

Optimizing Design Thinking Strategy for AI-Generated Image Models: Using Logo Design as a Case Study

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Abstract. In recent years, the rapid development of artificial intelligence (AI) has greatly improved design efficiency and visual effects. Nevertheless, the image design aspect remains largely rudimentary in current AI design platforms. Looking at examples of logo design, we see that most logos are merely replicas of current logos. To fully exploit the potential of AI in logo design, we need to optimize design thinking. This study investigates the advantages and challenges of existing AI image models in logo design applications. It proposes a training program to improve design knowledge, thinking, skills, and visual materials in the AI design platform database. Deepening training in specific domain knowledge improves the AIGC model's ability to understand the context of logo design, combining the designer's creative thinking with the AI's processing power to achieve more creative results. Additionally, this study creates a new model with user participation in design, using AIGC technology to collect user feedback and dynamically adjust the design scheme. The goal is to enhance the use of AIGC in logo design, offer a fresh design approach, aid AI in creating image technology to enhance design thought and expression, make AI logo generation technology more intelligent and varied, boost design creativity, and improve brand image construction efficiency and quality.

1 The Current Situation and Problems of AI Generated Image Models

1.1 An Overview of AI Image Generation Technology

With the development of AI technology, AI-generated images have become a hot research direction in computer vision. Designers mainly use machine learning, especially deep learning, to enable computers to automatically create new images based on massive data. In this process, the application of generative adversarial networks (GANs) is particularly prominent. GANs learn through the game between two neural networks, generating images (generation network) and evaluating image quality (discrimination network). In this process, the quality and authenticity of the generated images are gradually improved [1].

AI image generation technology has the benefit of creating fresh and lifelike images by utilizing extensive sets of already existing image data. In some instances, it can be challenging to tell apart these images from actual photographs. In the field of logo design, designers can use AI to generate a variety of creative sketches, greatly improving the efficiency and innovation of the initial stage of designing. There are challenges in applying technology, such as ensuring that generated images accurately convey brand information and addressing copyright issues related to AI-generated content.

1.2 The Problems with AI-Generated Logo Design

At present, many platforms on the market use AI technology to assist in logo design, where users can select a target visual expression style, input keywords, brand description, and industry information, and automatically generate a set of logo design schemes. Take the AI logo design module of X-Design developed by Meitu Company, an intelligent vision generation organization in China, as an example. After determining the logo name, advertising message, and industry, the platform will recommend the customer choose from related industry logo design templates and generate logo design graphics and typesetting according to the provided information and the selected template. Through many tests, we found that the problems existing in the graphic, font, color, and layout design of the generated logo are as follows.

(1) The Design of the Brand Logo Lacks Innovation and Uniqueness

For the pattern selection of AI logo design, the design pattern provided by the platform conforms to the common visual image of logo design in the market and industry. It lacks design innovation and relies solely on basic elements like point, line, and surface to realistically depict the industry and goods, resulting in a lack of creative graphics. Moreover, it is necessary to integrate the product's outstanding characteristics, brand

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name, pronunciation, and abbreviation into the design creativity [2].

(2) Low Image Integrity and High Deformity Rate

The intelligently generated logo only imitates the template logo in appearance, leading to the deviation between the generated and original graphics. For instance, the logo design of a fruit shop resembles a vase and leaves after being generated and transformed by AI, resulting in low recognition of the final logo. Another instance shows a stick figure chef holding food, with the logo missing details on the chef's attire, face, hands, and tableware outline. In addition, the integrity of some generated images is not high, and some graphics are unrelated to the theme. For example, the template graphics are linear graphics of vases and flowers. Still, the generated graphics include unrelated graphics, such as cameras and pet dogs, and unusual flower graphics, such as too many petals, separation of flowers and leaves, spoons, and fans similar to flowers, which decreases the completeness of the logo and the adoption rate of the design work [3].

(3) The Mismatch Between Font Design and Logo Style

The text font in the logo design doesn't match the font style of the chosen template, the icon style, brand image, or product style, and lacks uncommon words and unique creative fonts. For example, the font in the selected template combines bold and FZYaoTi. In addition to the font in the original template, many characters in bold and Song style in the logo generated by AI are inconsistent with the font style in the selected template. In addition, logos with scientific, technical, and masculine vibes are combined with naive and affectionate round or handwritten letters, which are examples where the font style does not match the logo's brand image or product style. In generating characters, some uncommon words are not presented in the expected font, resulting in two different fonts in the generated logo. Furthermore, some signage features inappropriate font sizes and spacing, as the brand name and subtitle sizes are uncoordinated, leading to excessively small intervals.

(4) Simple and Imprecise Graphic Layout

There is a single graphic typesetting form and imprecise text typesetting for the signs generated by AI. The generated logo icon is in the form of graphics combined with text but lacks the form of an individual picture or text. In practical application, using logo graphics or characters respectively is necessary, so combining them with other elements doesn't allow for flexible application. Furthermore, there is an issue with the lack of strictness in the layout of the text space. In the generated circular signs, we often use the form that the characters are arranged around the arc. Nevertheless, in the AI-generated ones, the circular arrangement of some characters does not follow the principle of left-right symmetry, resulting in the horizontal asymmetry of the characters in the signs.

2 The Visual Optimization Strategy of Integrating Design Thinking into AIGC Logo

2.1 The Integration and Utilization of Design Knowledge

Utilizing design knowledge effectively is crucial in producing high-quality AI-generated images, particularly in logo design. To enhance AI's effectiveness in logo design, professional design theories and principles must be integrated into the system as data for the intelligent system to grasp and assimilate visual design fundamentals. We input theoretical knowledge, including the four principles of plane composition, color composition, grid typesetting, and layout design, into the AIGC intelligent model for training so that the intelligent system can master the design theory and application methods such as visual semantics, visual focus, visual process, image creativity principle, font style and meaning, color collocation, and color psychology. Integrating the knowledge of brand communication with consumer psychology related to commercial visual design communication will enable AI to grasp the deep needs and cultural significance behind logo design more effectively [4].

2.2 Simulation and Training of Design Thinking

Design thinking refers to the strategy and process of using the designer's way to solve the problem. In the image model generated by AI, we apply design thinking, which means training AI to simulate designers' thinking modes and creative processes. It requires us to code the primary design thinking models, such as brainstorming, PEST, SWOT, divergent thinking, empathy, problem definition, prototyping, and test feedback, into algorithms that AI can analyze and execute. For example, the AIGC model is trained to simulate the brain's "brainstorming" to form creative thinking, and with PEST, SWOT, and other information research models, design-related keywords are generated, and tree-like divergence is carried out to increase the number of keyword divergences. Finally, the keywords of different generation chains are creatively integrated to get the results. In the empathy simulation phase, we extract important information from users' feedback and brand stories to define the design theme. In the "diversity thinking" phase, AI randomly combines and changes design elements to generate lots of design prototypes. In "test and feedback", due to the automatic A/B test and user feedback cycle, AI can identify the design scheme that best meets the user's preference and brand image.

2.3 Optimization of Visual Elements and Layout Design

Optimizing visual elements and layout design in AI-generated image models is one important strategy to improve the quality of logo design. AI performance skills include not only the use of basic design elements

such as point, line, and surface elements, creative graphics, fonts, colors, and textures but also how to combine these elements into attractive and expressive format design capabilities.

2.3.1 Optimizing Visual Elements

Visual elements in logo design include point, line, and surface graphics, fonts, colors, textures, and so on. We adopt various methods to optimize the visual elements generated by AI. On the one hand, training AI with high-quality visuals allows it to learn and emulate best practices from the industry, as well as understand differences and connections between visual styles and the practical implications of different designs.

Graphic creativity involves creating logo designs that express multiple meanings by combining brand names, product features, selling points, advertising messages in positive and negative forms, isomorphic grafting, heterogeneous homogeneity, and other graphic creative methods. We can also display the brand name in a three-dimensional form through font, product feature graphics, spatial composition, and contradiction space fusion. In graphic creation, it is suggested that point, line, surface, and visual semantics be combined to input the visual semantics of graphics into an AI model. For instance, children's industry logos incorporate circular outlines or arcs to create a friendly and secure psychological impression for kids. When creating the logo for women's products, we utilize thin lines in linear graphics to depict the delicate qualities of women.

For font design, we use the best font for logo design [5]. Song font is a combination of ancient Chinese brush font and type font, which represents the fusion of classic and modern, and can be used to design new Chinese-style logos with classic and modern styles, and its exquisite decorative corners are suitable for design. It is exquisite for logos of cultural and literary goods such as retro bookstores and flower shops. For blackbody, strokes are simple, elegant, steady, classic, and eye-catching. They suit commodity signs that show modernization, fashion, and sports. Round characters and cartoon characters written with round strokes are suitable for children's goods and commodity signs with affinity and warmth that show affection. Calligraphy is written with a Chinese brush, which shows the classical Chinese style and has a smart and elegant visual effect. Therefore, it suits the logo design of a traditional Chinese medicine museum, Chinese restaurant, oriental tea room, and other industries that show classical Chinese culture.

In color psychology, we match colors according to commodities, industries, and individuals. For example, cool colors, low lightness, and low purity are suitable for high-tech products and products for males, while warm colors and high purity are suitable for children and women.

2.3.2 Layout Design Optimization

Some of the problems mentioned above are: single arrangement of images and text, lack of strict arrangement of text space, too little spacing between graphics and characters, and inappropriate character size. To address the issue of graphic arrangement, we integrate a wide range of exemplary cases into the AI model to improve its ability to accumulate and analyze real-life examples. Based on this, we create various graphic layout templates for users to select from.

To address the issues of character asymmetry and lack of rigor in character layout, it is proposed that the alignment principle, one of the four fundamental principles of layout design, be incorporated into the AI generation model. In addition, to address the problems of too little spacing between graphics and characters, too little spacing between characters, and inappropriate character size, we use the principles of contrast and intimacy to train the AI model to ensure the rationality of the spatial arrangement of design elements.

In addition, it is necessary to use algorithm optimization technology to improve the accuracy and creativity of AI in image rendering, color matching, text layout, etc. It will ensure that the generated logo is visually appealing and effectively communicates brand information [6]. The AI-assisted user customization process is introduced, allowing users to amend the generated design draft. Subsequently, AI makes adjustments according to the feedback, ensuring the personalized custom of the design and improving applicability and satisfaction. Through this interaction, the performance of AI will be further exercised and optimized, which will better meet diversified and personalized needs.

3 The Optimization Strategy of Self-evaluation and Update of AIGC Model

3.1 A Multi-dimensional Evaluation of Model Performance

In the context of AI-powered logo design, the evaluation methodology employed to assess its performance is far more sophisticated than the conventional metrics of accuracy or generation speed. A comprehensive performance evaluation should encompass a range of dimensions, including creativity, practicality, aesthetics, brand fit, and user satisfaction. First, observing whether the model can generate a unique and impressive design is necessary for the creative evaluation. Second, practicality can evaluate the effectiveness of design in practical application, such as whether it is easy to be applied to diverse media. Third, aesthetic evaluation focuses on the design's artistic value and visual appeal [7]. Fourth, brand fit assesses the alignment of design with brand essence and market positioning. Ultimately, the user's satisfaction directly indicates how well the design is embraced and appreciated by the intended users. Table 1 shows a multi-dimensional evaluation:

Table 1. Multi-dimensional evaluation of AI logo design model performance

Evaluation dimensions	Evaluation indicators	Evaluation methods	Sample data
Creativity	Uniqueness	Expert review/algorithm analysis	85% (based on 100 design samples)
	Impression	User research/questionnaires	90% (based on 500 questionnaires)
Practicality	Application	Cross-media testing (print, screen, etc.)	92% (tested on 5 media)
	Easy to modify	Software compatibility/editing convenience	88% (based on 10 design software tests)
Aesthetics	Artistic value	Artist/designer review	80% (based on 10 professional reviews)
	Visual appeal	User research/eye tracking	85% (200 people surveyed)
Brand fitness	Core value consistency	Expert review	90% (according to comparison of brand core values)
	Market positioning matching	Market research/competitor analysis	88% (based on market feedback and competitive product analysis)
Customer satisfaction	Acceptance	User research/satisfaction rating	87% (according to 500 questionnaires)

3.2 Comparative Analysis of Logo Template and Generated Graph

The comparative analysis between an AI-generated logo and a traditional template logo is conducive to understanding the advantages and disadvantages of AI design. Comparatively speaking, we observe that AI design may have certain advantages in form innovation, style diversity, and execution efficiency. However, the design of AI generation may still need to be improved in the standardization, consistency, and pertinence of the template logo.

In this process, analysts need to pay attention to the design's originality, the degree of fit with the brand identity, the visual impact, and the handling of details. Through in-depth comparative analysis, we can accurately identify the model's advantages and limitations in its current state and improve it in subsequent training and optimization.

3.3 Logo Design Example-Driven Visual Style Optimization

After analyzing high-quality logo design examples, AI models learn and simulate excellent visual style. This "example-driven" approach not only helps AI understand the standards and trends of a specific industry or brand style more quickly but also stimulates the model's creativity potential and produces novel and expected design schemes.

To achieve this, we create a database of high-quality logo designs across multiple styles and industries. Using deep learning and pattern recognition technology, our AI can understand both the fundamental principles of design and complex stylistic elements based on examples. It can apply this knowledge flexibly to new design tasks, generating logo designs that better align with practical requirements and current aesthetic trends.

3.4 Visual Feedback Loop and Model Self-Optimization

Establishing a visual feedback loop is the key to realizing continuous improvement and self-optimization of the AI model. By collecting feedback from end users and design experts, AI can constantly adjust its generation algorithm to accurately meet the preferences and needs of target groups. Feedback includes direct evaluation of design and also involves user interaction data, such as click-through rate, stay time, and other indirect indicators.

To achieve an effective visual feedback loop, we design mechanisms to feed user experience and evaluation data to the system in real time. Using machine learning and adaptive algorithms, the artificial intelligence model can learn from this data and continuously improve its design strategy and implementation details. With the passage of time, the feedback loop has made significant progress in AI design quality and efficiency and finally reaches or even exceeds the level of human designers.

4 Conclusion

This study analyzes the basic theory of AI image generation, the advantages and limitations of the existing platform for designing AI-generated logos, and the integration strategy of design thinking in the AI model. We prove AI's practical value and development trend in design. AI can improve design efficiency, generate rich and diverse design schemes, and continuously optimize design quality and creativity by learning a lot of design knowledge and simulating design thinking.

Aiming at the visual optimization analysis of the AIGC logo integrated into design thinking, designers can optimize the visual elements such as point, line, surface graphics, font, color, texture, and layout design. This study highlights how technology can enhance AI's performance and innovative capabilities in logo design. We propose a multi-dimensional evaluation of model performance by employing a self-evaluation and optimization strategy for the AIGC model. Furthermore,

we compare AI-generated logos with those created with traditional design approaches and implement visual style optimization with a feedback loop based on design

examples. It stimulates the AI design model's innovation potential and provides a path for self-optimization and continuous learning.

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