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AIGC Empowering Model Innovation and Practical Pathways for Scientific Journals

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Abstract: With the rapid advancement of Artificial Intelligence Generated Content (AIGC) technology, the scientific journal publishing industry is facing unprecedented opportunities for transformation. AIGC technology not only optimizes publishing workflows and enhances efficiency but also holds the potential to reshape the production, dissemination, and operational models of scientific journals. This paper first systematically analyzes the pain points inherent in traditional journal models, including lengthy peer-review cycles, difficulties in filtering knowledge overload, limited dissemination reach, and singular service models. Building on this analysis, the paper constructs a "Three-Wheel Drive" model for AIGC-empowered scientific journals, elaborating on how AIGC drives model innovation across three core areas: content production and peer review, knowledge aggregation and dissemination, and platform reconstruction and services. Furthermore, the paper proposes specific practical pathways: at the content level, utilizing AIGC to assist with topic selection, literature review, language polishing, and preliminary manuscript screening; at the knowledge level, building intelligent summarization, cross-modal interpretation, and personalized recommendation systems based on AIGC; at the platform level, exploring new service models such as "intelligent Q&A knowledge bases" and "open science collaborative integration." Finally, the paper dialectically discusses the challenges encountered in this process, including academic ethics, intellectual property, and technological dependency, and proposes corresponding governance strategies. This research aims to provide theoretical reference and practical guidance for the transformation and upgrading of scientific journals in the intelligent era.

Keywords: Artificial Intelligence Generated Content; Scientific journals; Model innovation; Publishing process; Knowledge service; Academic ethics

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1. Introduction

Scientific journals serve as the core medium for recording, disseminating, and exchanging scientific research

findings, playing a crucial role in national scientific and technological innovation systems. However, in today's deeply digital and networked environment, the operational models of traditional scientific journals face severe challenges. Firstly, the issue of "publication delay" remains prominent, often taking months or even longer from manuscript submission to final publication, severely hampering the speed of scientific communication and innovation efficiency [1]. Secondly, in the era of information explosion, researchers face "knowledge overload", making the rapid and precise retrieval of needed knowledge from vast literature a new challenge. Thirdly, the dissemination methods of traditional journals are relatively passive and weak in interactivity, hindering the formation of deep exchanges within effective academic communities. Lastly, journal service models are relatively singular, primarily stopping at the level of paper publication, failing to fully exploit the potential value of research data. In recent years, Artificial Intelligence Generated Content (AIGC) technology, represented by large language models, has achieved breakthrough progress in natural language processing, knowledge reasoning, and content generation. From ChatGPT, capable of writing fluent text, to GitHub Copilot assisting in code generation, AIGC is demonstrating powerful content creation and intelligent assistance capabilities. This provides novel technological tools and methodologies for scientific journals to address the aforementioned dilemmas. Empowering scientific journals with AIGC is by no means a simple "technological grafting", but rather a profound model revolution. It holds the potential to transform journals from traditional "content providers" into "knowledge service hubs", and from "terminal stations for academic achievements" into "accelerators for scientific discovery." This paper aims to systematically explore the model innovation driven by AIGC and feasible practical pathways for scientific journals. By constructing an innovation model, analyzing application scenarios, and anticipating potential risks, it seeks to provide forward-thinking insights for the high-quality development and enhancement of the core competitiveness of scientific journals in China.

2. Model innovation of AIGC-empowered scientific journals: The "Three-Wheel Drive" model

The empowerment of scientific journals by AIGC is comprehensive. Its innovative model can be summarized as a "Three-Wheel Drive" model centered on "intelligence", specifically encompassing the models of content production and peer review, knowledge aggregation and dissemination, and platform reconstruction and services. In terms of content production and peer review, AIGC is instigating an "intelligent" revolution. It can act as an "intelligent research assistant" for researchers, aiding in topic discovery and project establishment before writing, assisting in literature review during writing, and performing grammar checks, language polishing, and even academic style optimization on drafts, particularly helping non-native English speakers overcome language barriers [2]. In the peer-review process, AIGC can be used for format compliance checks and preliminary screening of manuscripts, automatically verifying adherence to the journal's formatting requirements, citation standards, etc., thereby reducing the administrative burden on editors. More profoundly, AIGC can serve as an auxiliary tool for peer review, conducting preliminary analysis of a manuscript's novelty, logical structure, and methodological rationality, and generating key points for review comments for human expert reference [3]. This can not only significantly shorten the review cycle but also enhance the comprehensiveness and objectivity of review comments to a certain extent.

In terms of knowledge aggregation and dissemination, AIGC promotes a leap towards "precision." Traditional papers are static and linear, whereas AIGC can perform "deep processing" on them—for instance,

automatically generating structured abstracts or "key points" lists for lengthy papers, transforming complex experimental methods and data results into visual charts or brief video explanations, realizing cross-modal presentation of knowledge, and lowering the barrier to understanding. In the realm of precise dissemination, AIGC can build deeply personalized recommendation systems. By deeply understanding users' reading history, research interests, and real-time behavior, it can proactively push highly relevant research papers, academic trends, and even potential collaborators [4]. Furthermore, AIGC can automatically generate promotional content tailored to different audiences, such as science popularization articles for the public or research highlights for professional communities, greatly expanding the dimensions of paper dissemination and their impact.

In terms of platform reconstruction and services, AIGC facilitates a transition towards an "ecosystem." Future scientific journal platforms may evolve beyond the form of "paper repositories" into "intelligent Q&A knowledge bases." Readers can directly ask the platform questions about a specific paper or field. AIGC, by analyzing all relevant literature within the platform in real-time, generates accurate, in-depth, and well-cited answers, achieving a shift from "people finding information" to "information finding people" and even "acquiring knowledge through human-computer dialogue." Simultaneously, AIGC can become the "adhesive" and "catalyst" for open science practices. Journal platforms can integrate AIGC tools to support researchers in online data preprocessing, model simulation, result visualization, etc., while recording the process in real-time to promote research reproducibility. AIGC can also assist in managing different versions of a paper (preprint, reviewed version, published version), intelligently linking related data, code, and materials, ultimately constructing an open science ecosystem integrating creation, review, publication, communication, and re-innovation [5].

3. Specific practical pathways for AIGC in scientific journals

To ensure the implementation of the aforementioned model innovations, clear and practical pathways need to be planned. In the content production and peer review, the practical focus lies on tool embedding and process reengineering. Journal websites can embed AIGC-assisted writing tools within their submission systems, such as grammar checkers and automatic reference format verifiers. In the peer-review process, a mandatory AIGC preliminary screening can be added to automatically intercept manuscripts that are clearly out of scope or suspected of serious academic misconduct (e.g., plagiarism). Concurrently, a human-AI collaborative review mechanism needs to be established, clearly defining the "assistive" role of AIGC in peer review. Standard operating procedures should stipulate that AIGC-generated review comments are for reference only by editors and reviewers, and the final academic judgment must be made by human experts. Furthermore, training should be provided to editors and reviewers to enable them to effectively utilize and critically evaluate the output of AIGC.

In the knowledge aggregation and dissemination, the practical pathways include building intelligent summarization and interpretation systems and deploying next-generation recommendation engines. Develop or procure specialized AIGC engines to automatically generate uniformly formatted "enhanced abstracts" (including bullet points for research background, methods, results, conclusions) for all papers published in the journal. For key papers, allocate additional resources to produce AIGC-driven video interpretations or graphical abstracts. Simultaneously, collaborate with technology companies to train personalized AIGC recommendation models based on user behavior data. This should not only recommend individual papers but also periodically generate "personalized research briefs" for users, summarizing the latest progress in their fields of interest.

In the platform and service reconstruction section, practice can start with piloting intelligent Q&A functions

and promoting the linked publication of data and code. Select a specific disciplinary strength of the journal, first build a domain knowledge base based on published papers, and launch an experimental intelligent Q&A function. Continuously optimize the model based on feedback from early users, and gradually promote it to all disciplines once mature. Meanwhile, encourage or require authors to submit data and code synchronization upon manuscript submission. Utilize AIGC tools to attempt basic checks of submitted code (e.g., runnability checks) and automatically generate documentation for data and code, lowering the threshold for other researchers to reproduce and reuse them.

4. Challenges and governance countermeasures

The application of AIGC is not without obstacles. The scientific journal community must prepare and actively address the following challenges. Core challenges primarily include academic integrity and ethical risks, ambiguous intellectual property ownership, technological dependency, and the "black box" problem, as well as knowledge bias and fairness issues. Academic integrity and ethical risks are the most pressing challenges, encompassing authors using AIGC for "paper mill"-style writing, fabricating data or references, and the inherent "hallucination" problem of AIGC itself, where it generates plausible but actually incorrect content [6]. Regarding intellectual property, who owns the copyright for content generated by AIGC (e.g., summaries, charts)? Is it the tool user, the journal, or the model developer? This poses an impact on the traditional copyright system [7]. Technological dependency and the "black box" problem manifest as over-reliance on AIGC, potentially leading to the degradation of human research capabilities and review judgment, while the "black box" nature of AIGC's decision-making process makes it difficult to fully trust and hold accountable. Knowledge bias and fairness issues stem from the fact that the training data for AIGC models may itself contain biases, which could lead to reinforcing existing disciplinary biases when assisting in topic selection, review, and recommendation, unfavorable for the development of niche or interdisciplinary fields.

Addressing these challenges, governance countermeasures and recommendations include establishing sound academic norms, clarifying intellectual property rules, adhering to the "human-in-the-loop" principle, and developing trustworthy AIGC tools and evaluation systems. Journals should promptly formulate clear AIGC use policies, requiring authors to transparently disclose the use of AIGC in research and paper writing, the scope of use, and the tools used, and incorporating AIGC use compliance into academic misconduct detection [8]. Add clauses to copyright agreements to define the ownership and usage rules of AIGC-generated content, advocating that AIGC is a tool and the creative core of its generated content should still belong to the human author. In all critical links, especially in academic value judgment, human dominance must be maintained, positioning AIGC as a "collaborator" that enhances human intelligence, not a replacement, while strengthening ethical training and technological literacy education for editors and reviewers. Encourage the development of specialized AIGC tools for the scientific journal context with explainability, and establish quality evaluation and manual verification mechanisms for AIGC output to ensure the reliability of its application [9].

5. Conclusion and outlook

The rise of AIGC technology presents a historic opportunity for paradigm change in scientific journals. This paper systematically proposed a "Three-Wheel Drive" model for AIGC-empowered scientific journals, suggesting that by driving intelligent innovation in the three major models of content production and review, knowledge

aggregation and dissemination, and platform reconstruction and services, scientific journals can transition from traditional publishing processes towards a modern knowledge service ecosystem. The future scientific journal will no longer be merely a collection of individual papers, but a dynamic, interactive, and intelligent knowledge organism. It will be capable of understanding the needs of researchers and proactively providing knowledge solutions; capable of breaking down disciplinary barriers and promoting the cross-fertilization of knowledge; capable of accelerating the process of scientific discovery and becoming a key infrastructure supporting the national innovation system. However, the path towards this future requires steady progress. At the current stage, scientific journal publishing organizations should actively embrace change and proactively explore AIGC application scenarios, while placing high importance on the ethical, legal, and social challenges it brings. By establishing sound governance frameworks, they can ensure that technological application moves in a responsible, trustworthy, and beneficial direction [10]. Only in this way can scientific journals seize the initiative in the wave of AIGC, truly achieve their own transformation and sublimation, and better serve the scientific enterprise and human society.

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Disclosure statement

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