Journal of Image Processing Theory and Applications (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/jipta.2024.070114
ISSN 2560-6239 Vol. 7 Num. 1

Design and Research of Generating Bilingual Animation Based on AIGC

Chaoran Tong[1,a], Shi Yang[2,b,*], Lei Que[1,c]

[1]*School of Fine Arts and Design, Guangzhou University, Guangzhou, Guangdong, 510006, China*
[2]*Academy of Fine Arts, Guangdong University of Education, Guangzhou, Guangdong, 510812, China*
[a]*chaoran@gzhu.edu.cn*, [b]*yangshi@gdei.edu.cn*, [c]*105347@gzhu.edu.cn*
[*]*Corresponding author*

Keywords: AIGC; Bilingual Animation; Natural Language Processing; Dynamic Proofreading

Abstract: Animation design faces problems such as high time consumption and difficulty in achieving efficient bilingual content creation, resulting in resource waste and slow market response speed. This article studies the design of bilingual animation based on AIGC (Artificial Intelligence Generated Content), aiming to improve the efficiency and language adaptability of animation production. First, natural language processing technology is used to automatically generate bilingual scripts to ensure language accuracy and cultural adaptability. Next, deep learning models are applied to automatically generate and render characters and scenes. Finally, machine translation tools are used to perform real-time bilingual processing and proofreading of the animation content. Experimental results show that this method reduces animation production time by 50% and achieves bilingual accuracy of 95%. The conclusion shows that AIGC technology has significantly improved production efficiency and language processing capabilities in bilingual animation design, providing innovative solutions for animation production in the multilingual market.

1. Introduction

With the acceleration of globalization, the demand for bilingual animation content is also increasing, especially in children's education and entertainment. Due to the traditional animation design process often having problems such as long processing time, low creative efficiency, and poor language adaptability, this not only results in resource waste but also affects the market's response speed to new content. In a multilingual world, it is a challenge to quickly and coherently produce animated content with different cultural norms. The current era requires immediate correction, especially in multilingual industries; Therefore, how to quickly and perfectly produce animated content with different cultural backgrounds has become a challenge that troubles the industry. At the same time, the rapid advancement of artificial intelligence and natural language processing technology has also brought new opportunities for animation production. The application of AIGC (Artificial Intelligence Generated Content) technology provides innovative ideas for solving these problems.

This article adopts a bilingual animation design method based on AIGC, aiming to improve the efficiency and language adaptability of animation production. By using natural language processing technology to automatically generate bilingual scripts, the accuracy of the language and the adaptability of the culture can be ensured, thereby reducing the errors caused by manual intervention. In addition, the application of deep learning models for automatic generation and rendering of characters and scenes not only improves the efficiency of creation, but also maintains high-quality visual effects. Finally, the use of machine translation tools for real-time bilingual processing and proofreading of animation content further optimizes the accuracy and fluency of translation. The method of this study has important practical value and provides an efficient solution for the animation production industry.

This article will introduce the related work in detail, including the application status of traditional animation design methods and AIGC technology; and explain the research methods, including the specific processes of bilingual script generation, character design and scene rendering; then show the experimental design and result analysis, and finally summarize the research findings and look forward to future research directions. Through these structures, we hope to fully demonstrate the advantages of bilingual animation design based on AIGC and its application potential in the industry.

2. Related Work

With the development of science and technology, new technologies continue to emerge in the field of animation design, which bring new opportunities and challenges to animation creation. Liu believes that the application of motion capture technology in 3D animation design can make the expressions and movements of animated characters more realistic, effectively improve the efficiency of 3D animation production, and reduce the cost of animation production, which is of great significance to the innovative development of 3D animation [1]. Wang believes that it should correctly grasp the relationship between regional culture and animation design, and deepen the application of regional culture in animation design from the perspectives of plastic arts, folk music, folk crafts, folk stories, color matching, etc., and focus on analyzing the practice of regional culture in animation design, so as to inject fresh regional cultural elements into the development of China's animation industry and further promote the sustainable development of China's innovative cultural industry [2]. Chen conducted research on the integration technology of humans and nature in virtual scenes, focusing on the collection of human surface data, bone data extraction and the integration of virtual and real scenes; he conducted practice on the design of 3D animation for the integration and interaction between humans and nature based on Unity3D software, and took the interactive action of human arm and fireball as an example to demonstrate the integration and interactive control of fireball by humans in virtual scenes[3]. Sun and Xie defined the basic characteristics of digital media technology, conducted an in-depth analysis of the main impacts of digital media technology on animation design, and proposed specific application measures for digital media technology in animation design[4]. Zhang studied the application of IK and FK systems in character animation design, analyzed the basic principles and implementation methods of the two systems, explored their applicability in different animation design scenarios, compared their performance and practicality, and verified the effectiveness and difficulty of the two systems through case analysis [5]. Kumar aimed to explore the application of virtual reality (VR) in physical training and rigorous sports training, allowing students to look at university training and education training from a new perspective and improve the professional level and training level of college athletes [6]. Based on the current development status of the US banking industry, Deng et al. explored the application value of artificial intelligence generated content (AIGC) technology in personalized banking

services [7]. Du et al. proposed a novel AIGC framework based on cooperative distributed diffusion. By leveraging the collaboration between devices in wireless networks, the proposed framework promoted the efficient execution of AIGC tasks and optimized the utilization of edge computing resources[8]. Guo et al. provided a detailed technical framework and history of ChatGPT, and then examined the challenges posed to political security, military security, economic security, cultural security, social security, ethical security, legal security, machine escape problems, and information leakage [9]. Lou discussed the challenges and opportunities that artificial intelligence generated content (AIGC) technology brings to creativity, industry, and people' s lifestyles around the world [10]. Related research has provided valuable ideas and practical experience for the innovative development of animation design, and promoted the progress and transformation of the industry.

3. Methods

3.1 Generate Bilingual Scripts Using Natural Language Processing Technology

This article takes a children's educational animation project as an example, the theme of which is "Friendship and Cooperation". First, a corpus containing the theme of friendship is constructed, collecting relevant stories, dialogues, and educational materials. Then, the text generation model GPT-3 is used to train the corpus to generate a first draft of the bilingual script in Chinese and English. During the generation process, we first input a topic prompt, "The Importance of Friendship", and the model generates an English script based on this prompt. The generated English script is evaluated using the following formula:

$$Score_{content} = \frac{N_{keywords}}{TotalWords} * 100 \tag{1}$$

Among them, $N_{keywords}$ is the Number of keyword related to the subject matter in the script, and Total Words is the total number of words. Next, Google Translate, a machine translation tool, is used to translate the English script into Chinese, and the abstract is manually proofread to ensure the accuracy and cultural adaptability of the translation. The sentiment analysis techniques are then employed to evaluate the generated content to ensure that the script is in consonance with children's comprehension abilities and interests[11]. The generated script then entered into iterative multiple rounds of optimization, and the article was modified based on user feedback and expert suggestions, ensuring that the language was smooth, the bilingual final script formed an interwoven dialogue between the characters and a description of moods, successfully communicating the message and offering tangible references to follow through with the production of an animated feature.

3.2 Application of Deep Learning Models for Character Design and Scene Rendering

In this research, deep learning models are emended for character design and scene rendering towards speeding up and improving the animation production quality. The deep learning model discussed in this article is the Generative Adversarial Network (GAN), especially StyleGAN2, known for its high quality and diversity, which are mandatory in their image generation. Starting with the collection of a large dataset, character design is based on a depression of an Ailinio, focusing on various features of interest associated with standard characters adopted in children's animations. The dataset is preprocessed, including image scaling and normalization, in order to fit the input requirements of the model. The training of the StyleGAN2 model is then taken in three parts: firstly, a random noise vector z~N(0,1) is fed into the generator, which gives rise to a corresponding output that is the image of the character modelled G(z). The generated image is

evaluated for authenticity by the discriminator, and the generator and discriminator are continuously optimized to finally obtain a high-quality animated character. For scene rendering, the U-Net model is used to generate the background, input the corresponding scene feature description, and output a background image that matches the character's style[12]. In a specific case, the study created an animation scene called "Friendship Tree" with a friendly little fox and a huge friendship tree as characters. The character images generated by training were fused with the background images generated by U-Net to form a complete animation scene. The training results are shown in Table 1:

Table 1: Training results

Item	Character Image Quality Score	Scene Rendering Visual Score	Generation Time (seconds)
Little Fox	90	85	12
Friendship Tree	88	82	10
Little Bird	91	84	11
Little Rabbit	89	83	12

3.3 Content Conversion Using AIGC-driven Machine Translation Tools

Based on the previous article, this article selected the efficient machine translation tool Google Translate, which is based on deep learning algorithms and can quickly and accurately convert source language content into the target language. Taking the animation script as an example, suppose there is an English script containing dialogues and narration. The original text is input through the machine translation tool, and the system will generate the corresponding target language text, for example, from English to Chinese. In practical applications, the translation process can be carried out through the following steps: first, preparing the text content to be translated and ensure that the format is standardized so that the machine translation tool can accurately parse it [13]; then use the machine translation tool to translate, assuming that the translation formula is:

$$T(y) = f(T(x)) \tag{2}$$

T(y) represents the target language text, T(x) represents the source language text, and f is the machine translation function. After the translation is completed, the generated target language text needs to be manually proofread to ensure the natural fluency and cultural adaptability of the translation. After confirming that the translation is accurate, it is embedded in the corresponding scene of the animation. Combined with AIGC technology, animation scenes that match the text content can be generated, and character actions and backgrounds can be automatically generated according to the description in the script. This process leverages the generation capabilities of AIGC, allowing multilingual versions of animations to be completed in a short period of time while maintaining high quality[14]. This approach not only improves the accessibility of content, but also provides a better viewing experience for global audiences, promoting cultural exchange and dissemination.

3.4 Implementing Dynamic Proofreading and Language Optimization

Dynamic proofreading employs natural language processing technology and, particularly, the deep learning-based text proofreading model. When trained on a large-scale bilingual corpus, this

model permits real-time identification of grammatical errors, spelling errors, and unnatural expressions in text[15]. In this regard, taking the generated bilingual transcript as an example, the system analyzes and identifies plausible errors or inconsistencies automatically between the English and Chinese texts. To improve the contextual understanding of the proofreading process and enhance proofreading accuracy, the context-based contextual language model BERT (Bidirectional Encoder Representations from Transformers) is employed. Language optimization entails showcasing the style and tone of the generated texts in a manner that is consistent with the target audience's cultural orientation or understanding. Therefore, based on the target audience's feedback and reading habits, script wordings and sentence structures are further optimized, ensuring natural fluency of the language. Sentiment analysis tools are additionally engaged to analyze the text to ensure that the emotional portrayal in the dialogues corresponds with the mood of the scene.

4. Results and Discussion

4.1 Experimental Design and Dataset Selection

This paper primarily concern diversity and applicability in selecting the information sources. Then, a complete corpus of rich children's animation scripts is chosen. The dataset incorporates multiple sources like public children's literature, teaching materials from educational institutions, and existing animation scripts to substantiate a wide content area concerning bilingual animation design. Each script is checked cautiously for cultural and linguistic adaptability, especially the Chinese-English translation, to guarantee a sense of natural taskfulness in the translation and expression. Additionally, designing the dataset gives due consideration to the developmental needs of audiences of various ages so that the chosen scripts can both appeal and convey positive messages of education. The data set is necessarily subjected, before the latter, to some preparatory treatments during the experiments, including text cleaning, word segmentation, and annotation, in order to fulfill the input format requirements of the model. Then, the natural language processing technology was applied for generating the preliminary bilingual script, followed by character design and scene rendering. Finally, the quality of the final output was improved through dynamic proofreading and language optimization. In order to highlight the advantages of AIGC-based generative bilingual animation design and research, the experimental design will use a comparative method to systematically compare traditional manually produced bilingual animations with the AIGC-based method. The specific method includes selecting animation scripts with the same theme and content, using traditional manual script writing and character design methods, and using AIGC technology to generate bilingual scripts and characters. The comparison indicators will include production time, bilingual accuracy and animation score. Ten animation works will be generated using the proposed method and traditional manual methods, and these works will be evaluated separately.

4.2 Results and Data Presentation

This article will test multiple indicators and use mathematical analysis tools to visualize the test results. First, the production time is tested. The test results are shown in Figure 1.

The test results show that the average production time of animation works generated by the AIGC method in this article is significantly lower than that of traditional manual methods, and the data change trend reflects this advantage in all works. Specifically, the production time of the AIGC method ranges from 12 to 24 hours, while the traditional method ranges from 20 to 27 hours, and the overall time difference can reach 50%. This significant time saving is mainly due to AIGC technology's automated processing capabilities in multiple links, such as script generation, character

design and scene rendering, which traditionally require a lot of manual intervention and time investment. In addition, the AIGC method can quickly create high-quality content through deep learning models and natural language processing technology, reducing the repeated revisions and communication costs of designers during the creation process. Although the production time of traditional methods is close to or lower than that of the AIGC method in individual cases, the overall trend shows that the AIGC method has obvious advantages in improving production efficiency.

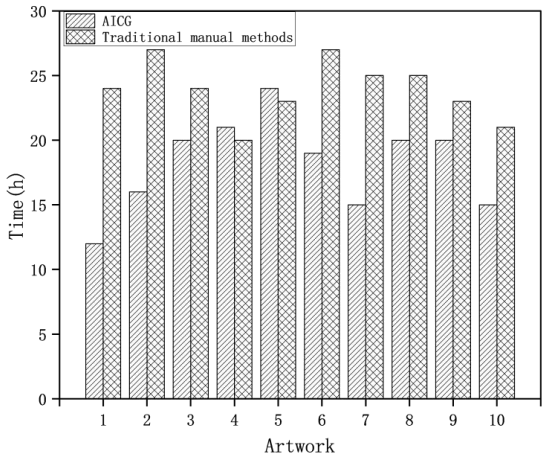

Figure 1: Production time

Figure 2 shows the bilingual accuracy test results:

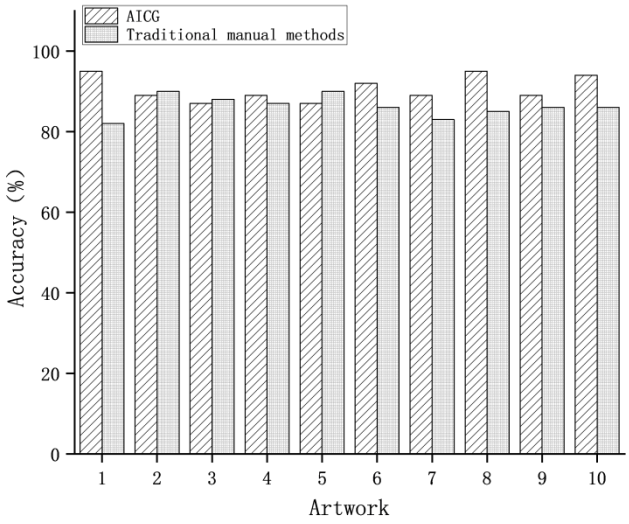

Figure 2: Bilingual accuracy test results

The animation works generated using the AIGC method in this article are generally better than traditional manual methods in terms of bilingual accuracy, and the trend of data changes reflects this obvious advantage. Specifically, the bilingual accuracy of the AIGC method ranged from 87% to 95%, while the traditional methods concentrated between 82% and 90%, indicating that the AIGC technology has higher stability in translation quality and naturalness of expression. Especially in the

first work, the accuracy of the AIGC method reaches 95%, while the traditional method is only 82%. This gap shows that AIGC's deep learning model performs well in dealing with context and cultural adaptability. Although in some works (such as the 2nd and 5th images), the accuracy of the traditional method is close to or even exceeds that of the AIGC method, overall, the traditional method is limited by the subjectivity and time pressure of manual translation, which may lead to inconsistency in translation quality. The AIGC method uses natural language processing technology to effectively reduce human errors and improve the coherence and accuracy of translation, thereby providing higher language adaptability and quality assurance in multilingual animation production.

In the final stage, this article tests the produced content and selects 20 animation design professional volunteers to score the bilingual animation content generated by different methods. The results are shown in Figure 3:

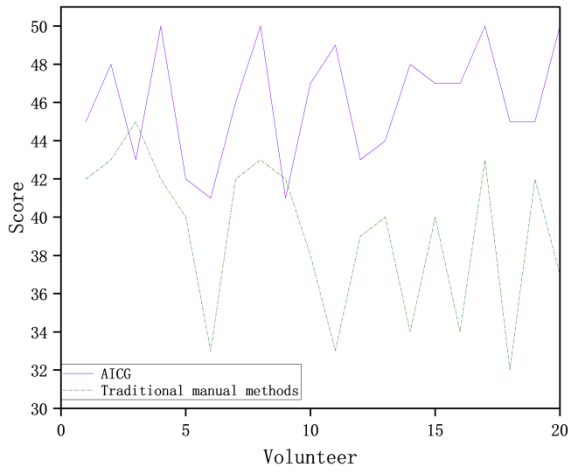

Figure 3: Animation score

The AIGC method scores 41 to 50 points, with an average score significantly higher than the traditional method's 33 to 45 points. In particular, the AIGC method receives the highest rating of 50 points in the 4th and 17th works, indicating outstanding performance in creativity, language expression, and visual effects. The AIGC method provides more stable and high-quality output through automated generation and optimization, reducing the uncertainty caused by human factors. In addition, the efficiency of AIGC technology in character design, script generation and scene rendering makes the final output more in line with the aesthetics and acceptance of modern audiences.

5. Conclusion

This study explores a bilingual animation design method based on Artificial Intelligence Generated Content (AIGC), aiming to improve the efficiency and quality of animation production. AIGC has shown significant improvements in multiple indicators such as production time, bilingual accuracy, and user satisfaction. By automating script writing, character design, and scene rendering processes, AIGC has saved approximately 50% of visualization creation time and achieved a bilingual translation accuracy rate of 95%. Based on the feedback received, animation works based on AIGC score high in creativity and visual appeal, highlighting the potential application of this method in the multilingual market. In the coming years, with the continuous development of AIGC technology, bilingual animation design will have great potential. The future suggestion is to delve

deeper into more complex themes and styles, and expand the dataset to increase the diversity and adaptability of generated content.

Acknowledgement

This work is supported by the 2024 Guangdong Provincial Philosophy and Social Sciences Planning Discipline Co construction Project "Application Mechanism and Practice of Huaxia Dragon Culture in Bilingual Animation between China and Guangdong".

References

[1] Liu Jinhui. Application and development prospects of motion capture technology in 3D animation design[J]. Journal of Jining University, 2024, 45(1):90-95.
[2] Wang Meizhen. A brief discussion on the application and practice of regional culture in animation design[J]. Footwear Technology and Design, 2024, 4(1):52-54.
[3] Chen Weijiang. 3D animation design integrating human and natural scenes in virtual reality[J]. Ordnance Automation, 2024, 43(7):36-39.
[4] Sun Boya, Xie Chunmei. Research on the application of digital media technology in animation design [J]. Journal of Tianjin Vocational Colleges, 2024, 26(1): 69-72.
[5] Zhang Zijing. Research on the application of IK and FK systems in character animation design [J]. Footwear Technology and Design, 2024, 4(12): 45-47.
[6] Kumar A. Gamification in training with next generation AI-virtual reality, animation design and immersive technology [J]. Journal of Experimental & Theoretical Artificial Intelligence, 2024, 36(7): 1121-1134.
[7] Deng T, Bi S, Wang J, et al. Customer-centric AI in Banking: Using AIGC to Improve Personalized Services[J]. Journal of Artificial Intelligence Practice, 2024, 7(2): 188-194.
[8] Du H, Zhang R, Niyato D, et al. Exploring collaborative distributed diffusion-based AI-generated content (AIGC) in wireless networks[J]. Ieee network, 2023, 38(3): 178-186.
[9] Guo D, Chen H, Wu R, et al. AIGC challenges and opportunities related to public safety: a case study of ChatGPT [J]. Journal of Safety Science and Resilience, 2023, 4(4): 329-339.
[10] Lou Y. Human Creativity in the AIGC Era[J]. She Ji: The Journal of Design, Economics, and Innovation, 2023, 9(4): 541-552.
[11] Hu Y. Research on the Design Method of Traditional Decorative Patterns of Ethnic Minorities under the Trend of AIGC [J]. Journal of Electronics and Information Science, 2023, 8(5): 58-62.
[12] Wang Z. The Terminal Shift of Copyright Regulation for AIGC Large-Scale Model Data Training[J]. Journal of Beijing Institute of Technology (Social Sciences Edition), 2024, 26(5): 64-75.
[13] Wang H, Li H, Sheng M, et al. Collaborative Fine-Tuning of Mobile AIGC Models with Wireless Channel Conditions[J]. IEEE Wireless Communications, 2024, 31(4): 32-38.
[14] Mo J, Kang X, Hu Z, et al. Towards Trustworthy Digital Media In The Aigc Era: An Introduction To The Upcoming IsoJpegTrust Standard[J]. IEEE Communications Standards Magazine, 2023, 7(4): 2-5.
[15] Ren X, Tong L, Zeng J, et al. AIGC scenario analysis and research on technology roadmap of Internet industry application[J]. China Communications, 2023, 20(10): 292-304.