Construction and User Experience Optimization of Personalized Interaction Design System Based on AIGC

Ranwei Huang

Jilin Polytechnic of Water Resources and Electric Engineering, Changchun, China

1060998279@qq.com

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Abstract: With the rapid development of Artificial Intelligence Generated Content (AIGC) technology, personalized interaction design has gradually become a key trend in improving user experience. AIGC can generate high-quality content in real-time through technologies such as Generative Adversarial Networks (GANs), Natural Language Processing (NLP), and multimodal fusion, meeting the diverse and personalized needs of users. This article focuses on AIGC and explores in depth the construction methods of personalized interaction design systems and their applications in user experience optimization, covering technical foundations, system architecture design, user experience models, and practical case analysis. Research has shown that interaction design systems based on AIGC can not only generate customized content through accurate user profiles, but also dynamically adapt to user needs, enhancing the immersion and participation of interactions. In addition, this article proposes strategies to optimize system performance and improve user satisfaction, including specific methods such as data privacy protection, content generation quality optimization, and multimodal interaction design. Through case studies in education, virtual navigation, and other fields, AIGC has demonstrated significant advantages in personalized interaction and user experience improvement. Finally, this article analyzes the current technological and ethical challenges faced and provides clear directions for future research and practice.

1. Introduction

Artificial Intelligence Generated Content (AIGC) is a cutting-edge technology based on deep learning models that automatically generates multimodal content such as text, images, audio, and video. In recent years, it has been widely applied in fields such as social media, education, gaming, and virtual reality. With the rapid growth of digital content consumption, users' demands for content quality, personalized customization, and real-time interaction are increasingly increasing. However, traditional static content production and single interaction methods have significant shortcomings in flexibility and responsiveness, making it difficult to meet the diverse user needs in complex scenarios. Therefore, how to fully utilize the advantages of AIGC technology and build a user centered personalized interaction design system to achieve efficient and dynamic user experience optimization has become a hot research topic.

This article explores the following key research questions from both theoretical and practical perspectives: How to design and construct an efficient personalized interaction design system based on AIGC technology? What specific mechanisms does AIGC technology use to optimize user experience? In practice, how to further enhance user satisfaction and verify its effectiveness by improving system architecture and design strategies?

Through in-depth analysis of these issues, this article attempts to provide theoretical guidance and practical inspiration for the research of personalized interaction design based on AIGC, and explore feasible paths for technological innovation and user experience improvement in related fields.

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2. Technical foundation of AIGC

2.1. Overview of AIGC

Artificial Intelligence Generated Content (AIGC) is one of the core applications of generative artificial intelligence, which relies on deep learning technology to automatically generate high-quality, multimodal content. The main technical support includes Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and large-scale language models such as GPT and BERT. GAN generates realistic images, videos, and other content through the game between generators and discriminators; VAE generates diverse content by compressing and reconstructing data; Large language models can achieve semantic understanding and natural language generation based on massive corpora. Compared with traditional content production methods, AIGC has significant advantages in automation, real-time performance, and diversity, which can greatly improve content production efficiency and meet personalized user needs [1].

2.2. Application of AIGC in Personalized Interaction Design

Figure 1 introduces the application of AIGC in personalized interaction design.

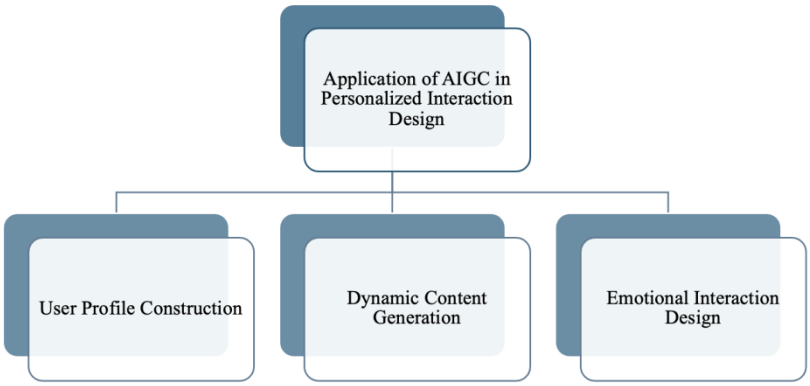

Figure 1: Application of AIGC in personalized interaction design.

2.2.1. User Profile Construction

By collecting and analyzing user behavior, preferences, and historical data, AIGC technology can generate highly accurate user profiles. These portraits provide a data foundation for personalized recommendations, enabling the system to dynamically adjust content and services based on user characteristics.

2.2.2. Dynamic Content Generation

AIGC meets users' dynamic needs by generating content in real-time. For example, in e-commerce platforms, AIGC can automatically generate customized product recommendation content based on users' browsing history and interest tags. In educational settings, the system can generate personalized learning materials for different students, thereby improving learning efficiency [2].

2.2.3. Emotional Interaction Design

AIGC, combined with emotion computing technology, can recognize users' emotional states and generate content that matches their emotions. For example, virtual assistants can provide comforting statements when users feel stressed, or recommend relevant content when users show interest, thereby enhancing the depth and warmth of the interactive experience.

2.3. The Advantages of AIGC Technology

AIGC technology provides a solid technical foundation for personalized interaction design with its efficiency, adaptability, and scalability, and significantly optimizes user experience through user profiling, dynamic content generation, and emotional interaction design, as shown in Figure 2.

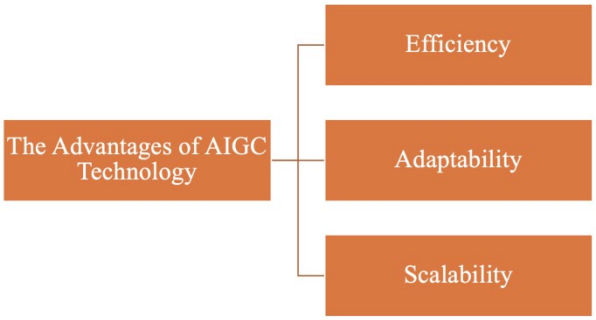

Figure 2: The advantages of AIGC technology.

2.3.1. Efficiency

AIGC significantly reduces the time and cost of manual content production by automating content generation, while also meeting user needs at a faster pace and improving production efficiency [3].

2.3.2. Adaptability

AIGC has the ability to dynamically adjust content based on user needs, behavior, and environmental changes, thereby providing users with highly tailored personalized interactive experiences. For example, in the smart home scenario, the AIGC system can adjust services in real-time based on users' daily habits.

2.3.3. Scalability

AIGC technology can be widely applied in multiple industries and scenarios such as social media, entertainment, education, and health management. Its powerful scalability not only enables it to adapt to the diverse needs of complex scenarios, but also provides innovative possibilities for cross industry personalized design and services [4].

3. Construction of A Personalized Interaction Design System Based on AIGC

3.1. System Architecture Design

The personalized interaction design system based on AIGC consists of multiple modules to achieve a closed-loop process of data collection, processing, content generation, and interaction optimization.

3.1.1. User Input Module

The user input module is responsible for collecting multidimensional data, including user behavior, interest preferences, historical records, and current environmental status. These data can be collected through device interaction, sensors, and applications as the basis for personalized system design [5].

3.1.2. Data Processing Module

This module utilizes deep learning techniques to preprocess, clean, analyze, and model the collected data, in order to extract user profiles and feature patterns. By deeply mining user behavior data, the system can dynamically predict user needs and provide support for personalized content generation.

3.1.3. Content Generation Module

The content generation module is the core of the system, which dynamically generates multimodal content such as text, images, videos, etc. based on user needs through AIGC technology. For example, in educational settings, teaching content suitable for students' learning progress can be generated, while in entertainment settings, video or game content that matches users' interests can be generated

[6].

3.1.4. Interactive Feedback Module

The interactive feedback module is responsible for collecting user evaluations and feedback on the system generated content. By continuously optimizing model parameters and content recommendation logic, this module achieves self-iteration of the system and continuous improvement of user experience.

3.2. Core Technology Implementation

3.2.1. Natural Language Processing (NLP)

NLP technology is the key to improving the text interaction experience. Through semantic analysis, intent recognition, and emotional understanding, the system can generate more targeted and natural text content, enhancing user acceptance and satisfaction with the system [7].

3.2.2. Computer Vision

Computer vision technology supports the generation of high-quality images and video content, achieving graphical and visual interactive design. For example, in virtual reality scenes, computer vision technology can generate 3D images in real-time, providing users with an immersive experience.

3.2.3. Multimodal Fusion

Multimodal fusion technology combines speech, text, visual and other information to achieve a richer and more dynamic interactive experience. For example, users can generate content through voice commands and confirm the generated results through visual feedback, thereby achieving more intuitive interaction [8].

3.3. Difficulties and Countermeasures in Implementation

3.3.1. Data Privacy Issues

The system may pose a risk of privacy breaches when collecting and processing user data. By introducing differential privacy and federated learning techniques, efficient data analysis can be achieved while protecting user privacy, ensuring system compliance and security.

3.3.2. Quality of Content Generation

The relevance, fluency, and creativity of content generation are key to system optimization. By continuously optimizing the parameters of the generated model and combining it with adversarial training methods, the quality of generated content and user satisfaction can be significantly improved.

3.3.3. Real-time Requirements

In high real-time scenarios, the system needs to respond quickly to user input. By adopting high-performance computing architectures (such as distributed computing) and optimizing model inference algorithms, the system response speed can be effectively improved to meet real-time interaction requirements.

In summary, the AIGC based personalized interaction design system provides users with an efficient, dynamic, and immersive interaction experience through modular architecture design and the application of multiple core technologies. At the same time, the countermeasures proposed for the difficulties in the implementation process provide practical and feasible solutions for system development.

4. The Core Dimensions of User Experience Optimization

A personalized interaction design system based on AIGC technology optimizes user experience from multiple dimensions, including four core aspects: personalization, immersion, usability, and sustainability. The synergistic effect of these dimensions can effectively meet the diverse needs of users, improve the overall efficiency and user satisfaction of the system, as shown in Figure 3.

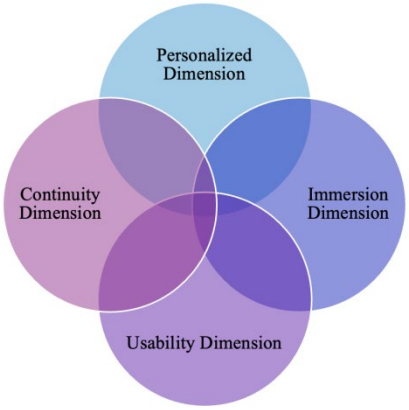

Figure 3: The core dimensions of user experience optimization.

4.1. Personalized Dimension

AIGC technology achieves highly customized content push through real-time analysis of user data, significantly enhancing user engagement and satisfaction. For example, in educational platforms, the system can generate targeted teaching content based on learners' knowledge level, learning progress, and interest preferences, such as customized exercise questions and learning videos. This personalized design not only meets the needs of users, but also improves the efficiency of system usage. In addition, in the field of e-commerce, AIGC can improve user experience and purchase conversion rates by analyzing users' purchase history and browsing behavior, recommending products that better match their preferences [9].

4.2. Immersion Dimension

Immersion is one of the important dimensions for optimizing user experience. Through multimodal interaction and dynamic content generation, AIGC technology can construct more realistic and vivid interactive scenarios. For example, combining virtual reality (VR) and augmented reality (AR) technologies with AIGC can provide users with immersive experiences, such as generating highly realistic environments and characters in virtual travel or games. This highly dynamic and interactive design helps users immerse themselves more deeply into the scene, enhancing the pleasure and attractiveness of the experience, thereby increasing users' dependence on the system and frequency of use.

4.3. Usability Dimension

AIGC technology also emphasizes system usability in user experience optimization. By using a user interface based on intuitive design, the operation process is simplified, the learning cost for users is reduced, and more users can conveniently use the system. For example, intelligent voice assistants utilize natural language processing technology to achieve smooth human-machine dialogue, allowing users to complete complex tasks with simple voice commands. In addition, simplified interaction processes and clear visual design help improve users' adaptability and satisfaction with the system. The adaptive design for vulnerable groups, such as the font enlargement function for elderly users, has further expanded the application population of the system [10].

4.4. Continuity Dimension

The continuous optimization capability of the system is one of the key factors for improving user experience. By collecting and analyzing real-time feedback from users, the system can continuously optimize the generated content and interaction design, ensuring a high degree of matching with user needs. For example, based on users' click through rates, dwell times, and evaluations of recommended content, the system can dynamically adjust the content generation logic and algorithm weights to ensure the accuracy and attractiveness of content push. This continuous optimization can not only enhance users' trust in the system, but also effectively improve users' long-term retention rate and

stickiness.

In summary, AIGC technology optimizes user experience from multiple dimensions, providing high-quality interactive experiences for users in different fields, from personalization, immersion, usability to sustainability. This user driven design approach provides important references for the development of personalized interaction design systems in the future [11].

5. Outlook and Challenges

With the continuous development of AIGC technology, its potential for application in personalized interaction design systems is becoming increasingly prominent. However, in the future development process, there are not only broad prospects, but also many challenges. Exploring future development directions and potential issues can help provide a clear path for the continuous optimization of AIGC.

5.1. Future Development Direction

5.1.1. Multimodal Interaction Optimization

The current AIGC technology mainly focuses on the generation and application of a single mode (such as text or image), while the potential of multimodal interaction has not been fully exploited. Future development can further enhance the collaborative interaction capabilities of various modalities such as voice, image, and touch. For example, in smart home scenarios, by combining voice control, visual feedback, and tactile interaction, users can interact with devices more naturally, achieving an immersive full sensory experience. Multimodal interaction optimization will further break the physical limitations of human-computer interfaces and provide users with a more realistic and dynamic interactive experience.

5.1.2. Emotion Computing Technology

Emotional computing is one of the important directions for future personalized interaction design. By combining AIGC with emotion computing technology, the system can accurately identify the user's emotional state and make corresponding responses. For example, the system can generate content that matches the user's emotions or provide customized services by analyzing their voice tone, facial expressions, and behavior. This emotional interactive experience not only enhances users' sense of belonging and satisfaction, but also plays an important role in areas such as interpersonal communication replacement and mental health support.

5.1.3. Cross-industry Applications

The application prospects of AIGC technology far exceed the current social media and entertainment fields. In the medical field, AIGC can be used to generate personalized treatment plans to assist doctors in diagnosis and decision-making; In the financial field, the system can generate customized investment advice based on real-time market changes and investor behavior; In the field of education, AIGC can generate personalized course content based on students' learning styles and progress. In the future, in-depth exploration across industries will further reveal the potential value of AIGC technology and provide innovative solutions for more fields.

5.2. Challenges Faced

5.2.1. Ethical and Privacy Issues

With the development of AIGC technology, ethical and privacy issues have become significant challenges that cannot be ignored. The extensive collection and use of user data may lead to privacy breaches, and there is also controversy over the authenticity and ethical boundaries of the generated content. For example, deepfake technology may be misused to create fake news or fraudulent content. To address these issues, it is necessary to establish sound laws, regulations, and industry norms, clarify the scope of use and responsibility attribution of AIGC technology, and strengthen the protection of user data through technological means such as differential privacy and blockchain technology.

5.2.2. Technical Bottlenecks

Although AIGC technology has made significant progress in content generation, there are still limitations in terms of the delicacy, authenticity, and diversity of generated content. For example, the generated image may lack realism in details, and the generated text may lack coherence and logic. In addition, real-time generation of high-quality content requires high computing resources, which puts higher demands on the hardware support and algorithm optimization of the system. In the future, technological breakthroughs are needed in optimizing model architecture and improving computational performance to meet the needs of complex application scenarios.

5.2.3. User Acceptance

The acceptance of AIGC generated content by users directly affects its application effectiveness in the market. At present, some users have doubts about the authenticity, reliability, and value of AIGC generated content, which may hinder its widespread application. In order to enhance user trust, it is necessary to improve users' understanding and recognition of AIGC technology through transparent generation processes, strict quality control, and active user education.

6. Conclusion

The personalized interaction design system based on AIGC demonstrates great potential for optimizing user experience, providing innovative solutions for multiple fields such as education, entertainment, and healthcare. AIGC provides users with highly personalized and immersive experiences through multimodal interaction, emotional computing, and real-time content generation. However, in its development process, it still faces ethical and privacy issues, technological bottlenecks, and challenges in user acceptance.

Future research and practice should further focus on multimodal interaction optimization, deepening emotional computing technology, and expanding cross industry applications. At the same time, effective ways to address ethical and technological challenges should be actively explored, including developing industry standards, strengthening technology research and development, and enhancing user awareness. Through the joint development of technology and society, AIGC is expected to become the core driving force of future personalized interaction design systems, creating higher value experiences for users.

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