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Online Clothing Brand Recognition Based on Fully Connected Neural Network

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Abstract: With the development of the e-commerce industry and the pursuit of quality of life, people buy big-name clothing online to enhance their visual enjoyment. An excellent visual identity of a clothing brand (CB) allows the brand to convey the designer's design concept and connotation of clothing to consumers, making the brand attractive to consumers and ultimately transforming it into purchasing power. For online CBs, this paper designs a real recognition system based on a fully connected neural network(FCNN). The system can identify which brand the clothing category belongs to by inputting the design elements of the CB and comparing the brand types summarized in the database. This paper compares the recognition effects of the three brands in clothing modeling, color, material, pattern and other elements, and finds that the system has the highest recognition accuracy for clothing patterns, which also shows that pattern is the most important element to distinguish a brand.

1. Introduction

The development of the CB identification system is not very different from the development of other industry brand identification systems. It has also experienced the process of development with the development of the human commodity economy. Until today, the development and application of the CB identification system has reached maturity golden age. The surging CBs not only bring beautiful sensory and visual enjoyment, but also focus on creating a distinct brand image from the perspective of brand connotation, but also change people from the perspective of life attitude and spiritual pursuit [1-2] .

At present, the research on brand clothing identification has achieved remarkable results. For example, some studies have pointed out that the functional appearance of the CB image recognition

system is also reflected in increasing the added value of the brand. Consumers get psychological satisfaction through the use and possession of the brand. For example, a woman wearing Prada, experienced Not only the comfort of Prada clothing, but also the satisfaction of enjoying the brand spirit of independence, autonomy, and strength conveyed by wearing the Prada brand [3]. Some studies believe that the visual identity design of CBs is to express the concept, culture and connotation of the enterprise with visual symbols, which is an intangible asset of the enterprise, which can accurately reflect its product quality, brand reputation, company size and the quality of employees can effectively communicate the strength of the company to the outside world. After a long period of continuous communication to the audience, the audience can form a subtle awareness of this brand. As long as the audience has the motive to buy such products, they can immediately think of the products of this brand [4-5]. To sum up, the application of systematic identification of CBs in the clothing market is more extensive, but in fact, the role of clothing designers should be more used for brand identification.

This paper introduces the concept of FCNN, introduces the FCNN into the online CB recognition application, and proposes to input the four elements of CB design into the network training to obtain the recognition effect. Effectively distinguish CBs, and the recognition accuracy is close to 100%.

2. Overview of Neural Networks and Apparel Brand Recognition System

2.1. FCNN

FCNN is a nonlinear mapping network composed of input layer, intermediate layer and output layer [6]. Hyperparameters are extremely important in FCNNs, which determine the learning speed and final results of FCNNs. Hyperparameters are usually set before training the selected model, and a set of optimal hyperparameters is selected later according to the experimental situation [7]. The FCNN has more than ten hyperparameters. The main hyperparameters are learning rate, batch_size, epoch, activation function, and loss function. For example, the range of the output value of the sigmoid activation function is (0, 1), which works better when the relationship between the various features is complex. The slope of any two points can be found by exploiting the smooth, easy-to-derivative properties of the sigmoid function.

$$c_j^t = f(\sum_k w_{jk}^t c_j^{t-1} + g_j^t) \tag{1}$$

Among them, w_{jk}^t is the input of the entire neural network, denoted as the weight of the kth neuron in the t-1 layer to the jth neuron in the t layer, g_j^t is the bias of the jth neuron in the t layer, and c_j^t is the activation value of the jth neuron in the tth layer.

Rewrite equation (1) in matrix form:

$$c^t = f(w^t c^{t-1} + g^t) \tag{2}$$

where $f(\cdot)$ represents the activation function.

2.2. Features of Online CB Recognition System

Based on the uniqueness of products and the differences of the industry, a successful online CB identification system should have the following four basic characteristics:

First, the uniqueness of brand building. The homogeneity of the online CB market is serious. Only by establishing a clear brand image can the market be effectively differentiated at the beginning of the brand strategy. This requires that the brand must uphold and emphasize the uniqueness of this feature when building [8].

Second, the appeal of the brand expression. The appeal of a brand is mainly reflected in the core value of the brand, which is the recognition of the brand spirit and brand culture by consumers. Especially for CBs, a successful CB must represent the most fundamental values and life attitudes of its part of the consumer group, and thus has a strong appeal to the target customer group, just as graffiti, rock, extreme sports must belong to punk, metal and A representation of absolute freedom [9-10].

Finally, brand extension compatibility. The product characteristics of online CBs determine that their brand identity systems must have compatibility. Innovation is the most distinctive feature of CB products, which determines that the CB image recognition system must take into account different product series [11]. The benefit of compatibility for CBs is not only to make their brand image more durable, but also to reduce the impact of product decline at each stage on the brand [12].

3. Design Elements of Online CB System Based on FCNN

When identifying the characteristics of an online CB, it is judged according to the basic elements of the clothing. Usually, the brand culture of the clothing can be learned from the clothing shape, color, material and pattern. Therefore, this paper studies the online CB recognition based on the FCNN. The system conducts research from these aspects, taking the shape, color, material and pattern of the CB as the input value of the FCNN, and the output value is the correct rate of brand recognition [13-14]. Figure 1 shows the four major design elements of the system.

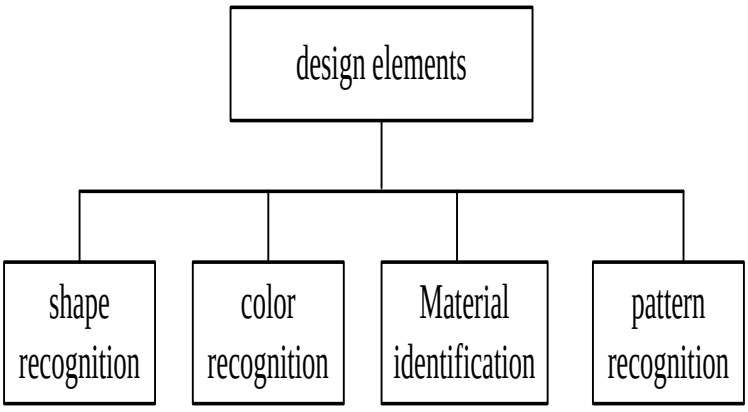

Figure 1. Identifying system design elements

(1) Modeling recognition elements

Shape recognition includes two aspects: profile recognition and detail recognition.

Profile identification elements: Profile identification is a profile that is frequently used or has unique characteristics of clothing, so as to be able to identify the brand. Profile is an important carrier of brand style. The contour with prominent features can have a clear product style and individual characteristics, and have the brand's own characteristics to distinguish it from other

brands [15]. For example, in Chanel's clothing, the most used silhouettes are H-shaped, O-shaped, and X-shaped. These three silhouettes represent the three styles of Chanel. The H-shaped Chanel is refined, calm, and has a neutral feeling. O-shaped Chanel casual, relaxed, slightly uninhibited feeling. The X-shaped Chanel is simple but full of flavor.

Elements of detail identification: details include art and detail design, and detail identification is the process or detail features that are frequently used, so as to be able to identify the brand [16].

(2) Elements of Color Recognition

Nature gives us a variety of colors, and different colors give people different feelings. Colors can arouse people's passion, and can also make people calm. Color identification is a color that is frequently used in clothing or a color that has a unique meaning for the brand, so as to be able to identify the brand. Usually brand clothing has one or more classic colors of the brand, which can reflect the spirit and culture of the brand.

(3) Material identification elements

Material identification includes two aspects: fabric identification and accessories identification.

Elements of fabric identification: Fabric identification is a fabric that is frequently used in clothing or a fabric that can directly convey the characteristics of the brand's style. Therefore, the identification of the fabric is indispensable to the shaping of the brand culture. What kind of fabric is selected represents the brand quality, style and culture [17].

Elements of accessory identification: accessory identification is an accessory that is frequently used in clothing or has a unique meaning for the brand, so as to be able to identify the brand [18]. The identification of accessories is to reflect the connotation and culture of the brand in subtleties, and it is also one of the places where clothing is very easy to reflect the charm.

(4) Pattern recognition elements

The generation of the pattern is composed of three parts: composition, pattern elements, and color. Composition is the most creative in design, and color expresses the emotions that the pattern wants to express.

Pattern recognition is a pattern that is frequently used in clothing or a pattern that can directly convey the style characteristics of the brand, so as to be able to identify the brand. Patterns can be rich in creativity and change, and it is also easier to express brand culture intuitively [19]. Therefore, paying attention to the use of pattern recognition is one of the powerful ways to build brand identity.

4. Application Analysis

4.1. Online CB Design

A CB has its own unique identity, and there are a few design elements that can identify the CB. Collect some CB images on the e-commerce platform, and analyze the font and pattern design of these CBs.

Figure 2 shows the proportion of online CB logo font design. Plain text logo is the main logo form of online CBs, which can be divided into three combinations: Chinese, English and Chinese-English combination. Chinese fonts are more suitable for start-up brands that emphasize the local characteristics of the brand and need to make full use of local advantages to develop. Commonly used font forms include official script, Song body and black body. For logos with special brand characteristics, the basic fonts will be improved to form special glyphs to conform to the brand characteristics. The logo design in pure English is more suitable for the international market. Regardless of Chinese or English, the logo form of pure fonts has certain limitations and inclusiveness in style communication. On the one hand, in order to ensure the legibility of the logo, the decorative character of the font must be sacrificed, which is especially prominent in Chinese

design. On the other hand, online CBs often have serialized or themed products, and concise font logos It is more inclusive for easy application.

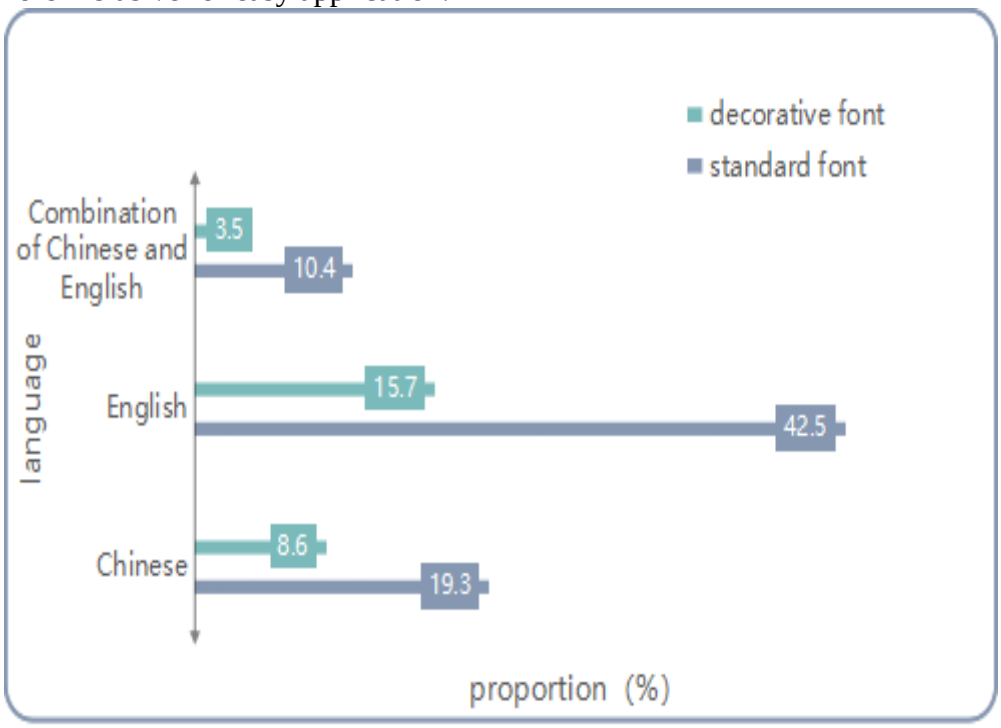

Figure 2. The proportion of standard fonts and decorative fonts

The pattern of the logo is generally understood as the graphic expression of the core concept of the brand, so the most important principle is to appropriately convey the style, concept and composition of the brand. The most commonly used logo patterns are figurative patterns, which are mostly designed with the help of figurative things in nature and real life. Such as animals, plants, landscapes, people, etc. The figurative pattern can convey the style and concept of the logo more directly and vividly, but it is easy to cause the convergence of the brand logo during the application process. Such as the butterfly image commonly used in women's clothing and the animal image commonly used in men's clothing. Table 1 shows the proportion of logo design of online CBs.

Table 1. Proportion of logo pattern types

	Proportion (%)
Figurative pattern	28.4
Abstract pattern	26.3
Symbol pattern	45.3

4.2. Application of Brand Recognition System Based on FCNN

Table 2. Recognition effect (%)

	Shape	Color	Material	Pattern	Average value
Uniqlo	98.97	96.43	98.25	99.86	98.38
Only	99.12	97.37	96.84	99.71	98.26
Metersbonwe	98.69	98.54	99.03	99.94	99.05

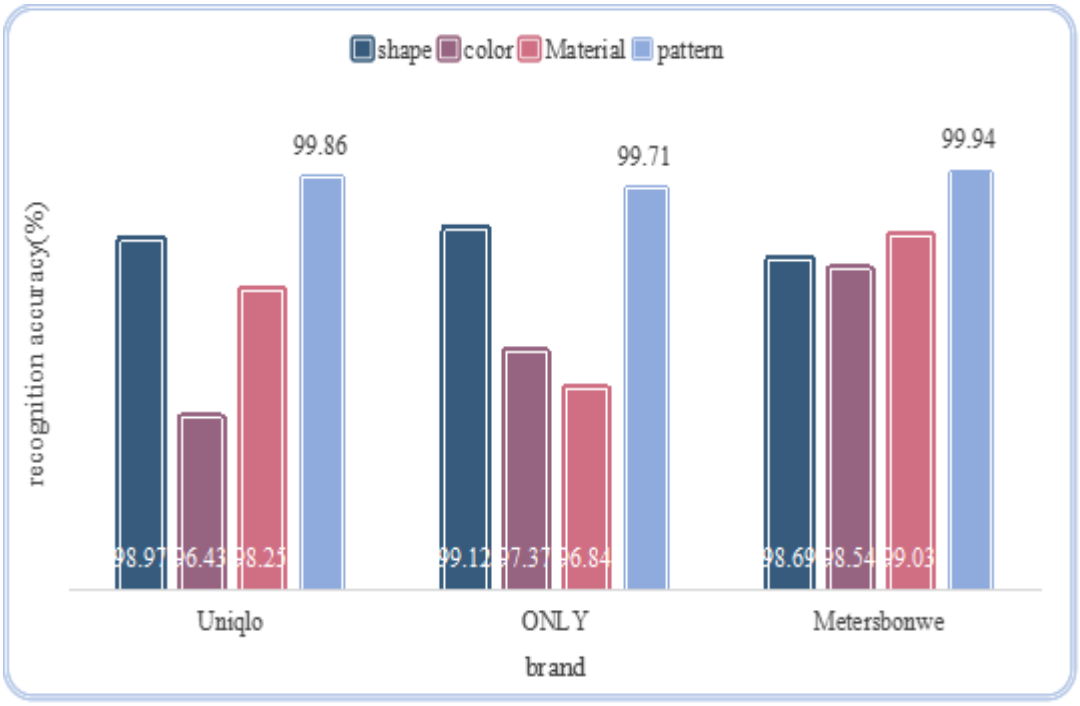

Figure 3. Recognition accuracy of each CB

The clothing images of Uniqlo, ONLY, and Metersbonwe are collected on the e-commerce platform. Each brand selects 20 images of different styles. The online CB recognition system based on the FCNN designed in this paper is used for detection. The design elements such as image shape, color, material, pattern and so on are input into the system. After some data cleaning operations, the system compares the various types of CBs listed in the system database, and takes the result with the highest brand matching similarity as the output result. Table 2 and Figure 3 show the recognition rates of the three brands in terms of shape, color, material, and pattern. According to the data in the table, the average recognition accuracy of Metersbonwe is 99.05%, which is the highest among the three CBs, followed by Uniqlo brand and ONLY brand. From the comparison of the recognition accuracy of design elements, the pattern recognition accuracy of each CB is the highest.

5. Conclusion

Throughout today's world, brands have a higher reputation and reputation among consumer audiences than simple commodities, showing an amazing strong effect. The so-called brand effect is the chemical reaction of the product through the brand imprint, which produces a qualitative change in the eyes of consumers, increases the added value of the product, and generates more and greater market value. This is the magic power of the brand. For the online apparel industry, to stand out in a market full of competitors, it is necessary to establish a brand image. Based on this, the CB identification system can deeply understand the brand's corporate philosophy and value system. Starting from the deepest cultural connotation of the brand, look for the most distinctive characteristics and appeal of the brand, dig out the closest place between the brand and the customer, and apply it throughout.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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