The Method Research based on GA-ANN Garment Intelligent Selection

Qingyun Han
Yanmei Li
Fan Ju
Shanghai University of Engineering Science
Fashion College
Shanghai 201600

Abstract

In daily life it is very necessary to help non-professional people select appropriate clothing material quickly. Artificial neural network model based on genetic algorithms can meet multi-objective optimization requirements which relate to the selection of factors of the clothing fabric and find the fitness function for genetic algorithm in order to establish intelligent selection system models the factors of fabric. In the case of choice of women's clothing fabric the women's clothing style, manner, price and season is the input layer. The fabric's raw materials, weaving methods, elements and tones are the output layer, which establish artificial neural network. Qualitative indicators of clothing selection translate to the value which the computer recognizes. Through the training of samples a new method of intelligent selection of clothing is developed. Then a new approach is provided for intelligent selection of clothing.

Keywords: Clothing materials, artificial neural network, fitness, intelligent selection

1. Introduction

With the development of the society and the improvement of human civilization people pay more attention to knowledge of clothing material. In daily life most of consumers will check the clothing material composition on the label when they buy clothes. The main reason is that the material selected has a direct influence on quality, performance and demand of clothing. But the choice of clothing for amateurs relies heavily on life experience, and they lack of the systematic knowledge for clothing material. So that it may often appear error. With the development of the society it emerges more and more mixed spinning and new materials. The available experience for consumers becomes difficult to select applicable clothing material. For example infant cannot express themselves feeling for the comfort of clothing selected by adult. So it is very necessary to help non professionals choose applicable clothing.

Artificial selection method can input clothing design requirements, constraints and the corresponding fabrics parameter into system, which can enjoy corresponding space mapping as much as possible [1]. It is the development trend to overcome the lack of technology through combining with artificial intelligence [2].The artificial neural network has been widely used in intelligent choice of heavy industry material such as gear, plastic products, and wire materials and so on. According to the characteristics of the fabric this paper optimizes neural network through combining with the genetic algorithm to develop a new method of clothing material selection.

2. The Choice Basis of Clothing Material

The performance of clothing material has a direct influence on the application scope of clothing. The performance of clothing formed by different fiber, yarn and fabric is different. The understanding of material performance will have great help for the reasonable design, manufacture, storage, use of clothing. Different types of clothing have specific requirements of materials. The wearing condition is very important .When consumers choose clothing material. The common method is 5W1H, which express, Who(object), When (season), Where (occasion), Why (intention), What (type), How much (price).So that we can have a quick smart choice in order to convenience suit and beauty [3].

With the development of society clothing material become diverse gradually and the selection of material of clothing has not specific method currently. So consumers can only choose clothing on the basis of previous experience. The research integrates apparel fabrics of various brands, which is translated into computer language. Then it use artificial neural network based on genetic algorithm to do memory training and study out a new method of choice of clothing material, In the process of buying clothing this method not only avoids value deviation of people experience , but also help people choose appropriate clothing quickly.

3. Establish Optimization Models of Fabrics Multi-Factors

3.1 The Establishment of the Optimization Model

Combining with ANN and GA system use the GA algorithm to correct step by step (error spread learning algorithm conversely), which is involved in the weights and threshold in BP algorithm. So that the revised BP network match with the requirements of the material better [5].In this study multiple factors for fabric (raw materials, weaving way, elements and tonal) select the error of degree, and the error is the multi-objective optimization model. Then the optimization model established is $U=[e_1,e_2,\cdots,e_n]^T$. x_i Express the selected error of factors. $i\in 1,2,\cdots,n.$ Require all of x_i as the minimum. While in the actual process the input value and multiple target values are difficult to reach the best in the same system. Therefore we set the importance of various factors to the importance of selecting fabric according to multiple factors of fabric. Assuming $e_1>e_2>\cdots>e_n$ in the actual calculation system can do reasonable compromise and coordination to multi-objective optimal value based on the importance of the principles of setting. So that the final optimization model meet the requirements better.

Neural network in the system is composed of three layers. "1" select this requirement, "0" do not select this requirement. Input layer represents style, price and seasonal and so on. As vector $[x_1,x_2,\cdots,x_m]^T$ $x_i\in[0,1], i=1,2,\cdots,m$ input layer, As vector $[y_1,y_2,\cdots,y_n]^T$ the output. The numbers of implicit layer are unknown, which need to set according to the concrete situation.

3.2 The Principle Analysis of Optimization Model

Using genetic algorithm to optimize neural network consists of the BP neural network and genetic algorithm to optimize the structure of weights and threshold values, the BP neural network training and prediction [6].According to the number of the sample input/output parameters determine the topology structure of BP neural network, so as to determine the genetic algorithm to optimize the number of parameters, and finally the code length of individual species [7].Neural network weights and threshold is generally through the random number randomly initialized to interval $[-0.5,0.5]$, the initialization parameters have big influence on of the network training, but it couldn't get accurately, for the same initial weights and threshold, the network of training results is the same, the introduction of genetic algorithm is aim to optimize the best initial weights and threshold [8].Genetic algorithm to optimize BP neural network algorithm flow as shown in Figure 1.

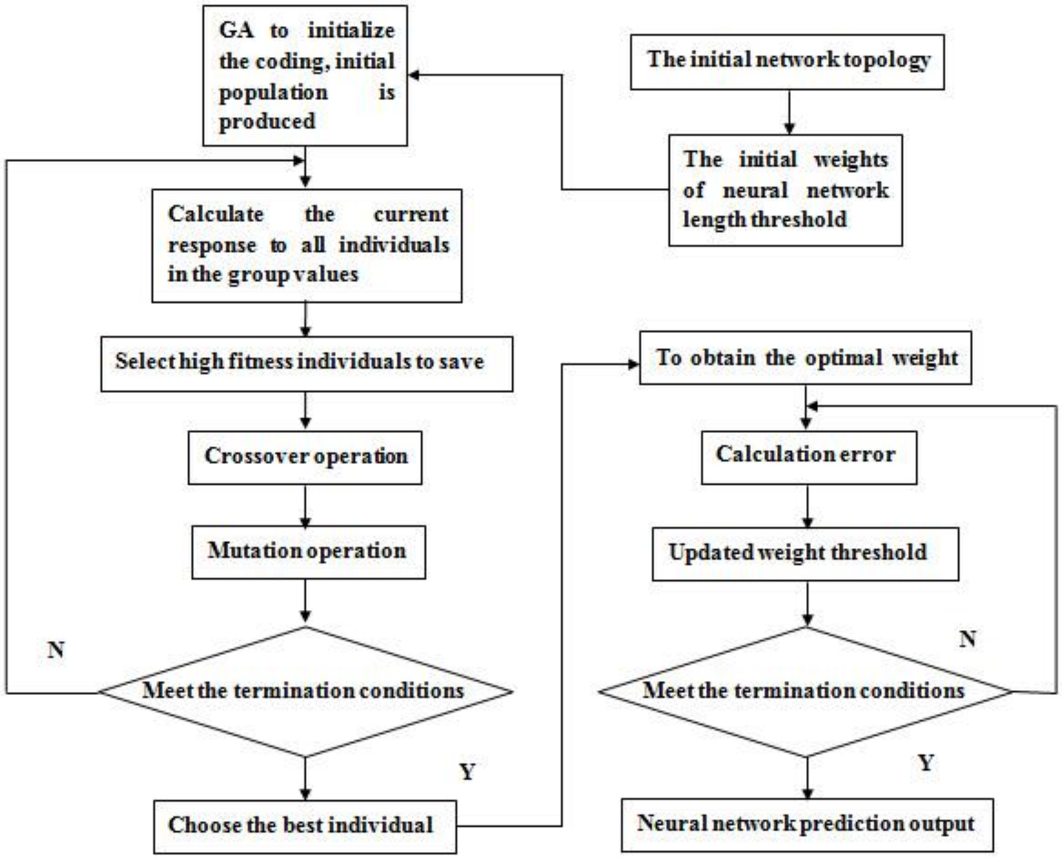

Fig.1 Algorithm Flowchart

4. The Application of Clothing Intelligent Selection Method

Clothing material selection method of input information reflected in whether people's requirement of material input item or not, in a "1", expressed in "0" no rules. Therefore, the system input element with element values of "1" and "0" n-dimensional vector to express. Output layer of the system, the output value represents the selected degree of material, the greater the material that corresponds to the output value, the greater the degree of the tendency of the material. According to the selected size, designers can obtain an even number of alternative materials [10].

Analysis of clothing material basis, there are five common kinds of requirements in the input layer: objects, design, season, style and price, demand for these 5 classes do further analysis, formed 24 requirements of the project, they form the input project of clothing material selection system, as shown in table 1.The object classifies from the perspective of gender, the female outfit design is based on common classification, screen out 10 kinds of influence the style of the fabric properties from the existing 18 kinds of clothing style. Output layer classifies based on fabric features, there are four types of properties: raw materials, weaving way, elements and tonal, as shown in table 1.One of the raw material classification from common fabrics on the market at present, the elements in the fabric chose affect larger clothing style, color classification is based on《The Fashion Color》written by Linjun Zhu.

Tab.1Project Selection System Input

Select material requirements	Enter project	Code
Object	Male	X_1
	Female	X_2
Pattern	T-shirt	X_3
	Shirt	X_4
	Coat	X_5
	Trousers	X_6
	Skirt	X_7
Season	Spring	X_8
	Summer	X_9
	Autumn	X_{10}
	Winter	X_{11}
Style	Hippie	X_{12}
	Commuting	X_{13}
	Gentlewoman	X_{14}
	National	X_{15}
	College	X_{16}
	Neutral	X_{17}
	Pastoral	X_{18}
	Europe and the United States	X_{19}
	Bohemia	X_{20}
	OL	X_{21}
Price	High-grade	X_{22}
	Mid-range	X_{23}
	Low	X_{24}

Tab.2 Project Selection System Output

Output layer	Classification
Raw material	Pure wool, pure silk, cotton, pure hemp, leather, fur ,pure chemical fiber ,polyester, Polyester+ cotton ,Polyester + spandex, wool + polyester, Cotton + nylon, Polyester + viscose fiber, wool + nylon, Polyester + acrylic, Cotton + wool, Cotton + acrylic, Cotton + spandex
Weaving way	Knitted ,woven, fabric
Element	Pure color, geometric lines, patterns, bud silk, hollow out, embroidery, jacquard, rivets
Tonal	Light pink, dark light, bright, bright, strong, deep, dark gray, gradient

Example: a hippie style spring high-grade T-shirt: choose pure polyester printing design of bright-colored color fabrics

The input sample vector (0,1,1,0,0,0,0,1,0,0,0,1,0,0,0,0,0,0,0,0,0,1,0,0)

The output sample vector:

Raw materials (0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0) weaving way (0, 1)
Element (0,0,1,0,0,0,0,0) color (0,0,0,1,0,0,0,0)

The performance of the network is closely related to the training sample. Design a good training sample should not only pay attention to the sample size, but also pay attention to the quality of the sample. Previous studies have shown that considering the mapping accuracy and sample contains the rule of network training, to choose a representative sample. Sample selection should pay attention to the balance of sample classification, as far as possible the number of samples of each category roughly equal, even if the same sample also want to take care of the diversity and uniformity of samples, the samples of the organization must pay attention to the input samples of different categories of cross into, or random input from a training set. As a result, the training of this system to select 200 groups of women's selection of samples contains four seasons of different styles and price T-shirt, shirt, coat, trousers and skirts, sample information is from the ladies of the fabrics on the market research.

As a result of the neural network input and output of the clothing material element is more, may cause the network convergence speed slowly. To improve the efficiency of neural network learning, in this paper, the normalized treatment was conducted on the input and output data. Training tests on 200 groups of samples, in addition to select 5 groups of samples to test generalization ability, and according to the output data to determine the corresponding number of hidden nodes and the number of the best training. Part of the training results data as follows [11]:

Tab.3: Test Sample Input Vector

Search keywords	Input vector
Spring hippie wind high-grade T-shirt	0,1,1,0,0,0,0,1,0,0,0,1,0,0,0,0,0,0,0,0,0,0,1,0,0
National high-grade shirts in summer	0,1,0,1,0,0,0,0,1,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0
Lady with intermediate coat in winter	0,1,0,0,1,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,0,0,0,1,0
Spring neutral wind mid-range pants	0,1,0,0, 0,1,0,1,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,1,0
Autumn commuter middle-grade dresses	0,1,0, 0,0,0,1,0,0,1,0,0,1,0,0,0,0,0,0,0,0,0,0,1,0

Tab.4: Test Samples Corresponding to the Target Output Vector

Search keywords	Raw material	Weaving way	Element	Tonal
Spring hippie wind high-grade T-shirt	0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0	1,0,0	0,0,1,0,0,0,0,0	0,0,0,1,0,0,0,0
National high-grade shirts in summer	1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0	0,1,0	0,0,0,0,0,1,0,0	0,0,1,0,0,0,0,0
Lady with intermediate coat in winter	0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0	0,1,0	1,0,0,0,0,0,0,0	0,0,0,1,0,0,0,0
Spring neutral wind mid-range pants	0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1	0,1,0	1,0,0,0,0,0,0,0	0,0,0,0,0,0,1,0
Autumn commuter middle-grade dresses	0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0	0,1,0	1,0,0,0,0,0,0,0	0,0,0,0,0,1,0,0

Tab.5 Raw Output Test Results

Search keywords	Raw material
Spring hippie wind high-grade T-shirt	0.1491,-0.1567,0,-0.0260,0,0,0.7779,0.0192,-0.0293,-0.1538,0.0080,0.1167,0.1328,0.0220，-0.0452,0,0.0013,0.1868
National high-grade shirts in summer	1.0136，-0.0289,0，0.0239,0,0，-0.0348,0.0409,0.0176,0.0487，-0.0341，-0.0541,0.0793,0.0161,0.0147,0，-0.0315，-0.0593
Lady with intermediate coat in winter	0.1076,-0.0720,0,-0.0044,0,0-0.1057,0.0326,0.5969,0.0085,0.1145,0.0271,0.1867, 0.0060,0.0046, 0,0.0352,0.0435
Spring neutral wind mid-range pants	-0.0188,0.0315,0,0.0105,0,0,-0.0949,0.0689,-0.0768,0.0003,0.0187,0.0334, 0.1103,0.0097,0.0007, 0,0.0224,0.8947
Autumn commuter middle-grade dresses	0.1216,-0.0948,0,0.0122,0,0,0.0488,0.0802,0.0901,0.2592,0.0482,0.0313,0.1152, 0.0063, 0.0841,0,0.0091,0.1753

Analysis of raw material forecast, for example, table 5 is the test output of raw material, the result can be found that the sum of each group of data is 1, the size of the data says the size of the selected degree, and the highest value is the best prediction results. High-grade national summer shirt, for example, can be found from table 5, respectively, the maximum value output is 1.0136, the test results: cotton is the raw materials, consistent with the target output in table 4.By analogy; weaving way of clothing materials, elements, colors and fabric style also can get a conclusion which is consistent with the sample. It suggests that neural network has good generalization ability.

5. Conclusions

With respect to BP artificial neural network based on genetic algorithm solve the problem of selection of clothing materials, which has a much higher accuracy of the final output. This method absorbs a large amount of knowledge of clothing materials and summary the experience of selection of clothing materials.

So that non professionals avoid to large amount of information and they can choose appropriate clothing more accurately, which support systematic knowledge for consumers to select appropriate clothing material. At the same time, this method can also train generalization of fabrics based on the latest trends， to simplify the working process of garment enterprises.

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