Research on Style Innovation and Precise Audience Targeting Path of Visual Communication of Animation IP Empowered by Deep Learning

Wang Xu[1,2], Won-joon Jung[2]
[1]Jilin Animation Institute, Changchun 130012, Jilin, China
[2]Tongmyong University, Busan 48520, Nouth Korea

Corresponding author: Wang Xu (e-mail: wangxu00sharon@163.com)

ABSTRACT Visual communication of animation IP is an important link between content creation and audience reception. Under the development of intelligent production technologies, animation design is shifting from traditional manual production toward data-driven intelligent creation. This paper analyzes visual style innovation and precise audience targeting in animation IP communication by integrating deep learning technologies, including generative adversarial networks, convolutional neural networks, and reinforcement learning. An intelligent creation and communication model is developed, including a multidimensional animation style generation system, an audience profiling method, and a propagation path optimization mechanism. The animation style generation model extracts visual features, analyzes style attributes, and generates new content based on controllable parameters. Audience profiles are constructed through multi-source user behavior data, while dissemination paths are optimized using reinforcement learning. Experimental results show that deep learning improves the diversity, consistency, and visual quality of animation IP expression, enhances communication efficiency, and supports more accurate audience reach through personalized content recommendation.

INDEX TERMS animation ip, visual communication, deep learning, style generation, audience targeting

I. INTRODUCTION

THE visual dissemination of animation IPs acts as a vital linkage between content creation and audience reception, where the integration of innovative aesthetics directly dictates the stylistic innovation and market vitality of cultural products. By elevating dissemination efficiency through material-inspired visual design, creators can enhance the tactile realism of digital content, thereby strengthening the overall competitiveness of the animation in the global creative economy. Driven by the digital wave, the animation industry is experiencing a profound change from traditional production to intelligent production. In recent years, with the gradual formation and maturity of generative deep learning technology, animation design has slowly evolved from the traditional hand-drawn animation to the intelligent creation of data. This transformation is not only observed in the improvement of productive effectiveness, but also it has been changed the basic plan of thinking and dissemination. Currently, the global animation industry is still in the period of sustained growth, which will reach $600 billion in 2027; intelligent animation production made from deep learning technology is the great driving factor of growth. However, despite some tremendous technological advancements, current research is mainly done in single point breakthroughs at the technical level with no systematic integration of innovation in visual styles and audience reach mechanisms. This, to some extent, limits the maximization of the value of animation IPs.

This paper investigates new avenues for animation IPs in intelligent creation and audience engagement based on the interdisciplinary so-called algorithmic models and dissemination mechanisms. It seeks to answer the following fundamental questions: How can we automatically generate and optimize animation visual styles by introducing interpretable style control parameters and diversity constraint mechanisms, and applying deep learning technology, so as to improve production efficiency while ensuring the complete expression of artistry? How can data-driven approaches be employed for precise identification and targeting of target audiences and effective dissemination feedback mechanisms? How can a technology-enabled animation IP dissemination paradigm be built to maximise the content value and dissemination effectiveness? Solving these problems has great theoretical and practical value to the

innovative development of animation industry. This research forms a complete logical loop from methodical design to experimental verification, offering a new perspective on the visual dissemination of animation IPs through innovative surface patterns and providing an actionable solution for industrial practice.

II. RELATED WORK

The cross-integration of animation design and visual communication technology is deepening. From the systematic application of 3D visual communication and the extension of visual communication principles in special effects and color design, to the practice of generative deep learning and CNN big data methods in animation advertising and interface design, a series of studies indicate that animation creation is gradually evolving towards intelligence, immersion and cultural narrative. Shan and Wang[1] explored how to systematically apply advanced 3D visual communication technology to the animation design process to create more immersive and visually impactful works. Liu[2] started from the basic principles of visual communication design and explored its specific application in animation special effects and color design. Zhang et al.[3] introduced interactive animation special effects, pointed out the advantages of interactive animation special effects production in visual communication design, and proposed the path of interactive animation special effects production in visual communication design. Fang and Gong[4] applied CNN and big data visual communication methods to realize the intelligence and precision of digital animation advertising design. Gong and Li[5] sorted out the inheritance and innovation practice of animation art on national art design elements, and analyzed the influence path of design trends on animation technology reconstruction and narrative expression. User interface (UI) is the bridge between users and digital products. Akwukwuma et al. [6] have confirmed that consciously using professional graphic design principles and sophisticated animation techniques can significantly improve the visual hierarchy and interaction logic of the user interface. Ardhianto et al. [7] explored the use of generative deep learning models to create landscape visual animation. Chen et al. [8] pointed out that the practice of artificial intelligence in the field of art and design provides a powerful and perceptible contemporary demonstration of object-oriented ontology. Satria et al. [9] recorded and analyzed the complete design phase of transforming the "Merarik" wedding custom into an animated medium. This project proved that a structured animation production process is an effective method for studying and introducing cultural heritage and can serve as a bridge for cultural anthropological research and public education. Emotional design theory points out that design should influence users on three psychological levels: instinct, behavior, and reflection. Chen and Khynevych [10] applied this theory to animation character design, aiming to go beyond appearance beautification and systematically shape characters that can evoke emotional resonance from the audience's psychological level. Existing research has made substantial progress in the technical realization of animation visualization, but lacks a systematic integration of the innovation of animation IP visual communication style and audience reach mechanism. Therefore, this paper explores innovative paths for animation IPs in intelligent creation and audience connection through the interdisciplinary integration of algorithm models and dissemination mechanisms.

III. METHODS

This study uses a comprehensive research methodology of a combination of theoretical modeling and empirical analysis (combination). It creates a deep learning open-framed structure for animation generation and dissemination, and tests the efficacy of the approach by using large volumes of user behavior data, created a full research system. The research methodology fully takes into account the unique characteristics of visual communication of animation IPs, from two aspects: the feasibility of implementing the technical measures and the feasibility of measuring the effect of dissemination, so that the research results have value in theory and value in guidance. The full research framework contains three main parts: design and optimization of the model of animation style generation, construction and analysis methods of audience profile and optimization of dissemination paths and effect evaluation mechanism. These three parts serve to support and validate one another in order to ensure systematicity and completeness of the research as a whole[11-12].

A. ANIMATION STYLE GENERATION MODEL

Through the use of advanced techniques employed in the fields of computer graphics and computer vision, the purpose of this research is to create a multi-layered (ML-LAYER) animation style generation (ASG) Model. The "multi-layered" approach here specifically refers to the model's deep design across three dimensions:

1) Multi-layered feature abstraction, capturing different levels of features from low-level texture to high-level semantics through stacked convolutional layers;

2) Multi-layered processing stages, decoupling the generation process into three independent stages: feature extraction, style analysis, and content generation, forming a modular processing pipeline;

3) Multi-layered optimization objectives, simultaneously optimizing pixel-level reconstruction loss, style consistency loss, and adversarial loss during training to ensure the visual quality and artistic expressiveness of the generated content.

ASG generates an animation using three separate modules:

(1) Feature Extraction,
(2) Style Analysis and
(3) Content Generation.

The model utilizes an end-to-end Deep Learning (DL) architecture which consists of three key elements (modules)

as previously stated. The first module, Feature Extraction, extracts deep features of animated samples through a multi-layer Convolutional Neural Network (CNN). In this process, visual components (e.g. lines; colours; texture; and motion pattern) are analysed, broken down and reconstructed. Thus, a comprehensive "representation system" of feature extraction is generated to support future animation creation. The second module, Style Analysis, uses an attention mechanism to assign relative importance to the various style features derived from the feature extraction process, enabling the model to map the relationship of these style features to the construction of new animated content. The third module, Content Generation, employs Conditional GANs to generate new animated content based on provided style parameters.

The innovation of the model is reflected in the following aspects: Firstly, a feature fusion mechanism aiming to achieve multi-scale fusion of the animation content is proposed, which can both capture the local details and global features of the animation content to ensure the visual consistency of the generated content; Secondly, an interpretable style control parameter system was designed, which allows creators to precisely guide the style characteristics of the generated content by intuitively adjusting the values of style control parameters, thereby transforming abstract artistic expression into quantifiable technical indicators and solving the core problem of "ensuring artistry while improving production efficiency".; Thirdly, a style evaluation index system is constructed, which contains the evaluation criteria of multiple features (visual quality, style consistency, originality, etc.). At the same time, in the process of model training, this study adopts the progressive training strategy, which is to start learning simple styles and gradually increase the complexity of styles so as to ensure that model stability and convergence can be achieved. Simultaneously, the model prevents pattern collapse by introducing a function for the loss of style diversity, so that the richness and diversity of the generated content is ensured.

The model is implemented on the basis of the PyTorch deep learning framework, and is trained on a dataset of 500,000 animation frames. A multi-stage optimization strategy was used according to the training, first was pre-training on basic style dataset, fine-tuning on specific style dataset, and adversarial training to further improve the generated quality. Experiments show that the model can not only learn good feature representations of different animation styles but also generate new content with good visual quality and style consistency, which provides good technical support in the process of creating animation[13-14].

B. AUDIENCE PROFILE CONSTRUCTION

Audience profiling is core at getting exact communication. This work addresses the option of establishing an overall audience profiling methodology, positioning the multi-source data fusion and deep learning analysis. Data sources include the data of user viewing behaviour, social media interaction and questionnaire survey, so as to ensure that the profiling is comprehensive and accurate. In data processing stage, a hybrid architecture of convolution neural network and recurrent neural network is used to extract deep features in user behavior sequence, including user's long-term interests, and short-term behavior pattern. The constructing process of user profile consists of three layers: basic attribute layer contains basic information like user's demographic attributes and the use of device, behavioral feature layer covers the behavioral data like user's viewing preference, user's interaction pattern, and user's time distribution, and finally, psychological feature layer analyses the user's comments sentiment or content preference and other deeper psychological characteristic information through natural language processing technology. These three layers of features are fused with a combination of feature cross-referencing and attention mechanisms to create a full user profile representation.

To ensure the timeliness dynamic of user profiles, this study designed an online learning mechanism that ensures user profile features are updated in real time, based on the latest user behavior data. Simultaneously, the technology of differential privacy is applied to protect the user data security, as much as possible privacy of the user is ensured while at the same time the accuracy of the profile is maintained. The profile model uses a hierarchical algorithm to cluster the audience into groups, each group with clearly defined feature labels and preferences that have descriptions and provide a foundation for making subsequent personalised recommendations.

C. OPTIMIZATION OF PROPAGATION PATH

Based on accurate audience profiling, this paper designs a strategy of data-driven propagation path optimization. The propagation path optimization problem is formulated as a sequential decision-making process and solved by using a deep reinforcement learning algorithm. The state space contains information from several dimensions such as the user characteristics, content characteristics and the environmental context, whereas the action space has different choices of propagation strategies. The core innovation of this model lies in the design of its reward function. To maximize user engagement and content dissemination while effectively addressing the potential "information cocoon" effect, we construct the reward function as a multi-objective optimization problem, specifically formalized as:

$$R = \alpha \bullet R_{\text{engagement}} + \beta \bullet R_{\text{diversity}} \tag{1}$$

Where, $R_{\text{engagement}}$ measures immediate user interaction with recommended content (e.g., clicks, viewing time, sharing), and $R_{\text{diversity}}$ measures the diversity and novelty of recommended content in terms of theme, style, and cultural elements, to avoid the model over-relying on users' past preferences. The parameters α and β are adjustable weighting coefficients used to balance the trade-off between short-term dissemination effects and the long-term health

of the user contentecosystem.This design provides a clear and optimizable mathematical framework for balancing mathematical framework for balancing personalizationand diversity.

The optimized model is based on the architecture of 'Actor-Critic Architecture' where we learn the best way to propagate using a policy gradient approach. To achieve the efficiency learning, a learning mechanism is created taking with basic propagation scenarios and increasing gradually the complexity of the scenarios. Simultaneously, ensemble learning is applied to a combination of several base models for more stable and generalizable policy. During the training of the model, a massive real-world propagation dataset that contains 100,000 users was used for the training data and also for the validation data.

The optimization of the dissemination path is not limited to the short-term effects of dissemination but also takes the maintenance of the long-term value to the user into account. A multi-objective optimization framework is applied to balance the trade-off for immediate effects of dissemination and long-term metrics such as user retention. Furthermore, the model considers the characteristics of various dissemination channels, personalized dissemination strategies for different channels are customized to maximally achieve the dissemination effect. Experimental results show that this optimization method can be effective to improve the content dissemination efficiency while keeping a good user experience.

IV. RESULTS AND DISCUSSION

A. PERFORMANCE EVALUATION OF STYLE GENERATION MODEL

For the performance evaluation of the style generation model, a comprehensive experimental methodology was created to test the performance of the model across various aspects including the quality of generated output, the variation in generated styles and the efficiency with which the model can produce output. The experiment used a large number of animation samples (a total of 5,000) reserved from the training dataset that were not used in model training. These samples covered different styles of animation, from traditional hand-drawn animation to computer-generated animation, and served as a test set for performance evaluation.

As shown in Table 1 below, all of the evaluation criteria, the generative model developed in this study performed better than traditional methods. The generative model was found to have the best FID score at 28.4 which shows that the generated content had a very natural visual presentation. The generative model also had a style diversity index of 0.91, which means that it was able to generate a wide range of style varieties without the pattern collapse issue. To assess users' subjective feelings about the generated content, we organized 20 evaluators with animation or design backgrounds to score the animated clips generated by the model according to pre-defined scoring criteria. These criteria included three dimensions: "Visual Appeal (1-10 points)," "Stylish Typicality (1-10 points)," and "Overall Artistic Appeal (1-10 points)." The final user preference score was a weighted average of the three dimensions (weights of 0.4, 0.3, and 0.3, respectively). The experimental results showed that the average user preference score was 8.5 points, indicating that users recognized the artistry and aesthetic appeal of the generated model's output.

Further analyses show that this model can perform style transfers of complex tasks very successfully. One example is the ability for use of the very different styles of ink painting and modern special effects to be combined into a hybrid animation that is capable of containing the aesthetic beauty of the ink painting style while in combination with the dynamism of modern effects. This is a very innovative output and was produced much easier with generative model than would be possible using traditional methods of animation production. The design of the model enable the extraction of many subtle features of different styles using a multi-scale feature extraction mechanism, while the progressive training method enable the model can train on the complex styles in stable manner. All of these advantages make this generative model an extremely valuable tool for the practical application of animation production and provide great enhancement in the efficiency of creative processes as well as new avenues for artistic innovation.

To more intuitively demonstrate the performance evolution of the proposed animation style generation model during training, the Fréchet Inception Distance (FID) scores of different models at different training epochs were recorded. A lower FID score indicates that the quality of the generated image is closer to the distribution of the real image, meaning a better generation effect. (See Figure 1.)

The optimized model proposed in this paper shows a rapid decrease of FID score during the early training processes, and the model becomes stable after approximately 200 rounds with the final FID value (28.4) being significantly lower than the comparison model. This curve intuitively validates the effectiveness of improved model architecture and optimized training strategy, which means that this study's method not only achieves better generation final quality, but also has more efficient training convergence characteristics.

B. AUDIENCE REACH EFFICIENCY ANALYSIS

The analysis of audience reach efficiency is verified by large-scale data of dissemination in real world, including the dissemination effects of different types of animation IPs on various platforms. The research has selected 100,000 currently active users as a sample, and followed their viewing behavior data for 3 months, and analyzed more than 10 million interaction records, By comparing the effect of personalized versus general recommendation strategies, the study dives in to the role of data-driven methods in making the reach more efficient.

TABLE 1. Performance Comparison of Animation Style Generation Models

Method	FID score	Style Diversity Index	User preference rating (out of 10)	Training efficiency (frames/second)	Inference speed (frames per second)
Traditional GAN models	45.6	0.72	6.3	120	85
The model in this paper (benchmark parameters)	31.2	0.89	7.8	95	65
The model in this paper (optimized parameters)	28.4	0.91	8.5	105	72

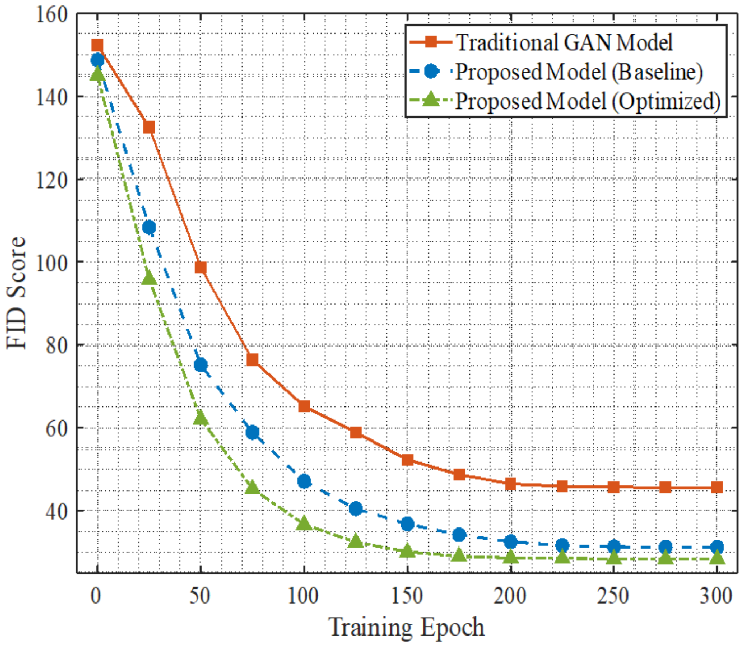

FIGURE 1. Training performance

As shown in Table 2, the personalized distribution strategy based on deep learning achieved good results under a variety of user groups. In terms of click-through rate (CTR), the personalized strategy had an average increase of 47.3% against the general strategy with the biggest increase in CTR (49.2%) occurring among middle-aged users (36-50 years old). With regard to viewing time, personalized recommendations increased viewing time, especially among young adults (21-35 years old), where the growth rate of viewing time was 192%, which means that personalized content better satisfied the viewing needs of this group.

Further analysis of the effects of dissemination by different types of content showed that narrative-based animated IPs benefited more from personalized recommendations. This type of content usually takes longer viewing time to see the art within it and with some personalized recommendations (with the proper match between the user's preferences) improved the view completion rates a lot. In contrast, the dissemination effect of short video animated material experienced relatively limited improvement which may be related to the inherent nature of short videos.

Regarding the optimization of the dissemination channels, the study found significant differences in preferences of different user groups for dissemination channels. The approach of delivering content to teenagers is more towards the short video platforms, and for the middle-aged people it is long video platforms. Based on these findings, differentiated dissemination strategies were tailored for different groups, such as priority given to social media pushes to "highly interactive groups." These optimizations not only made individual disseminations more effective but also allowed for sec-ondary dissemination of content via social networks of users, further increasing the reach of the messag e.

However, personalized recommendations are also not without their own interesting issues. Over-reliance on what users have wants to know in the past may result in an "information cocoon" effect, which restricts users from having the opportunity to access diverse content. To address this issue, this study explicitly introduces a diversity reward term into the reward function of the deep reinforcement learning model, as described in Section 3.3 above. This internalizes "exploration" as a quantifiable optimization objective at the algorithmic level. Specifically, when the model recommends content that exceeds the user's typical preferences, if the content garners positive user interaction

TABLE 2. Comparison of Audience Reach Efficiency (Unit: %)

User Group	Click-through rate (general strategy)	Click-through rate (personalization strategy)	Viewing time growth rate	Increased sharing rate	Improved completion rate	Increased rewatch rate
Teenagers (13-20 years old)	12.3	18.1	156%	55%	68%	42%
Young people (21-35 years old)	9.8	14.4	192%	61%	73%	51%
Middle-aged (36-50 years old)	6.5	9.7	134%	48%	59%	37%
Seniors (50 years and older)	4.2	6.1	118%	35%	46%	28%

(such as full viewing or sharing), the model receives additional rewards, encouraging a better balance between exploration and utilization. Experiments show that this method of mathematically balancing personalization and diversity in the reward function, while potentially lowering some metrics in the short term through moderate exploratory recommendations, helps improve user engagement and build a healthy content ecosystem in the long run.

C. CULTURAL ADAPTABILITY AND COMMUNICATION EFFECTIVENESS

Cultural adaptability becomes an important factor for the successful cross-cultural dissemination of animation IPs. This study has examined the impact of culturally adapted content on dissemination effectiveness systematically using a controlled experiment. The experiment selected 3 different types of animation IPs, animations with intangible cultural heritage themes, animations with modern urban themes, and experimental animations with mixed styles. Adapted versions were created for audiences from different cultural background and the differences in dissemination effects were compared and analysed.

As shown in Table 3, cultural adaptation significantly impacted the dissemination effect. In the animation dissemination experiment themed on intangible cultural heritage, the version adapted for Southeast Asian audiences, by adding local mythological symbols and cultural elements, saw a 38% increase in cultural identity score (based on a questionnaire survey of 50 audience members from the target cultural background, using a Likert seven-point scale to measure their subjective evaluation of their cultural belonging and acceptance of the adapted content, and calculating their average score), a 27% increase in comprehension level (assessed by evaluating the proportion of viewers who correctly interpreted specific cultural symbols and narrative logic in the animation, using a combination of open-ended questions and multiple-choice questions), and a cross-cultural communication efficiency index reaching 0.84, all higher than the original version. This improvement was particularly significant in works with richer cultural content, indicating that cultural adaptation is an effective way to enhance the international dissemination effect of animation IPs.

Further analysis shows that cultural adaptation goes beyond the visual things, including the integration of full consideration of other deeper cultural factors such as narrative style and values. Successful cultural adaptation, therefore, requires preservation of the original work's unique characteristics while considering the target audience's cultural habits, finding points of cultural resonance. For example, in the dissemination of an animated IP with an Eastern cultural background to a Western audience, appropriate changes in the narrative structure and explanation of the cultural background will greatly improve the communication effect.

The multilingual dynamic subtitle generation technology and the automatic cultural symbol recognition technology developed in this study support large-scale cultural adaptation at the technical implementation level; the core of these technologies lies in using deep learning models to accurately identify cultural visual symbols in animated video frames, and combining this with a cultural adaptation rule base that integrates expert knowledge and user feedback to achieve intelligent symbol replacement or annotation. To ensure the scientific rigor of the technology validation, we constructed a multi-dimensional validation system combining subjective and objective methods: we obtained users' cultural identification levels through questionnaires, analyzed objective indicators such as viewing time and attention heatmaps using eye-tracking and behavioral data, and assessed users' correct understanding of cultural content through knowledge tests. This method correlates subjective feelings, objective behaviors, and cognitive understanding data to comprehensively and holistically evaluate the actual effectiveness and underlying mechanisms of cultural adaptation technologies.

Additionally, cultural adaptation has challenges: Over-adaptation can lead to a loss of the original work, while under-adaptation may not produce the desired results. The challenge of balancing the desire to retain characteristics of the original work and to adapt it to the local culture requires ongoing investigation and exploration.

Cultural adaptation also raises complex copyright and ethical issues that require the design and establishment of appropriate regulatory frameworks for the implementation of this technology. To address the core technical challenges of this research—the inherent contradiction between the high computational resource demands of the constructed deep learning models (such as GANs and CNNs) and the reliance on mobile consumption scenarios for "accurate audience targeting" and "real-time updates"—the following specific solutions are proposed to overcome the practical limitations of current mobile deployments:

1) Employing knowledge distillation techniques to transfer knowledge from complex teacher models to lightweight student models; applying model quantization and pruning to

TABLE 3. The dissemination effect of culturally adapted content

Content type	Cultural identity rating (increase %)	Comprehension level (improvement%)	Cross-cultural communication efficiency index	Audience satisfaction	Social sharing rate
Intangible cultural heritage themed animation	38	27	0.84	8.2	12.5%
Modern urban theme	12	9	0.61	7.1	8.3%
Hybrid style experimental animation	25	18	0.73	7.8	10.2%

compress model parameters from 32-bit floating-point numbers to 8-bit integers and removing redundant connections, thereby reducing model size and computational load by more than an order of magnitude, enabling smooth operation on mainstream mobile devices (such as smartphones and tablets).

2) Deploying computationally less demanding tasks such as audience profile feature extraction and preliminary style classification locally on the mobile device to protect user privacy and achieve low-latency real-time feedback; while offloading computationally intensive, non-real-time tasks (such as the complete generation of new animation styles and deep clustering analysis of complex audience profiles) to cloud servers. This architecture effectively balances real-time performance, computational load, and privacy protection.

3) By leveraging 5G networks and edge computing nodes, some computing tasks can be offloaded from the central cloud to the network edge, closer to users. This not only significantly reduces network latency and meets the needs of real-time interaction, but also effectively distributes the computing pressure on core servers, providing stable and efficient intelligent services to a large number of mobile users.

The comprehensive review of this technology demonstrates that the utilisation of deep learning technology will continue to revolutionise the visual distribution of animation intellectual properties. The application of generative models allows for more efficient creation of styles, and more importantly, they provide additional creative avenues for artistic innovation. Furthermore, through the use of data-driven methods, the precision and extent of audience reach create greater effectiveness, especially in terms of outreach and marketing to audiences. Through the incorporation of intelligent cultural adaptation technology, barriers of culture are virtually eliminated, thus making animation intellectual properties much more accessible to the global market. On the other hand, the emergence of new challenges presented by technological advancements, such as balancing the intersection of artistry and technology, reconciling the conflict of personalisation and diversity, and determining the appropriate scale at which to make cultural adaptation, must be investigated in theory and in practice. Through specific technical approaches such as model lightweighting, edge-cloud collaboration, and edge computing, this research will focus on solving the practical bottlenecks of current model deployment on mobile devices, thereby providing practical technical support for the application prerequisites of "precise audience targeting" and "real-time updates".

V. CONCLUSION

This paper utilizes a deep learning-based framework to facilitate the collaborative creation of animated IP by translating visual communication strategies into innovative designs and patterns. By applying the developed methodology, this study provides empirical evidence for the creation of a comprehensive roadmap on how industries can best exploit available opportunities through automated or intelligent distribution of animation intellectual property. A major limitation of current intelligent content distribution models is that the models rely on extensive computing resources to implement. The model therefore faces challenges related to creating animations that can be delivered to users via mobile devices, and how to satisfy consumers on how to access animation IP efficiently and quickly. The quality and diversity of the training data set also affects the overall effectiveness of the current model. Therefore, researchers need to create an alternative framework for collecting and annotating data to prepare the best possible datasets to support the use of models that integrate artistic creativity and advanced technology in the creation of high-quality, audience-centered animated IP. Therefore, future research will focus on optimizing lightweight animation IP workflows to facilitate the seamless and efficient translation of digital assets into manufacturing environments.

AUTHOR CONTRIBUTIONS

Conceptualization –Xu Wang and Jung Won-joon; methodology – Xu Wang and Jung Won-joon; investigation – Xu Wang and Jung Won-joon; writing-original draft preparation – Xu Wang and Jung Won-joon. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

ACKNOWLEDGEMENTS

Not applicable.

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