021 edition of *Psychoradiology*, Li et al. reviewed the current state and future directions of AI applications in psychoradiology (Li et al., 2021). They pointed out the limitations of case-control neuroimaging research that fails to capture the biological heterogeneity and clinical relevance of psychiatric disorders and does not improve the diagnostic accuracy beyond the standard clinical evaluations. Additionally, the advantages and challenges of using AI methods to analyze neuroimaging data were highlighted, such as supervised and unsupervised learning approaches, deep learning, and graph neural networks. These tools may facilitate identifying novel biomarkers, subtypes, and predictors of psychiatric disorders, as well as integrating multimodal data and personalized treatment recommendations. Building on Li's work, this commentary offers a timely update on the burgeoning domain of AI (large language models) in psychoradiology and provides invaluable insights and guidance for forthcoming research endeavors and clinical applications.

ChatGPT: a cutting-edge ai dialogue system

One of the most advanced AI models that has attracted much attention recently is the chat generative pre-training transformer (ChatGPT, openai.com/blog/chatgpt), developed by OpenAI company in November 2022. ChatGPT is an AI dialogue system that can give clear and detailed answers in various domains of knowledge, and even write articles that are close to human-written ones (van Dis et al., 2023). Based on a groundbreaking AI generation technology, ChatGPT is built on a foundation of a large language model, supported by algorithms in the field of reinforcement learning.

As more individuals use ChatGPT in daily tasks, it is evident this technology will lead to major transformations in research operations. ChatGPT has reached a stage where it can perform

tasks such as designing experiments, searching the literature, writing and finishing manuscripts, and conducting peer reviews. However, several risks and challenges also arise from using ChatGPT in scientific research, and its role has come under much scrutiny by researchers.

How ChatGPT can benefit psychoradiology

ChatGPT will bring about several positive effects for psychoradiology. First, it can reduce learning costs for researchers in the field of psychoradiology, as this interdisciplinary field involves medicine, psychology, computer science, radiophysics, and other interdisciplinary collaborators. Psychoradiology researchers may struggle to grasp all these domains of knowledge, and some gaps will always persist. However, ChatGPT can serve as an educational tool that assists beginners in acquiring basic knowledge on a research topic or technique efficiently, staying updated with the latest research progress, and making complex computational analysis methods more accessible. Thus, further interdisciplinary collaboration might be enhanced by more efficiently exchanging ideas and better comprehending each other's needs and strategies.

For instance, researchers with medical or psychological backgrounds may excel in research design and result interpretation, but they may lack computational skills, especially in coding. Learning coding and understanding existing code libraries with the help of AI-based code completion and ChatGPT-style question answering will become an indispensable part of psychoradiology research. Likewise, psychoradiology is also a prime area for medical professionals to apply AI in clinical settings and research. ChatGPT and more powerful AI code assistants will compel psychoradiology researchers to fundamentally redefine their level of abstraction for their algorithms without dealing with primitive code. Rather than being replaced by AI, the exploration of psychoradiology researchers toward more advanced algorithm models will be shifted upstream in the value chain. Psychoradiology researchers should focus on leveraging ChatGPT and other advanced AI models to establish better algorithms for different clinical settings in the future.

Second, ChatGPT may unleash innovative abilities of practitioners in this field and transform the clinical landscape. For psy-

Received: 24 July 2023; Revised: 31 August 2023; Accepted: 26 September 2023

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choradiology researchers, AI chatbots can perform tedious tasks of polishing manuscript for non-native speakers, allowing academicians to dedicate their time to scientific inquiry and designing new experiments. They have the capability to substantially expedite the pace of innovation, thereby serving as a catalyst for igniting transformative discoveries across multiple domains (Leslie, 2023; Noy & Zhang, 2023).

One article points out that the benefits of using ChatGPT for scientific discovery are manifold. For example, it can help scientists save time and resources, improve research efficiency and quality, increase creativity and inspiration, foster interdisciplinary collaboration and knowledge sharing, and address complex and important social problems. It argues that ChatGPT can serve as a computational tool to help researchers explore unbounded search spaces and patterns in high-dimensional biophysical data, thus advancing richer experimental design, theory building, and scientific worldview formation. As for patients in radiology, ChatGPT can make professional imaging reports more accessible to patients with less background knowledge (The Lancet Digital Health, 2023).

Finally, ChatGPT will also bring significant second-order effects for psychoradiology in the long term. By integrating ChatGPT with other machine learning or deep learning techniques, psychoradiology researchers may achieve advancements in algorithms and create more accurate and reliable models for diagnosing and predicting psychiatric disorders and treatment outcomes, thus improving the quality of life for patients (Rajpurkar & Lungren, 2023).

Potential negative effects and limitations of ChatGPT

However, ChatGPT is not without its drawbacks and challenges for psychoradiology. First, ethical issues arise when considering scientific integrity, and human and AI contributors may clash over matters of authorship (Gao *et al.*, 2023). Academic journals (e.g. Nature Publishing Group) stipulate that large language models such as ChatGPT cannot be listed as authors, but the authors should mention the contribution of ChatGPT in the acknowledgment. Conversely, AI detection tools capable of identifying content generated by large language models can serve as an integral component of the editorial office, safeguarding the academic ethics (Biswas, 2023).

Second, there might be a tradeoff between the loss of researchers' potential and autonomy in the research process and the acceleration in the knowledge generation of AI. ChatGPT may generate standard or generic outputs that do not reflect personal insights or perspectives, which turns out to reduce the creativity and originality of psychoradiology researchers. Ultimately, investigator may rely too much on those automated outputs and neglect the need to acquire or improve their own skills and knowledge in this field.

Third, ChatGPT's output can be flawed or prejudiced, such as citing article references that do not exist or those that are outdated. Without human supervision, these blunders that ChatGPT may commit will lead research and clinical decision-making astray. In the clinical realm, ChatGPT might provide suboptimal medical care decisions if not carefully used, and a misdiagnosis due to insufficient information or incorrect logic could result in poor treatment outcome. It must be understood by the user that ChatGPT merely generates content based on logical associations between existing data in the training set, rather than truly

understanding their meanings and creating new ideas, and its output requires careful consideration based on their existing knowledge base (van Dis *et al.*, 2023).

Last, technology and model deployment may lag behind innovation itself. Although people can establish impressive algorithm models in a short time with the help of ChatGPT, it still requires a lot of trials and errors to build reliable and generalizable tools for diagnosis and prognosis in clinical settings.

Prospects of ChatGPT for psychoradiology

Looking ahead, ChatGPT will keep evolving and offer new possibilities for psychoradiology. A refined version of ChatGPT powered by GPT-4.0 (<https://openai.com/research/gpt-4>) is a more cutting-edge chatbot beyond imagination, which can access different plugins to update real-time information, achieve multimodal input from different sources (not just simple text), and even generate images with a similar algorithm derived from ChatGPT (e.g. DALL-E, openai.com/research/dall-e). Furthermore, other generative AI models like RadImageGAN and Google Bard have also demonstrated image-related capabilities (Aydin, 2023; Chen *et al.*, 2023), holding promising potential for applications in psychoradiology.

Imagine a future where psychoradiology researchers only need to provide a rough research idea and upload imaging and clinical data to a large-scale AI model dedicated to scientific research. The AI model will then automatically perform algorithm construction, data analysis, and manuscript writing. This sounds like a wild dream, but it could become a reality if AI models such as ChatGPT continue to evolve even at the expense of possibly compromising the quality and transparency of research (van Dis *et al.*, 2023). However, human researchers have to complete the creative work that AI is not good at, and an innovative idea remains the foundation for future research, not to mention that humans are also needed to optimize AI models. Currently, ChatGPT's diagnostic capabilities have been assessed using inputs such as patient history and imaging results, yielding an overall accuracy of 54% (Ueda *et al.*, 2023). For personalized clinical management of psychoradiology patients, designing an AI model that can take neuroimaging input from patients and automatically generate corresponding diagnostic and treatment plans would be very valuable and promising as well (Fig. 1). Therefore, for the clinical field of psychoradiology, advanced language models like ChatGPT may potentially enhance radiologists' interpretive abilities, improve patient-physician communication, and optimize clinical workflows after giving targeted human prompts (Grewal *et al.*, 2023; Yang *et al.*, 2023). Other emerging generative AI models like MedPaLM 2 and BiomedGPT hold great potential for swiftly advancing toward achieving physician-level performance in responding to medical questions and for augmenting healthcare outcomes within the field of biomedicine (Singhal *et al.*, 2023; Zhang *et al.*, 2023).

In general, we believe that the use of advanced AI models such as ChatGPT in psychoradiology is inevitable, and our research community is encouraged to embrace this revolutionary technology as much as possible while exhibiting caution to avoid its drawbacks. To better leverage ChatGPT-like advanced technologies, psychoradiology researchers may need to acquire some new skills in human-computer interaction and monitor and develop guidelines related to ethical considerations. At the same time, we should also consider which academic skills are indispensable, such as the ability to

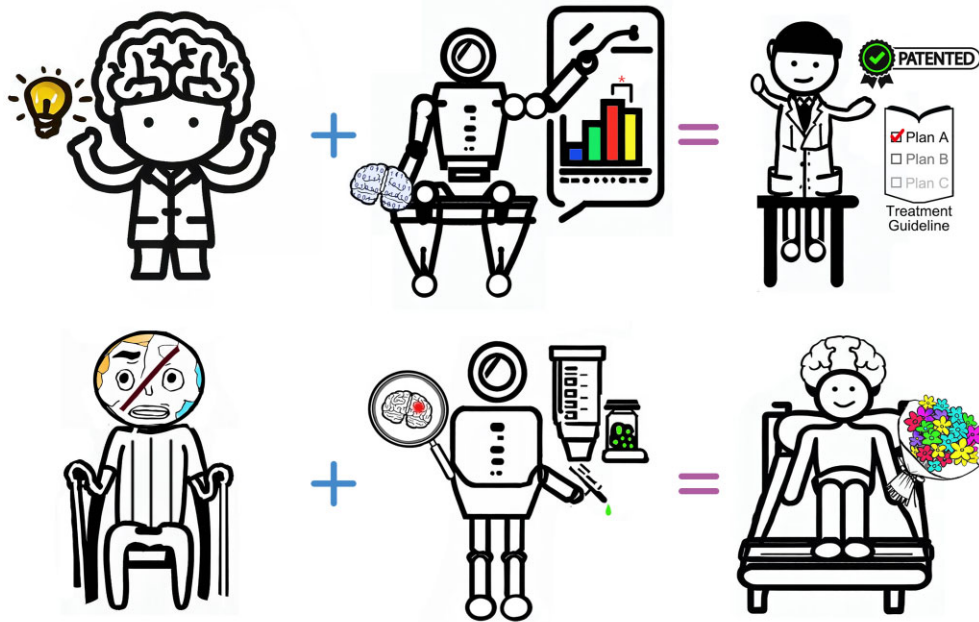


Figure 1: Applications of AI in psychoradiology research and practice. The upper panel illustrates how psychoradiology researchers use artificial intelligence to extract insights from neuroimaging data and make breakthroughs in the field. The lower panel depicts how a patient suffering from psychiatric disorders can regain a new life with the help of an artificial intelligence-assisted diagnosis and treatment system.

generate original and creative research strategies and techniques that currently, only humans can do.

Author contributions

Nanfang Pan (Conceptualization, Project administration, Visualization, Writing – original draft), Kun Qin (Conceptualization, Project administration, Writing – review & editing), Aniruddha Shekara (Writing – review & editing), and Melissa P. DelBello (Conceptualization, Supervision, Writing – review & editing)

Conflict of interests

Dr DelBello has received research support from NIMH, PCORI, Acadia, Alkermes, Allergan, Janssen, Johnson and Johnson, Lundbeck, Myriad, Otsuka, Pfizer, Sunovion, and Shire, and has provided consultation or advisory board services for Alkermes, Allergan, CMEology, Janssen, Johnson and Johnson, Lundbeck, Medscape, Myriad, Pfizer, Sage, and Sunovion. All other authors declare that they have no competing interests.

Acknowledgements

Yifan Yu, from West China Hospital of Sichuan University, also provided inspiration for figure creation. No funding was involved in this study.

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