Research on Method of Generating Clothing Images from Sketches Based on GAN

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Abstract: ***With the continuous development of the fashion industry and the progress of digital technology, the demand for converting sketches into target images using computers has been increasing. In the generation of clothing images from sketches, how to generate complex textures and realistic effects has always been an important challenge. This paper constructs a dataset for generating clothing images from sketches and realizes the conversion from sketches to clothing images based on the generative adversarial network model. Experimental results show that this method can effectively generate clothing images from sketches, and the generated images have clear textures and high fidelity.***

Keywords: Generating Clothing Images from Sketches; Generative Adversarial Network; Image Generation.

1. INTRODUCTION

Driven by artificial intelligence, the fashion industry is undergoing digital transformation, and clothing image generation plays an important role in promoting the digital process of the industry. The traditional fashion design and production models are facing challenges, and consumers' demand for personalized and diverse fashion products is increasing . With the support of data and hardware resources, artificial intelligence technologies based on deep learning have developed rapidly and been widely applied in the clothing industry, such as design and creative assistance, personalized recommendation, trend prediction, virtual fitting, clothing generation, quality inspection, and intelligent customer service, effectively improving the efficiency, personalized service, and innovation ability of the fashion industry . Clothing generation has attracted extensive attention in recent years because it has the potential to revolutionize the fashion industry. Traditional clothing design and production methods are time-consuming, expensive, and limited by human creativity . By leveraging deep learning technologies, the clothing design process can be automated and enhanced to achieve novel and personalized clothing. This paper aims to study the method of generating clothing images from sketches based on the Generative Adversarial Network (GAN), which can provide inspiration for fashion designers to improve the efficiency and creativity of the clothing design process.

2. RELATED WORK

As an important branch in the field of computer vision, image generation has witnessed a large number of deep learning-based image generation methods emerging in recent years with the research and development of deep learning. Peng et al. (2025) exploited aggregation and segregation of representations for domain adaptive human pose estimation [1]. Pinyoanuntapong et al. (2023) proposed Gaitsada, a self-aligned domain adaptation approach for mmWave gait recognition [2]. Wu et al. (2025) applied multi-level transfer learning for small-sample object detection of surface cracks in concrete structures of high-rise buildings [3]. Zheng and Jiang (2025) developed a new methodology for Chinese term extraction from scientific publications [4]. Shen et al. (2025) applied the whale optimization algorithm to financial payment fraud detection [5]. Sun (2025) addressed accessibility challenges and solutions in inclusive interface design for digital products [6]. Mao (2026) introduced a clustering-based approach to image compression using the K-means algorithm [7]. Dong and Li (2025) built a face generation model based on DCGAN [8]. Jie (2024) explored the application of artificial intelligence technology in industrial defect detection [9]. Zhang (2025) improved the steel surface defect detection algorithm of the YOLOv5 network [10]. Gao et al. (2026) conducted an experimental study and geomechanical modelling of hard and soft rock masses including fault zones [11]. Zhang (2026) proposed a hybrid LSTM-GARCH model integrating volatility factors from US financial markets [12]. Han et al. (2026) designed a dual-scale model with collaborative reasoning and multi-feature fusion for robust AI-generated image detection [13]. Shen et al. (2026) built a survival risk prediction model for colorectal cancer patients using graph convolutional networks and TCGA multi-omics data integration [14]. Tian et al. (2025) introduced a cross-attention multi-task learning approach for digital advertising recall [15]. Finally, Gao et al. (2025) presented a hierarchical reasoning and LoRa-enhanced large model framework for root

cause analysis in distributed systems [16].

In addition to the above basic models, researchers have also explored many other techniques and methods to improve the quality and diversity of clothing generation. For example, some studies are dedicated to generating high-resolution and fine-grained clothing details and achieving this by introducing more complex network structures and loss functions. There are also some studies focusing on integrating clothing generation with virtual fitting and fashion recommendation systems to provide personalized fashion experiences.

All in all, researchers at home and abroad have made remarkable efforts in the field of clothing generation and achieved fruitful results. They continuously explore new deep learning models and methods, aiming to address the challenges in clothing design and production. These studies are of great significance for promoting the innovation and development of the fashion industry. However, this field still faces some challenges, such as generating high-resolution and fine-grained clothing details, and maintaining the integrity of clothing structure during the image processing process, etc.

3. DESIGN AND CONSTRUCTION OF CLOTHING SKETCH DATASET

Aiming at the lack of clothing sketches in existing clothing datasets and the copyright issues of designers' hand-drawn sketches, this paper adopts a method based on edge detection algorithm to construct a clothing sketch dataset. First, this paper uses crawler technology to crawl clothing pictures from e-commerce platforms, then preprocesses the obtained pictures, and finally uses edge detection algorithm to generate a sketch dataset.

Figure 1: Original Dress Dataset after Duplicate Removal

Figure 2: Result Diagram after Edge Detection and Grayscale Inversion

This paper uses the Scrapy crawler framework to crawl pictures themed on "dresses" from a certain e-commerce platform, a total of 3089 pictures are crawled. After data cleaning, duplicate pictures and non-frontal pictures are removed, and finally 1542 pictures are obtained, as shown in Figure 1.

To generate a sketch dataset, this paper uses the Canny edge detection algorithm to extract the image edges, and then performs grayscale inversion on the extracted image, and finally generates clothing sketches, as shown in Figure 2.

The Canny algorithm is a classic edge detection algorithm. It identifies the edges in the image through multiple steps, including Gaussian filtering, gradient calculation, non-maximum suppression and double-threshold processing . Based on the extracted edge image, grayscale inversion of the image is performed. By inverting the grayscale values of the edge image, the black edges will become white, and the white background will become black. This can make the clothing edges in the clothing sketches appear black, conforming to the characteristics of sketches and simulating real clothing sketches. Finally, the generated sketch dataset is used for the training and testing of subsequent clothing generation models.

Pair the crawled real original images with the generated sketches, and eliminate the samples with poor quality of the generated images. Finally, 1001 pairs of images are selected. Resize all images to 256×256 pixels and divide the training set and test set according to the ratio of 8:2. The training set contains 801 pairs of images, and the test set contains 200 pairs of images, as shown in Table 1.

Table 1: Division of the Dataset

Dataset	Image size	Number of training set images	Number of test set images
Sketch dataset	256×256	801	200

4. CLOTHING IMAGE GENERATION FROM SKETCHES BASED ON GAN

In the research field of generating real images from sketches, many related research works have emerged. Among them, the classic image style transfer model pix2pix has successfully achieved the conversion from sketches to real images. However, pix2pix performs well in processing images with simple features, but it performs poorly in the clothing generation task, and the generated image quality and texture are not ideal. To verify this conclusion, this paper conducts a comparative experiment between pix2pix and CycleGAN. The experimental results show that the CycleGAN model can better solve the problem of converting sketches into realistic clothing images.

The CycleGAN model consists of two generators and two discriminators. One generator is used to convert sketches into clothing images, and the other generator is used to convert clothing images back into sketches. The two discriminators are respectively used to distinguish real images and generated images and provide parameters for adversarial training, as shown in Figure 3.

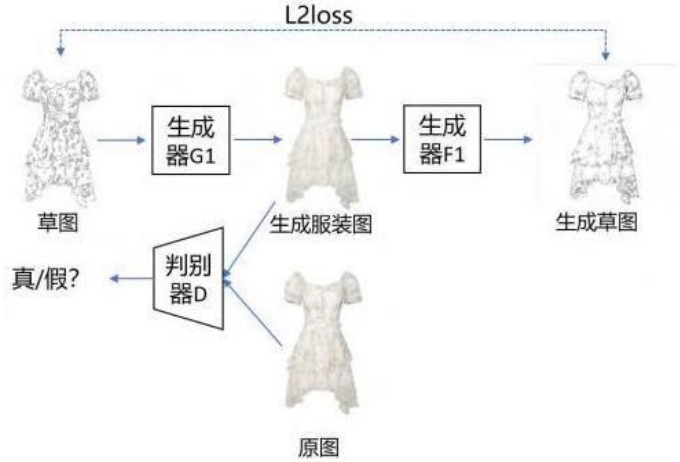

Figure 3: Algorithm Diagram of Clothing Image Generation from Sketches Based on GAN

This paper uses the constructed clothing sketch dataset to train the CycleGAN model. In the experiment, the image size is 256×256 pixels, the batch size is set to 1, and batch normalization is not used. In the first 100 epochs, the learning rate is set to 0.0002, and in the subsequent 100 epochs, the learning rate linearly decreases to 0. The experimental results are shown in Figure 4. It can be seen from the experimental results that compared with pix2pix, the images generated by CycleGAN have clearer textures and lines, and the overall effect is better. This shows that training the CycleGAN model with the sketch dataset constructed in this paper can generate more realistic and texture-clear clothing images.

Figure 4: Comparison Diagram of Clothing Generation Results from Sketches Based on GAN

5. CONCLUSION

This paper explores the task of generating realistic clothing images from sketches, constructs a clothing sketch dataset, and uses the CycleGAN model for image conversion. The experimental results show that this method can generate clothing images with clear textures and high fidelity. Compared with traditional methods such as pix2pix, CycleGAN performs better in clothing generation. This research provides an effective image generation solution for the fashion industry and the field of fashion design, with great application potential. Future work can further improve and optimize this method to enhance the quality and diversity of the generated images and promote the development of this field.

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