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How Artificial Intelligence Innovations in Journalism Can Overcome the Digital Divide

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Abstract: With the rapid development of information technology, artificial intelligence has become a key force driving innovation in journalism. However, this technology-driven innovation has also exacerbated the problem of digital divide, especially the difference in information acquisition and processing capabilities. The purpose of this paper is to explore how the application of AI in journalism can effectively bridge this divide. Using case studies and empirical research, it provides an in-depth analysis of the application of AI technologies such as natural language processing, machine learning and big data analytics in the news gathering, editing and distribution process, and how these technologies contribute to the democratization of information and improve the accessibility of news content. By comparing the information accessibility and satisfaction of audiences in different socio-economic contexts, the paper reveals the potential of AI technologies in improving the quality and distribution efficiency of news content. Attention is also given to how AI can enhance user experience and engagement while ensuring news authenticity and transparency. The paper concludes that the judicious application of AI technologies can not only address the digital divide facing journalism, but also provide the impetus to build a more inclusive and interactive news ecosystem. This finding is important for guiding news organizations on how to leverage AI technology innovation to achieve broader social inclusion.

1 Introduction

In today's age of information explosion, the news industry is undergoing unprecedented changes. The rise of intelligent communication technologies, especially the application of artificial intelligence, is reshaping all aspects of news production, from gathering and writing to editing and distribution. However, this technological revolution is not without its challenges; the digital divide - i.e., unequal access to information brought about by technological development - has become an issue that cannot be ignored. Against this background, an in-depth exploration of how AI can

innovate in journalism and utilize these innovations to overcome the digital divide is not only of great academic value, but also of great significance to social practice.

The application of AI technology in journalism has begun to show its great potential. Through algorithm-driven news aggregation and distribution, news organizations are able to locate audiences more precisely and achieve personalized push. Automated newsgathering and writing, on the other hand, has greatly increased productivity, allowing journalists to devote more time to in-depth reporting and analysis. Innovations in data journalism have even added a rich dimension to news stories, helping the public better understand complex phenomena. However, these technological advances do not universally benefit all populations. The technologically disadvantaged may not be able to access them because they lack the necessary skills or resources, thus exacerbating the digital divide.

It is therefore particularly urgent to examine how AI innovations in journalism can overcome the digital divide. This involves not only improvements at the technical level, such as increasing the popularity and ease of use of algorithms, but also the need to explore how to enhance the public's technological literacy by means of policy guidance and education and popularization from the perspectives of sociology and communication. In addition, news organizations also need to find a balance between commercial interests and social responsibility to ensure that technological innovation can benefit a wider audience.

In summary, the innovation of AI in journalism has brought new development opportunities for the industry, but it has also brought the challenge of digital divide. This study aims to analyze this phenomenon in depth and explore how the combination of technological innovation and social intervention can enable all people to enjoy the dividends of technological progress equally. Through such efforts, we can expect to build a more inclusive and just information society.

A review of existing literature reveals that a central challenge in exploring the application of artificial intelligence (AI) to journalism innovation is how to bridge the digital divide and ensure that technological advances benefit all social groups. Many studies have focused on the question of how AI can overcome the digital divide by reshaping humanistic news production through intelligent communication technologies, such as algorithmic journalism, automated newsgathering and writing, and data journalism innovations (Jie Wu, Xiangdong Xu, 2023). This topic involves not only the front stage of news production, i.e., user-algorithm interactions, but also the middle stage, where journalists collaborate with AI, as well as the back stage, where editors analyze data, revealing the dynamic balance between people and technology at all stages of the news lifecycle.

First, humanistic news production emphasizes the need to pay attention to the deep involvement of news users despite technological interventions, and to ensure that algorithmic aggregation and distribution can fairly reflect and satisfy pluralistic needs (Wu Jie, Xu Xiangdong, 2023). Second, automated news production challenges traditional editorial roles, requiring journalists and writing robots to form complementary roles in order to improve efficiency while maintaining the professionalism and impartiality of the news. Further, data journalism practices in newsrooms need to maintain the ability to interpret complex information and think critically with the support of data technology to prevent data-driven decisions from leading to information inequality.

The existing literature covers all kinds of media organizations, especially those cases that have successfully transformed and utilized AI to enhance brand communication, such as Punch News (Feng Xiaoxiao, 2022). Through precise product, user, and functional positioning, Pengpei News demonstrates how it can use AI tools to enhance its brand impact while expanding its audience base in an attention-scarce environment, which provides practical insights for addressing the digital divide.

In summary, this study will deeply analyze the innovative application of AI in journalism, aiming to reveal its potential in bridging the digital divide, and provide a theoretical framework and

practical strategies for policymakers, journalism practitioners, and scholars to promote the inclusive development of journalism.

2 Overview of Artificial Intelligence Technology

2.1 History of Artificial Intelligence

In exploring the topic of how AI innovations in journalism can overcome the digital divide, it is first important to understand the evolution of AI, which reveals how technological evolution is shaping the current media landscape. Since its initial explorations in the 1950s, AI has undergone a paradigm shift from symbolism to connectionism to deep learning. This process is not only a leap in algorithmic and computational power, but also a deepening understanding of the nature of intelligence.

Early AI systems, such as expert systems, relied on rule bases in an attempt to mimic the knowledge-based decision-making of human experts. However, this approach appeared to be inadequate when dealing with complex, unstructured information. The subsequent rise of machine learning, particularly neural networks, has revolutionized news recommendation and content generation by enabling systems to learn and improve themselves from massive amounts of data.

In recent years, breakthroughs in deep learning, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), have led to remarkable achievements in the field of natural language processing (NLP). These technologies have not only made possible the automatic generation of news headlines, but also improved news search and personalized recommendations through natural language understanding, reducing the digital divide caused by information overload. For example, by intelligently analyzing a user's reading history and preferences, AI systems can accurately push relevant and valuable news, making access to information more efficient and equitable.

Nonetheless, the development of AI is not without its challenges. Data bias, algorithmic transparency and privacy issues are all current challenges that need to be addressed. To overcome the digital divide, we need to ensure that AI technologies are fair and inclusive, and avoid algorithmic decisions that reinforce social inequality. This requires incorporating ethical considerations into the design of the technology, enhancing algorithmic interpretability, and promoting public understanding of and participation in AI.

Table 1: Key milestones in the evolution of AI

Phase	Key Events	Impact
1950s	Expert systems are born	Rule-Driven Intelligent Decision Making
1980s	Rise of Machine Learning	The beginning of self-learning
1990s	Neural Networks Renaissance	Large-scale data processing
2010s	Deep Learning Breakthroughs	Advances in NLP and computer vision

By understanding the developmental pulse of AI, we can better assess its potential in journalism and how technological innovations can bridge the digital divide and enable wider information access and participation.

2.2 Current Status of Artificial Intelligence in Journalism

It is not difficult to find that this technological innovation has both brought about efficiency gains and exposed the digital divide.AI interventions, such as the automated production of

algorithmic news and data-driven decision-making, have undoubtedly yielded significant results in terms of the speed of news-gathering and coverage. However, such advances have not been evenly distributed and have instead exacerbated inequalities in access to information (Table 2).

Table 2: Current status of AI applications in journalism

Fields of application	Impacts and Challenges
Automation News	Enhances productivity and reduces human error, but can lead to homogenized content and unemployment.
Personalized recommendations	Enhances user experience, but also creates an information cocoon and exacerbates social divisions.
Data Analysis	Aids decision-making and mines deep information, but relies on high-quality data and may neglect marginalized groups.

While the use of AI in the front office of news production has increased efficiency, the complex game in the back office reveals the importance of humanism. The dynamics of the relationship between news editors and writing robots show that technology cannot completely replace human judgment and creativity. In addition, while innovations in data journalism have enhanced the depth of coverage, the use of technology in data collection and interpretation may exacerbate geographic, cultural, and economic disparities, leading to the marginalization of some groups.

To overcome the digital divide, we need to recognize the limitations of AI tools and emphasize their role as an aid, not a substitute. Education and training are key to ensure that journalists and editors are able to understand and navigate these technologies, while maintaining a focus on journalistic ethics and social responsibility. In addition, equitable data access and network infrastructure should be promoted at the policy level to guarantee equal participation in the information society for all.

In conclusion, the current state of AI application in journalism suggests that while technology advances, we must be alert to the inequalities it may exacerbate, and strive to bridge the digital divide and achieve inclusive development of journalism through education, policy adjustments, and ongoing humanistic practices.

3 Status and Challenges of the Digital Divide

3.1 Definition and manifestation of digital divide

The digital divide does not only refer to the technological gap, it is a multi-dimensional concept that covers all aspects of socio-economic, cultural and educational as well as information access inequality. It is specifically manifested in:

Digital divide = α-(technology access gap) + β-(information literacy differences) + γ-(socio-economic inequality)

Where α,β,γ represent the influence weights of each factor respectively, and these weights are adjusted with changes in the social environment. The technology access gap is reflected in network coverage and device ownership between urban and rural areas, age groups, and income classes, while the information literacy gap relates to people's ability to access, process, and understand information. This gap is further exacerbated by socio-economic inequalities, with low-income groups often unable to afford the high cost of the Internet, limiting their access to and use of new technologies.

The rise of smart communication technologies, such as algorithmic and automated journalism,

while increasing the efficiency of news production, also exacerbates the divide. On the one hand, algorithms may lead to information filtering bubbles that trap some users in a cocoon of homogenized information; on the other hand, groups that lack digital literacy may not be able to use these tools effectively, leading to unequal access to information. Therefore, journalism should work to bridge these gaps while promoting technological innovation.

To achieve this goal, news organizations can adopt the following strategies: (1) provide digital skills training to enhance public information literacy; (2) design inclusive algorithms to reduce information filtration; and (3) utilize smart technologies to expand the scope of their services, such as reaching low-income groups through low-cost mobile applications. These initiatives not only help to narrow the digital divide, but also promote sustainable journalism and ensure that humanism is implemented in news production.

With such a comprehensive strategy, we are able to see that while AI brings new challenges, it also offers the possibility of overcoming the digital divide. The key is that journalism needs to take an active role in social responsibility, transforming technological advances into tools for universal benefit rather than catalysts for increased inequality.

3.2 Impact of the digital divide on journalism

The digital divide does not exist in isolation, but is the intertwined result of multidimensional issues. It manifests itself in news access, production and distribution, affecting information equality in society. The digital transformation of journalism, while bringing efficiency gains and personalized services, has also exacerbated this divide, as not everyone has equal access to and use of these new technologies.

On the one hand, the popularization of algorithmic journalism has made information distribution more efficient, but at the same time it may lead to the formation of information filter bubbles, limiting users' exposure to a plurality of viewpoints. This phenomenon is particularly pronounced among low digital literacy populations, who may be trapped in information homogenization due to a lack of understanding of algorithms. On the other hand, automated news writing reduces labor costs, but it also excludes groups who do not have access to or use smart devices, leaving them marginalized and the impartiality and representativeness of news compromised.

Overcoming this challenge requires journalism to adopt human-centered strategies. First, education and training are key to improving the public's digital literacy so that they can critically understand and utilize the information provided by AI. Second, news organizations should work to build inclusive technologies, such as designing interfaces that are easy to understand and use, and ensuring that users from different backgrounds can participate equally. Further, the development of regulatory policies should not be overlooked, aiming to prevent the misuse of technology and protect the information rights of vulnerable groups.

In summary, the use of AI in journalism should not exacerbate the digital divide, but rather serve as a tool to bridge the gap. Through education, inclusive design, and effective policies, it is possible to build a digital journalism environment that is both efficient and equitable.

Table 3: Areas of Impact and Challenges

Areas of Influence	Challenge
Access to Information	Algorithmic filter bubbles, homogenizing information
News Production	Automation exclusion, marginalization of some groups
Distribution and access	Unequal use of technology, digital literacy disparities

4 Innovative Applications of Artificial Intelligence in Journalism

4.1 Intelligentization of newsgathering

Artificial Intelligence (AI) has undoubtedly opened up new possibilities in the process of smartening up newsgathering, but it has also exacerbated the problem of the digital divide. In this section, the paper looks at how AI innovations can overcome this challenge rather than simply widen the gap.

The automation of newsgathering, such as the use of AI-driven algorithms for information filtering and sorting, has dramatically improved efficiency and coverage, allowing massive amounts of data to be transformed into valuable news leads in an instant (Table 4). However, the diffusion of such technologies is not balanced, with large, resource-rich media organizations often adopting and benefiting from them more quickly, while smaller or local media outlets may lag behind due to financial and technological constraints. This asymmetry can lead to information inequality and further deepen the digital divide.

Table 4: Impact of AI adoption by news genre

Media Type	AI Adoption	Impact
Major News Outlets	High	Enhanced Efficiency
Local or Small Media	Low	Limited Access

To mitigate this problem, the key is to promote the equitable distribution of AI technology. On the one hand, policymakers should encourage the development of low-cost, easy-to-use AI tools for small media and lower the technological threshold. On the other hand, intra-industry cooperation and knowledge sharing are crucial, and large media can help small media improve their capabilities through training and technology transfer. In addition, education and public awareness are necessary to ensure that the public understands and is able to utilize diverse sources of information and avoid over-reliance on a single platform.

Mathematical formulas seem less appropriate here, as newsgathering is primarily concerned with information processing and dissemination rather than complex mathematical operations. However, we can use a simplified formula to symbolize the role of AI in newsgathering:

$$\text{AI} + \text{Data} = \text{News Insights}$$

This formula suggests that the combination of AI and big data can generate valuable news insights, but only when this combination is fairly and widely distributed can the digital divide be truly bridged and journalism progress across the board be realized.

4.2 Automation of News Editing and Processing

In the area of automation of news editing and processing, the intervention of AI has undoubtedly brought about both efficiency and accuracy, however, it has also raised concerns about the growing digital divide. In this section, we will explore how this challenge can be overcome through intelligent innovation to ensure the equitable dissemination of information.

Automated news editors are not only able to process massive amounts of information and quickly generate news releases, but also customize and push relevant content to users through algorithmic analysis (P1), thus improving the personalization and relevance of news. However, over-reliance on algorithms may lead to a loss of news diversity, marginalizing the voices of some groups (P2). To address this problem, we need to integrate humanistic concerns into the technical

design and ensure the transparency and interpretability of the algorithmic decision-making process (P3).

On the one hand, establishing diverse datasets and algorithmic models to ensure the breadth and representativeness of news sources can prevent the formation of information filtering bubbles and narrow the digital divide caused by algorithmic bias (P4). On the other hand, educating the public to understand and evaluate algorithmic recommendations to improve digital literacy is the key to bridging the digital divide from the user side (P5).

In addition, news organizations should be actively involved in setting up ethical norms to ensure that the application of AI in news production follows the principle of fairness and does not harm the public interest (P6). Through such a multi-dimensional strategy, we can effectively address and gradually eliminate the digital divide problem in journalism while enjoying the convenience brought by AI.

Table 5: Strategies to overcome the digital divide

	Strategy	**Role**
P1	Automate News Generation and Push	Improve efficiency and personalize service
P2	Preventing Algorithmic Bias	Maintaining Diversity in News
P3	Enhance algorithmic transparency	Ensure fairness
P4	Diversify data and models	Avoiding information filter bubbles
P5	Enhance public digital literacy	Bridging the gap at the user end
P6	Establishing ethical norms	Protecting the public interest

In this era of rapid change, AI should not be seen as a catalyst for exacerbating the digital divide, but rather as a tool for bridging the gap and promoting information equality. With the above strategies, we are confident that everyone will have equal access to rich and diverse news information in the era of intelligent distribution.

4.3 Personalization of news distribution

In the digital transformation of journalism, personalized news distribution with artificial intelligence has become a key strategy to overcome the digital divide. This innovation aims not only to enhance the user experience, but also to bridge the inequality in access to information and ensure broad accessibility and diversity of news.

Personalized news distribution uses advanced machine learning algorithms to analyze a user's reading history, interest preferences, and even social network behavior to push customized content to meet individual information needs. This process is not simply a reinforcement of information filtering bubbles, but rather a way to broaden the cognitive boundaries of users and break the limitations of the information cocoon through intelligent recommendations. Mathematically, this can be expressed as user u's personalized news stream Nu is a weighted combination of his interest vector Iu and his news library N. The following is a summary of this process:

$$Nu = f(Iu, N)$$

where f is a recommendation function based on the user's interests with the goal of maximizing user satisfaction while introducing elements of diversity and new information.

However, personalization should not ignore social responsibility. News organizations should ensure the transparency and fairness of their algorithms to prevent them from discriminating or over-relying on a single data source. For example, the risk of bias can be reduced by integrating multiple data sources and implementing regular algorithmic audits:

$$ffair(Iu, N) = \sum ws - fs(Iu, Ns)(s \in Sources)$$

Here, ffair is the fair recommendation function and ws is the weights from different data sources s, ensuring balanced consideration of information from multiple perspectives.

Furthermore, educating the public to understand and engage in the process of personalized news is crucial. By improving digital literacy, users are able to better understand the sources of information and thus actively participate in consuming and evaluating news, promoting a healthy balance in the news ecosystem.

In summary, AI-driven personalized news distribution plays a central role in bridging the digital divide, but the ethical aspects of the algorithms need to be handled with care in order to achieve inclusive, diverse and unbiased news distribution.

5 How Artificial Intelligence Can Overcome the Digital Divide

5.1 Improving Information Access

The core advantage of intelligent communication technology lies in its efficient information processing and personalized recommendation. Through algorithmic analysis, AI is able to identify the interests and preferences of news users, thus realizing the accurate distribution of content ($E=P\times I$, where E stands for effective information, P stands for user preferences, and I stands for information base), which significantly improves the efficiency of users' access to relevant information.

However, this personalized push may also lead to the information cocoon effect, limiting users' exposure to multiple viewpoints. Therefore, AI should incorporate diversity and balance considerations while respecting users' individuality to ensure the richness of the information flow. This can be achieved by optimizing algorithmic weights and introducing cross-domain content recommendations, allowing users to enjoy customized services while also being exposed to information that might otherwise be overlooked ($D=\alpha P+(1-\alpha)B$,where D represents the final recommended information, α represents the personalization weights, and B represents the balanced information base).

In addition, for the other side of the digital divide - unequal technological access - AI should aim to lower the technological threshold. For example, speech recognition and natural language processing technologies enable groups without advanced digital skills to easily access and interact with information. At the same time, the popularization of intelligent assistants can help the elderly and other disadvantaged groups cross the digital divide and improve their access to information.

In summary, the application of AI in journalism should not be limited to improving efficiency, but should also focus on fairness and inclusiveness, and ensure wide dissemination and balanced access to information through algorithmic optimization and technological innovation, so as to truly bridge the digital divide. This process requires continuous academic research and practical exploration to realize the value of humanistic news production.

5.2 Improve content quality and communication efficiency

Focus on the key aspect of improving content quality and dissemination efficiency. The application of AI not only revolutionizes the way of news production, but also provides an effective way to bridge the information gap. The primary argument is that AI technology enhances the depth and breadth of news through intelligent content generation and optimization, thereby reaching a wider audience.

On the one hand, AI's automated news writing capabilities can quickly process large amounts of

data to generate accurate and timely reports, especially in areas that require the integration of large amounts of basic information, such as financial news or sporting events. This efficient production not only reduces the workload of journalists, but also ensures the immediate dissemination of information and reduces the inequality caused by news delays. On the other hand, AI's personalized recommendation mechanism customizes and pushes content based on users' interests and behavioral patterns, broadening their access to information. In addition, AI's data analysis capability improves the accuracy of news and reduces misleading reports. Through the mining of complex data by deep learning models, news organizations are able to interpret social phenomena in greater depth and provide more objective analysis, and this in-depth analysis reduces misunderstandings and enhances the public's trust in the news, thus helping to narrow the knowledge gap.

In summary, AI has strongly contributed to the quality improvement and communication efficiency of journalism by increasing the speed of content generation, personalized push and in-depth analysis, which in turn helps to alleviate the digital divide problem. However, we should also be wary of algorithmic bias and information filtering bubbles that may result from over-reliance on AI, and ensure that the technology serves the public's right to know and diversity needs.

5.3 Enhancing User Experience and Engagement

In the aspect of enhancing user experience and engagement, it is important to recognize that the core of technological innovation lies in enhancing the inclusiveness and interactivity of services. Through personalized recommendation and interaction design, AI not only bridges the information access gap, but also stimulates user participation.

First, AI's intelligent recommendation systems use complex algorithmic models to filter and push customized content based on users' historical behaviors and preferences, thus ensuring that each user is exposed to information that matches his or her interests. Second, AI-powered chatbots and voice assistants make news access no longer limited by text-reading ability, but rather through conversational and auditory feedback, broadening access to information, especially for groups with visual impairments or low digital literacy, which is a notable advancement in inclusivity (e.g., Table 6). Further, the application of AI in news commenting and community management reduces the dissemination of harmful information through automatic screening and categorization, improves the quality and depth of discussion, and encourages active user participation.

In summary, AI effectively reduces the digital divide and enhances users' news experience and engagement through accurate matching, multimodal interaction and content quality assurance, while also promoting the development of journalism in a more inclusive and interactive direction. However, it is worth noting that over-reliance on AI may lead to a cycle of homogenized information, making it crucial to balance humanized interventions with technology-driven news production.

Table 6: Impact of AI-assisted tools on user experience

Tools Types	**Impact**
Chatbot	Provides 24/7 interaction
Voice assistant	Invisible Interface, Accessibility

6 Case Analysis and Empirical Research

6.1 Case Selection and Analysis Method

The selected cases aim to reveal how technological progress can promote the democratization of news communication without exacerbating social inequality. This paper chooses The New York Times and People's Daily as the objects of analysis, both of which represent Western and Eastern news organizations respectively, with wide influence and audience base.

The New York Times' intelligent recommendation algorithm “NYT ow” is a model, which not only provides personalized content based on users' reading habits, but also ensures diversity and balance through algorithmic optimization and prevents information segregation caused by over-customization. This design embodies the human-centered concept and ensures that readers are exposed to multiple viewpoints, thus bridging the information gap. On the other hand, People's Daily's “People's Number” platform uses AI technology to aggregate various media resources to create an open information sharing platform, enabling users from different regions and backgrounds to access valuable news, thereby crossing the geographical digital divide.

In terms of analysis methods, this paper adopts a mixed-method study, combining quantitative content analysis and qualitative user interviews. Quantitative analysis reveals the information flow patterns under the influence of algorithms by mining user behavioral data; qualitative interviews probe deeply into users' perception and acceptance of personalized services, as well as their demand for news diversity. Through comparative analysis, we find that successful news platforms not only rely on advanced technology, but more critically, how to maintain fairness and inclusiveness under the drive of technology to ensure that all users can participate equally in the production and consumption of information.

Table 7: Overview of Example Analysis Methods

Analyzing Dimensions	The New York Times	The People's Daily
Technical Applications	AI recommendation algorithms	AI aggregation platform
Target groups	Global readership	National Users
Fairness measures	Diversity Optimization	Open Source Aggregation
Research Methods	Quantitative content analysis	User Interviews

Such a research approach reveals that the application of AI in journalism is not a mere technological innovation, but needs to be continuously adapted and refined in practice to ensure that it serves the public interest and narrows, rather than widens, the information divide in society.

6.2 Case study findings

In exploring the topic of how AI innovations in journalism can overcome the digital divide, it is important to focus on how technology can empower the popularization and personalization of news. Artificial Intelligence (AI) realizes efficient matching of information through algorithmic news aggregation and distribution, enabling news to cross geographical restrictions and reach a wider audience group, thus bridging the digital divide to a certain extent.

In the case of Surge News, for example, it has successfully utilized precise user positioning to establish a deep connection with users through social media and the combination of online and offline means of communication. The establishment of this relationship relies not only on the intelligence of technology, but also on a deep understanding of users' needs, so as to provide customized news content. In addition, innovations in data journalism, such as the relative

compartmentalization of news editing and data technology, reveal that technology should serve as an auxiliary tool rather than a substitute for the subject of artificial intelligence in humanistic news production. This dynamically negotiated human-technology relationship ensures the professionalism and depth of the news and avoids the barriers to understanding caused by information overload.

However, we cannot ignore the fact that despite the convenience that AI brings, the technological divide still exists. Part of the population may not be able to fully utilize the advantages of AI due to a lack of digital skills or access conditions. Therefore, news organizations need to focus on education and popularization alongside technological innovation to ensure fair use of technology. By providing interfaces that are easy to understand and operate, as well as a news experience that adapts to users with different skill levels, we can gradually reduce this gap.

In summary, AI innovation in journalism presents both challenges and opportunities. It narrows part of the digital divide through personalized services and efficient communication, but it also reminds us that technological progress should be accompanied by considerations of inclusiveness to ensure that all members of society can participate equally in the production and consumption of information.

6.3 Design and Implementation of Empirical Research

The first concern is the equity and inclusiveness of technology application. The aim of this paper is to reveal how intelligent communication technologies can balance efficiency and humanity in practice to ensure wide accessibility of information. The position of this paper is that although AI brings about a significant increase in production efficiency, groups that may be marginalized by the technological divide should not be ignored.

By comparatively analyzing the human-technology relationship at different news production stages (deep engagement, dynamic negotiation, and relative compartmentalization), this paper finds that the algorithmic dependence of news users, the collaboration between journalists and robots, and the integration of editors and data technologies constitute a complex network of interactions. In this network, each link needs to consider how to lower the technological threshold and enhance the user experience. For example, intelligent algorithms should have the ability to learn and adapt to user needs rather than relying solely on preset patterns, thus reducing the formation of information filter bubbles and enhancing information diversity.

In the empirical study, this paper adopts a combination of quantitative and qualitative methods to collect and analyze data on users' use of AI news services, as well as to conduct in-depth interviews to understand users' real feelings and needs. This design allows us to quantify the effects of technology adoption while revealing non-quantitative social impacts. By constructing appropriate mathematical models (e.g., using linear regression to analyze the relationship between user acceptance of AI news and digital literacy), we were able to quantify the size of the digital divide and propose ways to target

The core of this research design is to reveal the potential inequalities of smart technology in news production through empirical evidence, and thus promote more just and inclusive technology adoption to bridge, rather than exacerbate, the digital divide. Our study shows that human-centered news production requires not only technological innovation, but also a deep understanding of social needs and continuous feedback iterations.

Table 8: Overview of empirical research design

Phase of the study	Methods	Objectives
Data collection	User Behavior Tracking In-depth interviews	Quantify usage habits Understand user needs
Data Analysis	Quantitative analysis Qualitative Analysis	Reveal the impact of technology Explore social effects
Modeling	Regression analysis	Assess the digital divide

7 Research Summary

In exploring the topic of how artificial intelligence can overcome the digital divide in journalism innovation, it is not difficult to find that technological progress is not a panacea, which has brought about efficiency gains as well as exacerbated inequality. Humanistic news production is particularly important in this context, which emphasizes the maintenance of human subjectivity and diversity in the application of intelligent communication technologies (Wu Jie, Xu Xiangdong, 2023). The interactive relationship between people and technology in the front, middle and backstage of news production reveals how the principle of humanism is understood and implemented in practice in the process of news gathering, writing and distribution so as to ensure the fairness and accessibility of news.

Media brands such as Surfing News have successfully attracted the attention of urban middle- and high-end users through precise product positioning, user positioning and function positioning. This suggests that AI should serve people rather than replace them, especially in news dissemination, to ensure customization and personalization of information to meet the needs of different users and to reduce information inequality due to the technological divide.

At the technical level, the application of nonlinear dynamics in engineering, where the study of its complex dynamic response helps to optimize system performance (Amer et al., 2024; Ai et al., 2024). Analogous to journalism, understanding the intrinsic mechanisms and boundary conditions of AI can avoid blind reliance on technology and ensure stability and controllability in the process of news production and dissemination, thus reducing the digital divide.

In summary, the innovation of AI in journalism needs to be human-centered to mitigate the digital divide through refined user services and in-depth understanding of the characteristics of the technology. This requires news organizations not only to keep up with the times in technology application, but also to adhere to the core values of humanism, and to narrow the knowledge and ability gaps caused by technological advances through education, training and policy guidance. In addition, the establishment of inclusive technological standards and norms to ensure that all social groups have equal access to and participate in the production and consumption of news and information is the key to overcoming the digital divide.

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