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Product Packaging Plane Image Visual Design Based on Artificial Intelligence Computer Model

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Abstract The high-quality progress of various information technologies has brought convenience to people's daily life, which also makes the high-quality development speed of social economy gradually accelerate. To some extent, it can be said that the development and adoption of Information Technology (IT) in the field of modern scientific research has become the engine to promote the progress of social economy. On the other hand, this information reform in all walks of life can also bring considerable benefits to all types of enterprises. Among them, the most intuitive is the improvement of enterprise's market competitiveness and operation efficiency. At this time, the graphic design field is also seeking a method of information transformation to further improve the competitiveness of different enterprises in the graphic design field. The new mode of products or services created for market operation has also made great changes in many industries. The current Visual Design (VD) of the plane image of commodity packaging needs to be based on the function of transmitting information to realize the implicit publicity of products. Among many current information technologies, Artificial Intelligence (AI) can complete this work through relevant algorithms and derivative technologies. With the powerful data processing ability of AI technology, firstly, the needs of the product packaging to be designed are analyzed, and then a usable plane VD of product packaging is created by learning a large number of sample data. At first, this paper deeply analyzed the workflow of the current VD mode of product packaging plane image, and then confirmed the feasibility and reliability of the adoption of AI computer model in the VD of product packaging plane image. Finally, a VD mode of product packaging plane image oriented to AI computer model was proposed. Through simulation experiments, the performance difference between the AI computer model-oriented product packaging plane image VD mode and the current plane image VD mode on multiple evaluation indicators was analyzed, and the performance of this new design mode on multiple evaluation indicators was determined to be improved by about 26.8% on average.

Index Terms Product Packaging Design, Graphic Visual Design, Artificial Intelligence, Computer Models

I. Introduction

In the field of graphic design, if a better product is to be designed, the sense of innovation is an essential quality of relevant practitioners, which is also one of the basic driving forces to promote the rapid development of graphic design. However, in today's highly developed Internet, the Internet is full of a large number of data for designers to find inspiration. Therefore, it can be said that the arrival of the information age is good news for the development of graphic design industry.

At this time, some researchers have explored the development of graphic VD. These researchers hope to find the future development direction by exploring the development history of graphic VD. Zheng Xinru explored the influence of layout of graphic design on content expression. Through the analysis of the importance of layout in graphic design, he proposed a layout mode of graphic design based on the generation model of depth, and evaluated the advantages and disadvantages of graphic design products under this mode, thus determining the feasibility of this mode [1]. Zhao Min explored the role of ecological teaching methods in graphic design education in colleges and universities. Through the in-depth study of the graphic design education model, the feasibility of the in-depth application of the relevant theories of pedagogy and ecology in the graphic design education model was confirmed [2]. Li Sen explored the help of figure modeling changes to graphic design. Through the in-depth study of the current graphic design mode, it was determined that graphic design was mainly a technology to express a unique connotation by combining text and graphics. This technology could achieve resonance across language differences [3].

Rohmawati T explored the role of modern IT and systems in the field of graphic design. Through the investigation of graphic design in the information age, he used qualitative methods to study the application of IT or system in the

field of modern graphic design, and determined that modern IT could play a better role in the field of graphic design [4]. YAZICI Yeliz explored the relationship between computer programs and the use of foreign languages in graphic design. Through in-depth research on the design process of graphic design, he determined that the computer program could translate the foreign languages needed in the process of graphic design, so as to better complete the graphic design works [5]. Tjung Caroline explored the help of graphic designers in designing mobile game applications for educating young children to speak. Based on the role of graphic designers in mobile game-based learning applications, the feasibility of graphic design in this regard was determined [6]. Al-Qudah Ali Abdullah explored the impact of modern graphic design under the dual background of cultural and political changes. Through descriptive methods and questionnaires, he analyzed the skill level of many graphic designers and the impact of political and cultural changes on the designer's skills, and determined that the impact of graphic design was weak [7]. However, these researchers' exploration of the development of graphic VD was too fragmented, so they could not play a good role in the development of graphic VD.

Other researchers have studied the development direction of graphic VD and the role of packaging design, so as to hope to propose a graphic VD model that is more in line with the needs of the times through various means. Celhay Franck explored the relationship between packaging graphic design and cross-cultural communication. Through in-depth research on the role of packaging graphic design in many commercial fields, he determined that the graphic design language of packaging could arouse the ideological resonance of people in different cultural areas [8]. Guerra Julio explored the application of VD in navigation in a more complex open learning model. Through the research on the role of modern open learning model in the field of navigation and VD, he determined that VD could make navigation under the open learning model have a better development [9]. Festila Alexandra explored how to convey food health information more tactfully through packaging design. Through investigating the publicity mode of many food enterprises and the degree of trust of consumers, he determined that adding key words or pictures such as green vegetables in the packaging design process could effectively gain the trust of consumers [10]. Rezaei Jafar explored the life cycle of packaging design of sustainable products in the food supply chain. Through the research on the multiple decision selection method of packaging design of sustainable products, he determined that the packaging design of sustainable products had a long life cycle, so it was generally necessary to use a more understandable packaging design language [11]. Chrysochou Polymeros explored the packaging design language of organic products. Through in-depth analysis of the nature of organic products and their publicity models, he determined how to set the packaging design language and model suitable for the characteristics of organic products, and also verified the feasibility of this packaging design model [12]. These researchers' research on graphic VD and packaging design still could not play a better role in helping the high-quality development of graphic VD.

Through the analysis, it was determined that there were still some areas that could be optimized in the current graphic VD mode. This paper aimed to optimize the current graphic VD mode to a certain extent through AI computer model, which was mainly to collect and analyze a large number of usable materials in the Internet through AI technology. At the same time, some algorithm models in AI computer model were used to analyze the design requirements, so as to select appropriate materials for intelligent design of product packaging. This new design model made the final cost have better publicity effect and innovation.

II. AI Computer Model Evaluation

II. A.AI Technical Evaluation

Among modern IT, AI technology is a more representative fit, which is a direct manifestation of intelligent technology that simulates human intelligence [13]. AI technology includes a variety of information technologies, including AI algorithm, Machine Learning (ML), data mining technology and so on. It can be said that AI technology has made great contributions to promoting the intelligent development of society, and has also changed the original operation mode of all walks of life, which makes it more efficient and intelligent [14]. This certainly brings more convenience to people's daily life, but some people are worried about the possibility of AI technology replacing artificial jobs in the future. Especially in the field of graphic VD in recent years, many practitioners have such concerns. AI technology can complete the analysis and screening of more massive data in the process of collecting materials in graphic VD, which makes graphic VD have more choices. At the same time, the deep integration of AI technology and graphic VD can further improve the visual communication ability of graphic VD and meet the vision and psychology of designers and viewers. On the other hand, in the VD of plane image of product packaging, AI technology can also independently complete the in-depth analysis of products. At the same time, relevant keywords are searched on the Internet to determine the promotion direction of the product, so as to design a more suitable plane image visual product for it. The application fields of AI technology are shown in Figure 1.

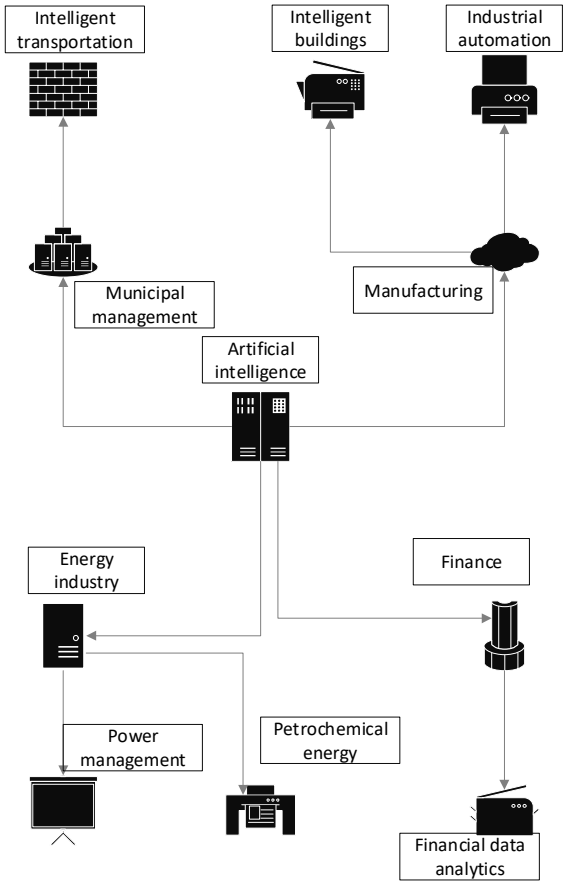


Figure 1: Schematic diagram of application areas of AI technology

II. B.ML Algorithm Evaluation

The most commonly used algorithm in AI technology is the ML algorithm. The ML algorithm can well achieve the preset goal in many industries, which also shows that the ML algorithm can also play a good role in the VD mode of plane images. ML algorithm mainly analyzes a large amount of data through relevant algorithms, and learns the relevance between data, so as to complete the prediction of things by virtue of the relevance of data [15]. However, the current AI technology started late. ML can only play an auxiliary role in the VD of plane images, and can not independently complete the VD of plane images of product packaging. This is mainly because AI technology cannot realize people's intelligence and learning ability in the current application, and these two abilities are just the basic abilities of plane image VD. ML algorithm can complete the analysis of a large number of Internet data in a short time in the plane image VD of product packaging, and select the plane image VD materials that can be applied to product packaging. General graphic VD pays more attention to the expression of people's emotions. AI technology and ML algorithm still cannot achieve this function at present, so it is impossible to create more famous works of art. This is also one of the key issues to be solved in the future development of AI technology and ML algorithm. The modeling and operation process of ML is shown in Figure 2.

III. VD Evaluation of Product Packaging Plane Image

III. A. Product Packaging Design Evaluation

Various rapidly developing emerging technologies are integrated into the product publicity. In the process of product publicity, not only the characteristics of the product itself should be publicized, but also the design of product packaging should be analyzed and conceived in depth. Product packaging design not only includes the selection of product packaging materials, but also requires in-depth analysis of the characteristics of the product itself, audience groups and other relevant factors, so as to use sophisticated production methods to design exquisite product decoration. For unfamiliar markets, the packaging design of products can directly affect the purchase intention of customers. A beautiful and precise product packaging design can make products more competitive.

III. B. Evaluation of Plane Image VD

In the development of graphic VD, it has experienced a variety of design concepts. In graphic VD, the understanding and use of points, lines, planes and colors is the core content of the design mode. In the development of graphic VD, predecessors summarized a variety of aesthetic views and criteria. The current graphic VD mode is mainly to make reasonable use of points, lines, planes and colors within the specified framework, so as to design design works with aesthetic and visual performance. At the same time, in the graphic VD, practitioners also need to master the guidance of the viewer's vision. VD is a design mode that attracts people's vision to a place when receiving the flow of various kinds of information. In this design mode, there are systematic provisions for the visual guidance of viewers, and this provision is of great help to the design of product packaging. Graphic image visual designers can often guide people's first sight to the place where designers need consumers to see through the control of design images, which plays an important role in product publicity.

The general process of plane image VD is shown in Figure 3.

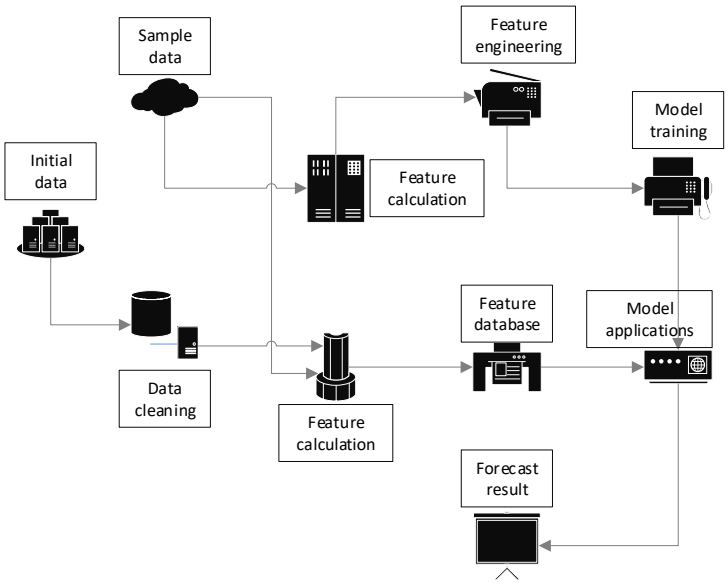


Figure 2: Schematic diagram of the modeling and operation process of ML

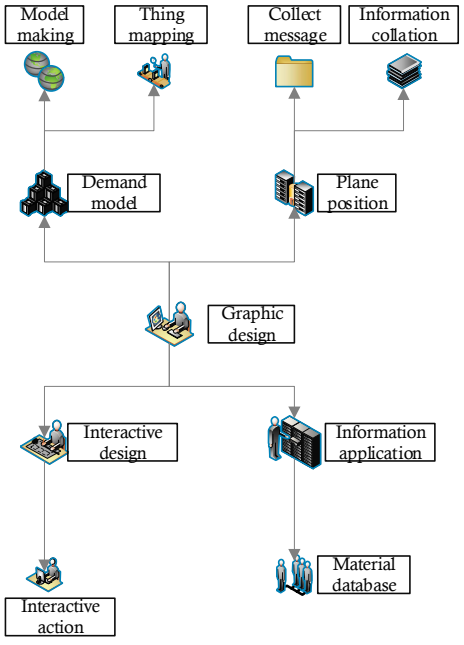


Figure 3: Schematic diagram of the general workflow of graphic image VD

IV. Algorithm Evaluation of AI Technology

AI technology is an important driving force to promote the transformation of intelligent society in the modern information society, and it is also a direction for better development of all walks of life. This paper explored the application of AI technology in the graphic VD industry, and hoped to propose a new pattern of graphic image VD through AI technology, thus helping the graphic VD industry to achieve better development. Graphic VD is usually a combination of multiple characters, graphics and landmarks on a two-dimensional plane to complete the expression of a certain content. Today's graphic design model requires designers to spend a lot of time on creative ideas, but whether the final design works can be recognized by customers and the market is still unknown. The plane vision design pattern that integrates AI computer model is usually used to analyze the needs of customers through linear regression algorithm and association rule algorithm in AI technology. At the same time, it can also analyze a large number of given sample data and select some relevant data that can be applied to the design work, so that the final design work can have more accurate visual performance.

The linear regression algorithm is used to analyze and predict the customers' needs in the plane image VD mode of product packaging. First, the linear regression formula is introduced, as shown in Formula (1).

$$h(w) = \sum_{i=1}^{n} a_i * x_i \tag{1}$$

Among them, n represents the characteristic number of sample data; x_i represents the characteristics of specific data; a_i represents the coefficient corresponding to the feature. The error in the calculation process is calculated. Generally, the loss function is used to calculate the error, as shown in Formula (2).

$$J = \frac{1}{2} * \sum_{i=1}^{n} (y - \theta^T * x_i)^2 \tag{2}$$

Among them, y represents the real value, and θ^T is the weighted value of the predicted value. The predicted value is solved. First, the density of the predicted value is calculated, as shown in Formula (3).

$$P = \frac{1}{a\sqrt{2\pi}} ex \frac{\theta^2}{2a^2} \tag{3}$$

Among them, ex is the mean of the normal distribution. The calculation of error is brought into the calculation of distribution density for calculation, as shown in Formula (4).

$$P = \frac{1}{a\sqrt{2\pi}} ex \frac{(y - a_i * x_i)^2}{2a^2} \tag{4}$$

The calculated real value and the predicted value are solved by the logarithmic likelihood method to obtain the similarity between the predicted value and the real value, as shown in Formula (5).

$$L = \sum_{i=1}^{n} log \frac{1}{a\sqrt{2\pi}} \cdot \frac{-(y - a_i * x_i)^2}{2a^2} \tag{5}$$

The association rule mining algorithm is used to calculate the dependency between the material and the customer's needs, so as to design the product packaging more in line with the customer's needs. First, the support between data is calculated, as shown in Formula (6).

$$S = \frac{P(A \cup B)}{AB} \tag{6}$$

Among them, A and B represent two different things, and P represents probability. Finally, the confidence between data is calculated. This confidence operation can also be called confidence operation, as shown in Formula (7).

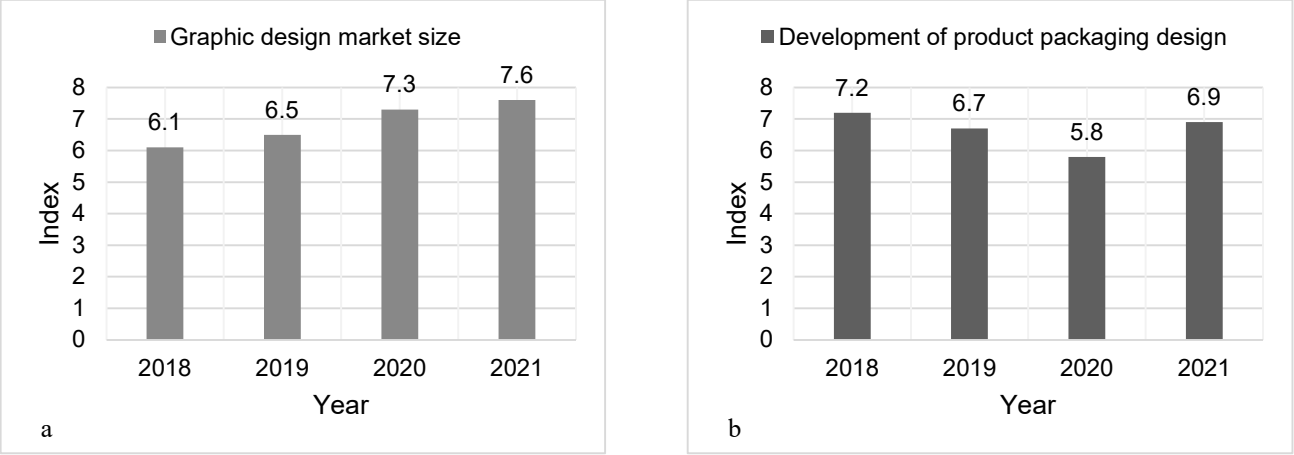
$$C = \frac{P(B/A)}{AB} \tag{7}$$

By using the above two algorithms to update and iterate the plane image VD mode of the existing product packaging, not only can the work efficiency of the plane image VD mode of the existing product packaging be greatly improved, but also the collection range of materials can be expanded to a larger range. This also makes the plane image VD more innovative. At the same time, this optimized plane image VD mode can also make the final product packaging have more intuitive visual performance, and make the product packaging designed by this mode obtain higher satisfaction.

V. Experimental Investigation on Product Packaging Plane Image VD under AI Background

With the continuous progress of social economy and technology, people have begun to enter the information age, and their daily life and various industries have also undergone earth-shaking changes. This kind of change also makes the traditional design form of plane VD and the language to be expressed also changing greatly. In the traditional graphic VD mode, more designers combine their observation and perception of various things in their own lives with the design works to present excellent graphic VD works. With the rapid growth of various types of information in the information age, people can access a huge amount of different types of information every day. On the one hand, graphic visual designers in this background can have a wider design space. On the other hand, it also makes the works it designs no longer limited to a certain category. However, the information age has also led to the explosive increase of various types of graphic VD works, and the design works have gradually become consistent. At this time, an emerging technology is needed to help graphic VD get out of this quagmire and help VD works have more possibilities. AI technology can just analyze and classify more data in a short time, thus providing more thinking and imagination space for practitioners of graphic image VD, which also provides the possibility of creating more different works in the field of graphic design.

First of all, the market scale of graphic design and the development of graphic image VD of product packaging in a specific period of time in a region were analyzed, as shown in Figure 4.



a. Schematic diagram of graphic design market size

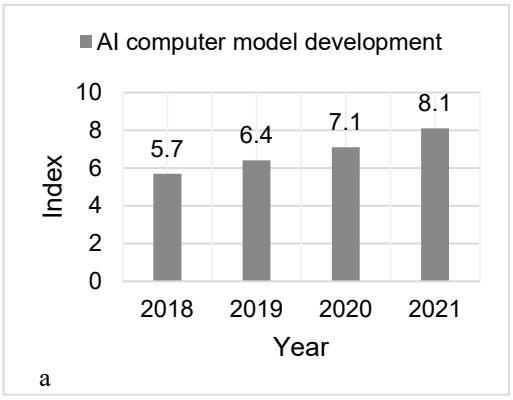
b. Schematic diagram of the development of product packaging design

Figure 4: Schematic diagram of the development of graphic design market size and product packaging image design in a certain region

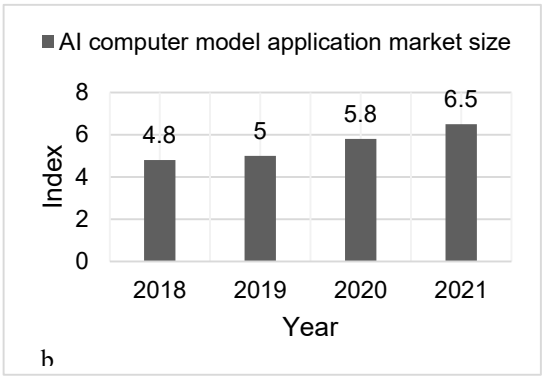
Nowadays, the development of IT makes all industries face greater challenges, but it also brings new development opportunities for all industries. At the same time, in the context of the information age, the field of graphic design has increased the importance of traditional art and culture, and some new graphic design methods have been invented with the help of some emerging information technologies. This also makes the entry threshold of graphic design further lower, and helps the graphic design industry to achieve better development.

After analyzing the development trend of the market size of graphic design in the region in the four years in Figure 4a, it could be determined that graphic design had a good development in the region in the four years. The growth rate of the market size from 2018 to 2019 and from 2019 to 2020 was increasing, but the growth rate of the market size from 2020 to 2021 was relatively slow. On the other hand, after analyzing the development of graphic VD of product packaging in the region in the past four years in Figure 4b, it was determined that the graphic VD of product packaging had the best development in 2018. However, this situation continued to decrease with the development of time, and this decline trend improved from 2020 to 2021. In 2020, due to the integration of a variety of emerging technologies and the enhancement of the emphasis on traditional art forms, the graphic image VD of product packaging made a good development.

The development of AI computer model and the market scale of its application in the same period in the region were analyzed, as shown in Figure 5.



a. Schematic diagram of the development of AI computer models



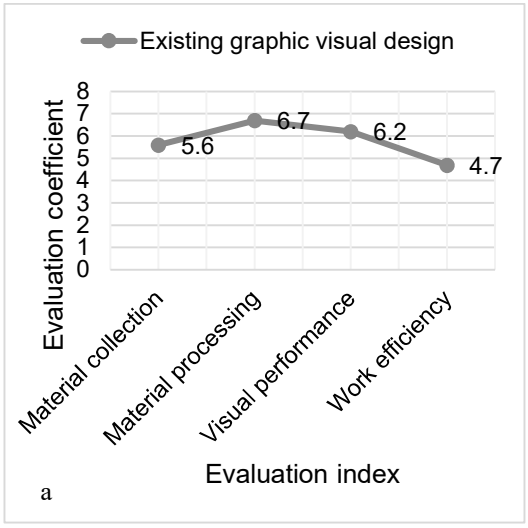
b. Schematic diagram of the application market scale of AI computer models

Figure 5: Schematic diagram of the development and application market size of AI computer models in this region

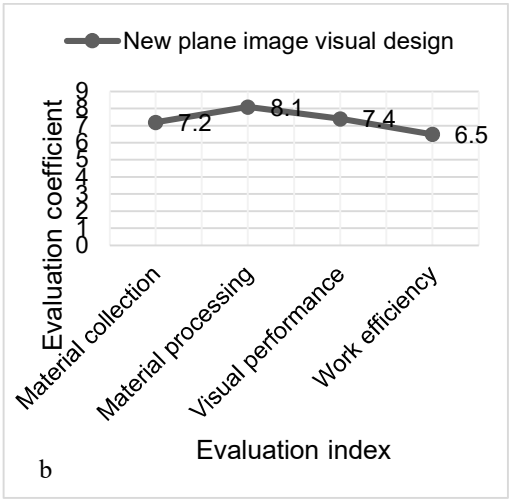
The works created by the graphic design mode combined with AI and other emerging information technologies can have a clearer image. With the rapid development of AI technology in recent years, the current AI technology theory and various application technologies have gradually matured. The integration of AI technology and traditional models in various industries has improved the development ability of all industries. At this time, the development focus of AI technology has shifted to a commercial and mature application system.

The first was to analyze the development of AI computer models in the region in the past four years in Figure 5a. It could be concluded that AI computer models had a good development in the past four years. The growth rate of this AI computer model was increasing rapidly every year. This also showed that researchers in the region paid more attention to the development of AI technology in recent years, and the application process of AI computer model was also advancing. In addition, the market scale development of AI computer model in Figure 5b in recent four years was analyzed. Firstly, it was determined that the market scale of AI computer model put into use in the region showed a steady growth trend in the past four years. This development trend was not obvious from 2018 to 2019, but it was relatively stable in 2019 and beyond.

Finally, the performance differences between the new product packaging plane image VD model proposed in this paper and the existing plane image VD model in multiple evaluation indicators were analyzed, as shown in Figure 6.



a. Schematic diagram of the performance of existing flat image VD patterns



b. Schematic diagram of the performance of the new flat image VD mode

Figure 6: Schematic diagram of the performance difference between the new product packaging plane image VD mode and the existing plane image VD mode

The graphic VD of product packaging has always been the focus of many entities. This paper analyzed the current graphic VD mode of product packaging, and judged which processes could be combined with AI computer model to play a better role. On the other hand, it also explored the technology or algorithm that can be applied in the plane image VD in AI technology, and determined that the linear regression and association rule mining algorithm in AI technology can optimize the plane image VD mode of the existing product packaging, so that it has better work efficiency and improves the visual performance of the final product.

The first was to analyze the performance of the existing graphic VD pattern of product packaging in Figure 6a on multiple evaluation indicators, and determine that the performance of the existing design pattern on the collection of design materials and work efficiency were relatively weak. This also showed that the existing graphic image VD had great room for improvement in these two workflows. On the other hand, the performance of the optimized plane image VD mode in Figure 6b on the same evaluation index was analyzed, and it was determined that the new plane image VD mode combined with AI computer model had a great improvement on the four evaluation indexes. This improvement was mainly due to the addition of AI technology and related algorithms, which greatly improved the ability of existing plane image VD patterns in these two aspects. Finally, the performance difference between the two product packaging plane image VD modes was analyzed comprehensively, and the average improvement of the performance of the new plane image VD mode in many aspects compared with the existing plane image VD mode was about 26.8%.

VI. Conclusions

In modern society, graphic VD exists in every part of people's daily life, such as Internet pages, various applications, various entities or virtual advertisements, and so on. However, with the continuous progress of time, various graphic designs gradually tend to be consistent, and innovation has become a more important part in the field of graphic design. Relevant researchers showed the practitioners in the design field how AI technology can bring more innovation to graphic design and help improve the efficiency of graphic design by analyzing a large number of design works. In the existing graphic image VD process of product packaging, image visual designers need to communicate with customers for a long time to determine their various needs, and then they can carry out image VD of product packaging based on these needs. The plane image VD mode integrated with AI computer model can conduct in-depth analysis of customers' needs and combine it with a large amount of accumulated training experience, so as to carry out more accurate positioning of customers' needs. The plane image VD mode integrated with human AI computer model can also make the final design of the finished product present a more unique form of expression through the analysis of a large number of works, which would also make the product get better publicity.

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