Two Key Application Scenarios of AI Empowering Clothing Design: Virtual Try-On and Virtual-Reality Fashion Show

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Abstract: Focusing on the two aspects of fitting and catwalk in fashion design, from the perspective of three different AI virtual fitting application objects, this paper makes an in-depth study of AI fitting mirrors in retail stores, AI virtual changing models on online shopping platforms, and vivid virtual fitting models for designer scenes idm-vton. Combined with the virtual fashion show in the virtual reality show, individual "virtual" wear and the combination of reality and virtual, this paper expounds the application of AI enabled clothing design from multiple perspectives.

Keywords: Virtual fitting model; Virtual reality show; Ai artificial intelligence; Fashion design

1. Introduction

AI technology is changing our lifestyle and social structure at an unprecedented speed. AI has a wide range of application scenarios in the clothing industry, covering multiple links from design, production to sales. However, the consumer demand of the clothing industry is diversified, changing rapidly, and the clothing design work is highly professional, which leads to the clothing practitioners' one-sided and single cognition of the effect of Ai application in the industry, thus affecting the effective application of Ai in the clothing industry. From the Perspective of clothing designers, this paper discusses the two application scenarios of clothing design in the AI intelligent field, focusing on the two aspects of clothing design trial and show.

2. Virtual Fitting Scene

2.1 AI Fitting Mirror in Retail Stores

The traditional clothing retail industry has the following pain points in the three aspects of people, goods and market: the low flow of customers to the store, the lack of drainage means, the low customer stickiness, the difficulty of secondary consumption, and the difficulty of activating potential customers; It is difficult to coordinate the increase of effective SKUs, and the inventory turnover period is too long; High operating costs, high labor costs, difficult to find good shopping guides, and direct impact on customer experience[1].

AI fitting mirror is an intelligent device that combines augmented reality (AR), artificial intelligence (AI), 3D modeling and other technologies. It can let customers see the effect of trying on clothes of different styles, colors and sizes without actually changing clothes. Its basic principle is that the AI fitting mirror captures the image of customers in real time through the capture camera, and uses AI algorithm for human body recognition and size measurement. The real mirror is based on the

reflection law of light. If the mirror reflects light to form a virtual image of an object, users can see their real image and wearing effect through the real mirror. However, the fitting process requires users to actually put on clothes. The changing process is cumbersome and time-consuming, and it also cannot provide the personalized customization and intelligent recommendation functions of virtual fitting glasses. The virtual fitting mirror can superimpose the virtual clothing model on the real image of the customer according to the clothing style and size selected by the customer, so as to realize the real-time display of the fitting effect. Some AI fitting mirrors also have interactive functions such as gesture control and voice recognition, so that customers can operate more conveniently. Taking the AI fitting mirror of cloud dream technology as an example, it can provide teaching virtual fitting, size measurement, interactive experience and data collection. Consumers only need to stand in front of the fitting mirror, and the system can automatically identify and accurately measure the user's bone size, body shape and posture and other physical parameters within 2 seconds, and intelligently recommend suitable clothes, and automatically put on the selected clothes for them to show the fitting effect. Display more SKU categories through virtual shelves, reduce the display space of physical goods, and shorten the purchase process and decision-making time of users in a more convenient way. At present, the virtual fitting technology of retail stores is mostly based on two-dimensional images or simple three-dimensional models, which is difficult to fully simulate the texture and wearing effect of real clothing. Especially in terms of color differences, due to factors such as the resolution of different devices and screens and the degree of color restoration, the color presentation on the virtual fitting mirror in most retail stores is different from the actual clothing, which affects consumers' emotional experience after purchase.

2.2 Online Shopping Platform AI Virtual Changing Model: Catvton Multi Task, Multi Category Virtual Fitting

Figure 1: Catvton Can Also Change From Character [2].

Based on the deep learning technology, especially the generation model (diffusion model) is used to realize the effect of virtual fitting. Taking catvton as an example, it solves the problems of clothing texture and wearing effect of virtual fitting mirror in retail stores. Catvton uses the generation model (diffusion model) to realize the virtual try on, which is a simple and efficient virtual try on diffusion model. Catvton can realize seamless transmission as long as it connects any category of stores or worn clothes with the target character as input in the spatial dimension. Catvton is an AI virtual try on tool for online fashion retailers. Different from the virtual AI fitting mirror in retail stores, it uses conditional generation method and diffusion model to generate high-quality fitting effects. Catvton can achieve seamless transmission as long as it connects any category of stores or worn clothes with

the target character as input in the spatial dimension. The biggest feature of catvton is that it supports multi task and multi category virtual dressing. For example, catvton can not only realize the dressing change from traditional tile clothing map to characters, but also support the dressing change of different categories of clothing such as tops, pants, skirts and suits at the same time. The shape and fine texture of clothing can maintain high consistency to meet the diversified dressing needs. As shown in Figure 1, catvton can also change from character a to character B without explicitly specifying the category.

Through the virtual try on function, customers can preview the realistic effects of different clothes before purchase, and can see the actual effect and matching effect of clothes, so as to increase the confidence of purchase decision, reduce the return rate, and improve customer satisfaction.

2.3 Designer Scene: Idm-Vton Vivid Virtual Fitting Model

Catvton and idm-vton, as two virtual fitting technologies, aim to improve the realism and accuracy of virtual fitting. They are also based on deep learning technology, especially the diffusion model, to achieve the effect of virtual fitting.

Idm-vton enhances image fidelity and detail retention in virtual fitting tasks by improving the diffusion model. It uses two different modules to encode the semantics of the clothing image. Given the basic UNET of the diffusion model, it fuses the high-level semantics extracted from the visual encoder into the cross-attention layer to further improve the detail quality of the image. At the same time, the technology also integrates the low-level features extracted from the parallel UNET into the self-attention layer, and provides detailed text prompts for clothing and character images to enhance the authenticity of the generated visual effect

Figure 2: Realistic Texture Pattern of Idm-vton [2].

Compared with idm-vton, catvton is a small AI virtual clothing changing model, while idm-vton depends on complex network structure and a large number of trainable parameters. The two focus on different application scenarios. Catvton is mainly used in e-commerce platforms to enhance customers' shopping experience. Idm-vton is mostly used by professional fashion designers, which shortens the design and display time of designers and reduces the production cost of clothing. In addition, idm-vton analyzes the images of people and clothing from the perspective of digital technology by improving the diffusion model, and generates and enhances a high fidelity virtual fitting image to retain the details of the clothing. As shown in Figure 2, its pattern, texture, shape and color can be highly restored to generate a higher quality virtual fitting image, which is similar to the realistic fitting effect image of real wear. The comparison of two mainstream virtual fitting technologies, idm-vton and catvton, is shown in Table 1:

Table 1: Comparison Between idm-vton and Catvton.

Comparison content	CatVTON	IDM-VTON
Memory requirements	1024X768, <8G VRAM	video memory requirements are high, >16G
Personalized fitting	user's body shape, skin color and other characteristics	fitting effect by using deep learning technology
Ability to adaption	adapt to different light background	advanced image processing technology
Reasoning process	fast, efficient and complex	generates high-quality image
Suitable for scene and object	fashion retailers to manage	suitable for professional designers

3. Virtual Reality Show Scene

3.1 Virtual Fashion Show

Virtual fashion show mainly realizes the visual effect experience of wearing through image processing, AR and other technologies. Virtual fashion shows do not need to rent physical venues, set up stages and employ a large number of staff. At the same time, they can also be produced and released quickly. Compared with physical fashion shows, physical fashion shows are usually held in physical venues, such as fashion weeks, shopping malls, theatres, etc. The audience needs to be present at the scene according to the time and place to watch the fashion show, and they are not free to choose the viewing angle, so they need to watch it according to the on-site arrangement. The display form is more traditional, including real T-stage, model, lighting and background music. The interaction is relatively less, and the charm of the fashion show is mainly felt through the on-site atmosphere and model performance.

Virtual fashion shows mainly rely on digital technologies, such as virtual reality (VR), augmented reality (AR) and 3D modeling [3]. Viewers can watch virtual fashion shows on the Internet through computers, mobile phones or other smart devices. You can freely choose the viewing angle, and even feel the atmosphere of the fashion show through virtual reality technology. The display forms are more diversified, including virtual T-stage, virtual model, virtual background, etc. At the same time, it provides more interaction, such as online comments, likes, sharing, etc. Designers are not limited by real technology and materials, and can display bolder and more avant-garde virtual clothing for clothing design. They can more realistically simulate various materials and colors, present richer visual experience for the audience, and show more possibilities, such as trial fitting, matching and customization of virtual clothing.

The first show of virtual fashion show is from auroboros, a digital luxury company in London, UK. An important milestone in the combination of fashion and digital technology took place at the London Fashion Week in June 2020. Auroboros released their first virtual ready to wear series - biomimicry. This ready to wear series only has pure digital series, no physical products, and only exists in "online" digital files. The first virtual ready to wear series in China is the ayayi brand released in December 2023. The first clothing series is called "linked adventurer". Ayayi also provides consumers with a digital interactive experience. Consumers can use ayayi's app to get their own ayayi by placing their mobile phones close to clothing tags ® Avatar digital assets. Through the camera

function of the app, you can experience the wearing effect of real time ar digital assets and view personal digital assets in the "wallet" of the app.

3.2 Individual "Virtual" Wear

If we say that the host of virtual fashion show is generally the enterprise brand side, and the individual "virtual" wear belongs to the individual user to satisfy self-aesthetics and share social psychology. It is realized through the image post synthesis of live photos and virtual fashion. Individuals can not only watch virtual fashion, but also experience it in fashion. Just like a game character wearing a game skin, the difference is that the protagonist is replaced by himself in the real world. The milestone event of individual "virtual" wear is the digital clothing "iridescence" released by the Dutch company the fabricant in May 2019. This clothing can be tracked, traded, auctioned at a price of nearly US $10000, and then synthesized into a live image. Using AI technology to design their own fashion works, and integrating individual "virtual" wear with the virtual human created for themselves in their own image, is also another manifestation of individual virtual wear. For example, ruby gloom, a digital virtual human artist at the Hong Kong Polytechnic University, created a virtual IP - the virtual human ruby 9100m, which appeared on the social platform instead of herself to express her emotional spirit and fashion.

3.3 Mix Reality and Virtual

AI fashion show with virtual reality integration refers to the combination of virtual clothing, models, scenes and other elements with fashion shows in the real world, and the integration of virtual reality through technical means to present a unique fashion feast for the audience. The digital fashion of mixed reality and virtual refers to both real products and corresponding virtual products. For example, in the CCTV 2024 China AI grand ceremony program, the virtual reality fusion AI fashion show "flower realm", planned by yuyimeng, a teacher of the Central Academy of fine arts, is a mixed reality fashion show with AI enabled fashion design and show design. The hybrid reality technology, which uses AI style training and image generation technology, combines the virtual scene with the real stage. The costumes in the show are both real and virtual. The combination of virtual and real brings an immersive viewing experience to the audience.

With the continuous development of AI, VR, AR and other technologies, AI fashion shows with the integration of virtual reality and reality will be more realistic and interesting.

4. Conclusion and Prospect

Try on and walk show are two important activities of fashion design. The application of AI technology in these two activities has achieved initial results. AI technology is of great significance to the design and production, artistic creation and wearing experience in the field of fashion. In the future, with the continuous progress of technology and the deepening of application, it will also stimulate more designers to use AI technology to accelerate the innovation and development of fashion industry from personalized customization to design efficiency and innovation, and bring new development opportunities and challenges to the fashion design industry [4].

Acknowledgements

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