

Research Article

Optimization of Digital Media Product Interface Design Based on Multidimensional Heterogeneous Emotion Analysis of Users

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Due to the characteristics of strong interaction, pertinence, and digital communication of digital media technology, this study combines it with interactive technology. It not only increases customers' feelings in the process of experience but also promotes the progress of new media technology. However, people's demand for digital media interface has gradually shifted from functional demand to emotional demand. In order to make a good interaction design, interaction designers must first deeply understand and study users' cognitive behavior and psychological activities. In this study, through multidimensional heterogeneous emotion analysis of users and optimizing the interface design of digital media products, users can easily and efficiently complete tasks, increase the sense of intimacy, comfort, and success, and improve user satisfaction and brand reputation. Digital media product interface carries the function of visual invisible logic language. As the most common form of visual communication, it affects everyone's life. Digital media carries all kinds of information. How to get more user experience in the same type of media is a problem to be considered in the design of digital media interface. Applying emotional design to digital media interface design, users can not only meet the needs of actual functions but also get a more emotional experience. Starting with the emotional design theory of digital media product interface, this paper studies the emotional instinct layer, behavior layer, and reflection layer in the creativity of user interface design, analyzes the emotional relationship between users and products with the three layers of emotion of design, and discusses the characteristics of the emotional design of digital media product interface from the perspective of design.

1. Introduction

In order to meet people's spiritual and cultural needs and fill the shortcomings of traditional technology, digital media technology appears in front of the public [1]. The biggest feature of the experience economy is to highlight humanization. It no longer starts from whether the product function or service is comprehensive, but from the user's experience. People's emotional demands and the realization of self-worth have increasingly become the focus of attention [2]. "Digital media art" refers to the art form of publishing works based on computer and network platform, based on digital technology and with the help of digital technology-related media [3]. Meanwhile, the mobile internet has created a new social life form. The internet plus action plan has been continuously promoting the development of all

walks of life. The impact of the internet on the whole society has entered a new stage, [4]. Digital media interface design is not simply the result of the development of internet and computer technology. It involves many different disciplines, such as computer technology, human-computer interaction, visual design, esthetics, consumer psychology, digital media technology, linguistics, and so on [5]. Today, digital media art, as the expression form of art in the new era, is a new and open field that is constantly developing, breaking the traditional concept [6]. It can be seen that the future information is like a cross network. Various forms of expression can be formed in the art field. The mutual integration of digital media technology and art design opens up a new path for art expression and provides more opportunities for art and culture. This road is still in the exploratory stage, but it has achieved initial results in some fields.

Product designers usually need to collect customer requirements when designing new products or improving product functions [7]. The traditional methods are mostly interviews, questionnaires, or market surveys. These survey data are usually obtained by investigators under the premise of clear objectives [8]. Multidimensional sentiment analysis is a branch of natural language processing, also known as opinion mining, opinion extraction, sentiment classification, subjective analysis, and so on. Its definition is the process of collecting, analyzing, processing, and reasoning text data with subjective sentiment. The appearance of new media makes great changes in the media and content of color communication, visual form, mode of communication, and so on and also makes designers' creative ways and audiences' experience ways constantly change [9]. Attention to enterprise user experience has become a new upsurge, and the improvement of user experience mastery will become the turning point of a new round of enterprise market competition. By integrating the related concepts and contents of interactive products with digital media technology, the customer's own sense of experience has been enhanced to a certain extent, and it has played a positive role in promoting the progress and perfection of digital media technology and also promoted the development of media field.

In the process of the development of the internet to today's era, enterprises that initially hoped to establish an image and seize the market by establishing websites began to realize that the established websites should care about what users really like and need, and providing high-quality user experience is the competitive advantage of sustainable development [10]. Emotional memory is a term from psychology. In recent years, it has also become prominent in literary works and may be seen in film and television performances in the field of art, but it is rarely mentioned in the field of domestic design. According to different classifications of interface design, for example, from the perspective of psychology, it can be divided into many aspects: visual, auditory, tactile, and emotional interaction. How to get more users in a wide range of media is a problem that digital media interface designers need to think about. Through in-depth analysis and exploration of the elements of the interface design of the works, we sort out which elements are mixed with the user's sense of experience. These elements are positive elements for user interface design. Such exploration is not only the promotion and promotion of the research of interface artworks, but also a new exploration of the method of interface design, but also a new attempt in the application and theoretical research of digital media.

2. Multidimensional Heterogeneous Emotion Analysis of User Comments and Product Optimization Design Method

2.1. User Comment Emotion Analysis and Product Optimization Design Framework. Online user reviews reflect users' satisfaction or dissatisfaction with product features and also reflect users' various needs for products. In designing interactive digital media technology products, the link that can

most affect the experience is the user interface. By adding various and convenient product design effects into it, users' acceptance of it can be increased, so as to attract more users' eyes. The goal of user experience is shown in Figure 1.

First, we need to get a large number of online user comments from the website. In addition to meeting the consistency with the daily work sequence, the task process should also ensure that users can continue to work before exiting when they return after quitting halfway, give users sufficient control, and greatly improve the user experience. The interactive interface is an important part of interactive behavior. It is an important medium for people and computers to input and output information. The most common interactive interface is presented by the computer-based display, and it needs to be operated by a mouse and keyboard connected to the display. Generally speaking, two 3×3 convolution kernels with a step size of 2 are equivalent to a 7×7 convolution kernel, which is calculated by the convolution formula:

$$N = \frac{(W - F + 2P)}{S + 1}. \quad (1)$$

Sense is an important channel between digital media product user interface and brain emotion. The design elements that can stimulate vision in digital media product user interface include the following: graphics, color, text, and layout. Emotional experience mainly refers to a kind of psychological reaction of people. When people interact with each other in the interface of digital media, different styles of interface design will give users different visual feelings. Through the use of this process, they can also perceive the content of usage requirements in a large range, thus completing the optimization of a design in a short time and increasing people's need for this technology. The process of user experience design is clearly shown in five levels: strategy, scope, architecture, framework, and performance, as shown in Figure 2.

Second, after the collection of user comment data, the word segmentation tool is used to segment and label these texts. There are also many improvements in the information input process of the form. The form elements should be simplified as much as possible to avoid asking for too detailed information from the user too early. Otherwise, the cumbersome input operation will not only prolong the time to complete the task but also lead to the user's boredom and abandon the use. On the basis of emphasizing easy-to-use function and good emotional experience, interaction design also pays more and more attention to the interaction and emotional communication between people, that is, the so-called everyone interaction. Therefore, the trend of interaction in the future will develop from simple human-computer interaction to everyone interaction. According to different mobile phone settings, it can be divided into a single screen and multiscreen. The difference is that the single-screen wallpaper will not change according to the user switching the icons of each screen interface. All the contents in the picture will be presented on the screen. The formula for content image feature extraction is as follows:

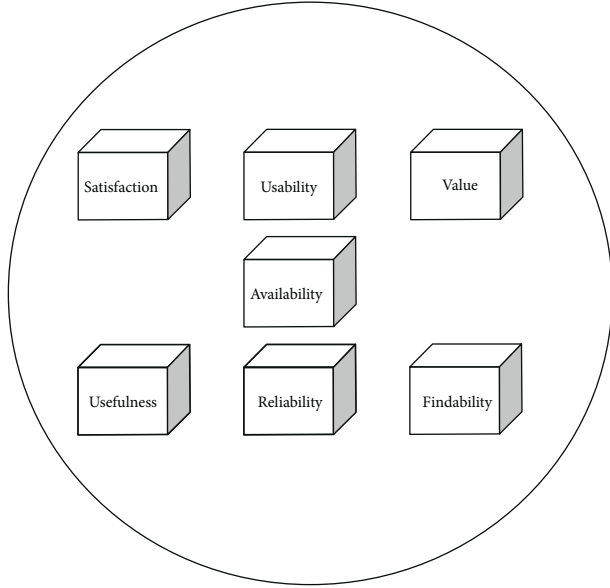


FIGURE 1: User experience goals.

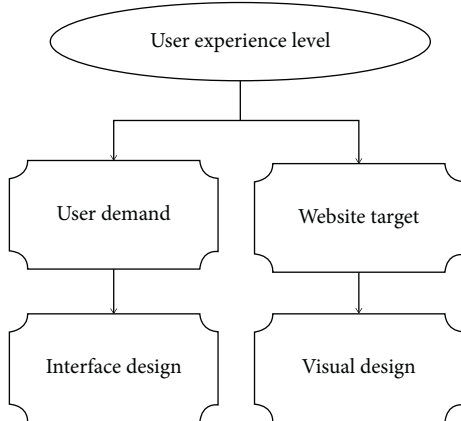


FIGURE 2: User experience element model.

$$p^l \in R^{Ni * Mi}. \quad (2)$$

Visual symbols mainly have the function of collecting including various characters, graphics, colors, and navigation displayed on the interface. We can identify what image information, icons, and buttons are on the interface, the current state of the interface display, and the next step of guidance information, and visual symbols play a leading role here. The same function is represented by the same control, so as to avoid the user's doubts about the function of the control; according to users' spatial memory patterns when surfing the internet, buttons with similar functions should be put together and distinguished from buttons with other functions in style. Because the color saturation of the image may not be the most satisfactory result for users after style transfer, the edge information of the image may be lost in the process of redrawing, and we can get the content loss function:

$$L_{\text{content}}(p, x, l) = \frac{1}{2} \sum_{i,j} (F_{i,j}^l - p_{i,j}^l)^2. \quad (3)$$

Finally, the multidimensional heterogeneous emotion analysis results of online user comments are applied to product optimization design. The pages corresponding to similar tasks should adopt a consistent interface layout and style, and a familiar interface can reduce the learning burden of users; it should be ensured that the visual effects of controls representing the same function are the same on all pages. For example, the link style on each page of the website should be consistent. The extraction of texture features from the style map is different from the feature extraction of the content image. The style map does not need to consider the specific location of the image information, so the GMM matrix needs to be used in the extraction:

$$G_{i,j}^l = \sum_k F_{i,k}^l F_{j,k}^l. \quad (4)$$

Since penalties tend to be smaller and more dispersed weight vectors, the final classifier is encouraged to take all input dimensions into account, instead of focusing on just a few input dimensions. This plays an important role in improving the generalization performance of the classifier and preventing overfitting. At the same time, in order to avoid the influence of styles among different regions, regularization loss is added to the loss function to ensure the natural transition between different regions, and its loss function is as follows:

$$L_{\text{style}} = \sum_l w_l E_l. \quad (5)$$

In the project process of digital media product interface design, color allocation is a link that attracts much attention, and it is also a controversial point that the design team emphasizes emotional expression. The application of color emotion based on the user's needs can make the product stand out from many competing products.

Using multidimensional heterogeneous emotion analysis results, the user's attention and satisfaction with the product can be calculated. According to the user's attention and satisfaction, the product features that need to be optimized and improved can be obtained. The text is processed into the form of word sequences, and then, this string of word sequences is converted into word vectors, which are input into the appropriate neural network model. Further searching customers' opinions on the corresponding product features from online user reviews, and judging users' personalized needs, we can put forward corresponding product optimization design strategies, help users build accurate mental models, improve their attention, and reduce the chance of making mistakes.

2.2. This Essay Comments on Multidimensional Heterogeneous Emotion Analysis Methods. Multidimensional heterogeneous emotion analysis of short text comments is a key step of user comment emotion analysis and product optimization design model based on deep learning. Many designers ignore

the influence of short text comments on emotion analysis in user interface design, which leads to the unsatisfactory user experience of the final software interface. Regardless of the use process and information architecture of the product, it is necessary to consider the user's visual experience, use habits, and expected interaction mode. The flowchart of this method is shown in Figure 3.

First, when using a convolutional neural network for multidimensional heterogeneous emotion analysis, it is no longer necessary to use any emotion dictionary. Some training data with emotion labels are input into the convolutional neural network model to train the model, and the model can automatically learn emotion. The essential problems that need to be paid attention to in the design process are as follows: the interaction of the product itself, design, service, convenient use, and interesting design. The generated image I needs to have both the content features of the content image C and the style features of the style image S . Finally, the following formula is used to update the target image:

$$\frac{\partial L_{\text{total}}}{\partial x} \quad (6)$$

Emphasis is on the natural experience in the interactive process and the overall color atmosphere so that users can experience the functions and emotions of the interface in perceptual color and also make up for the defects of interface mobility. The prompt box pops up in the middle of the application screen and above all other views, so as to provide users with important information in a highly visible way. The core of this cross-domain multidimensional heterogeneous emotion analysis algorithm is to project the source domain data and the target domain data into the same feature dimension, so as to reduce the differences among various domains and learn a feature representation suitable for domain adaptation, thus realizing the migration of process data. For process data Z , each row represents a word data, and each column represents a feature. BN is the operation of averaging each feature, so a one-dimensional mean vector is obtained. The formula is as follows:

$$\mu_{\xi} = \frac{1}{n} \sum_{i=1}^n x_{ij}. \quad (7)$$

Because the target word may be composed of several words, and because the target word itself is a noun without any emotional information, if these words are directly input into the LSTM structure, noise may be introduced and some important information will be lost, which will have a serious impact on the effect of the model. The prompt box displays two buttons: one is the button to perform the corresponding action and close the prompt box, and the other is the button not to perform the corresponding action and close the prompt box. Therefore, it can well process the sequence data with time continuity, in which the sequence data are defined as a series of data that can represent the changes in things and phenomena with time. Similarly, the variance of each feature of process data Z is calculated to obtain a one-dimensional variance vector. The formula is as follows:

$$\sigma_j^2 = \frac{1}{n} \sum_{i=1}^n (x_{ij} - \mu_j). \quad (8)$$

Second, the essay reviews are used for multidimensional heterogeneous sentiment analysis, and then, the sentiment analysis labels of the essay reviews are assigned to the product features contained in the reviews. This is a sentence-level judgment method, which will not cause any loss of the original information and fully takes into account the contextual information. Through rational use of customer interface, it can bring them different feelings and make them focus on products, so as to promote the popularization of the product image and make products more easily accepted by consumers. As we all know, the structure of the LSTM will bring the information of the previous sequence into the later time step, which can better learn the long-term dependency, but it is only one way. When a user completes a specific task, both the human and the computer are disturbed by external environmental factors. The user interface of the mobile device presents information to the user, and the user perceives the displayed variables in the user interface and compares them with the task objectives. The output vector of the model is obtained by learning the output network and finally normalizing the vector by the softmax function. The calculation process of the output layer is as follows:

$$y = \text{softmax}(OW_o + b_o). \quad (9)$$

W_o is the trainable parameters of the output layer; c is the number of types of emotion analysis.

Finally, the convolution neural network model can automatically learn the features needed in emotion analysis, and there is no need for artificial feature extraction. In the case of deleting an object, it is particularly important to display it with high-contrast color first, so as to avoid accidental deletion; the function of error recovery shall be provided as far as possible to improve the friendliness of the system. The AdaGrad optimization method is used to train the update parameters in order to minimize the value of the loss function. The loss function is the cross entropy of the correct label and prediction results. The calculation formula is as follows:

$$\text{loss} = - \sum_{i=1}^e y_i \log \bar{y}_i. \quad (10)$$

The size is set according to the screen size parameters of the mobile phone product itself. Generally, the default size of the design is 2000×1000 pixels. Most of the production tools provided by manufacturers can be cut up and down or scaled in equal proportion according to this size to adapt to different specifications of mobile phones. The dimension of the vector trained in this way can be controlled, and there will be no dimension disaster. At the same time, the vector itself contains semantic information, and the absolute path between the vectors represents the similarity of grammatical and semantic information between the two vectors. Respective weight values are assigned to the training data samples in the source domain so that different strategies can

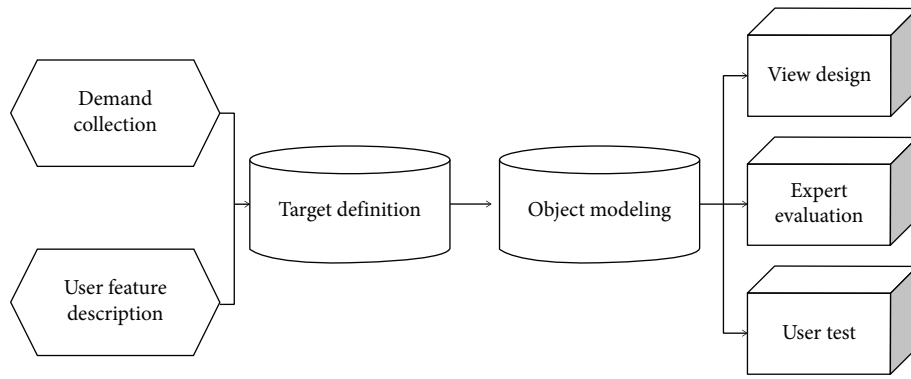


FIGURE 3: Flowchart of the user-centered design method.

be adopted for data from different domains in cross-domain multidimensional heterogeneous sentiment analysis.

3. Research on Emotion Analysis Algorithm of Interface Design Optimization

3.1. Extracting Domain-Independent Feature Representation Analysis. The shared encoder in the network is used to extract the public features between the source domain and the target domain. By making the text representation of the data samples of the source domain and the target domain after being processed by the encoder to the greatest extent, the text features of different domains can be projected into the same feature space. In order to maximize the use of screen size, the current mainstream interface design is the single-task window mode, that is, only one main window is displayed on full screen at a time, which leads to the user may voluntarily give up the current task after suddenly receiving a call. The biggest difference between the RNN and traditional neural network is that this network structure can retain the previous information and apply it to the calculation of the current output, that is, with the continuous increase in input data, the RNN will transfer the last state to the current input. Therefore, the guiding elements should be appropriate; otherwise, the focus will be scattered, leaving users at a loss and interfering with the smooth reading of information, as shown in Figure 4.

First, the multidimensional heterogeneous emotion analysis algorithm based on emotion computing takes into account the weight, classification tendency, and emotion analysis tendency of emotion words. The supervised training corpus can be obtained by randomly selecting parts from short text comments and tagging them, or the existing supervised training corpus can be used. Effective communication with users at the visual level requires a series of user experience methods in building a reasonable product hierarchy, that is, interactive mode, so as to find out the possibility of innovation, establish the basis for pleasant operation, highlight the pain points of users, and correct them in time. Due to the differences between people, different groups have different requirements for products. When designing, we should divide the users into groups, understand the individuality and commonness of each user group, narrow the user groups of products, and find the

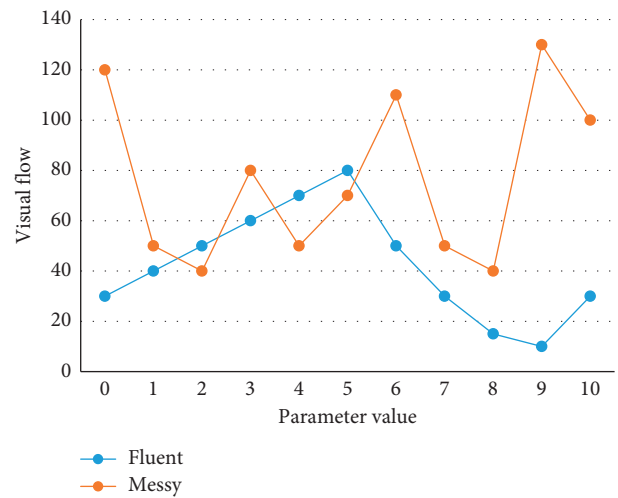


FIGURE 4: Visual flow comparison.

“target users.” The accuracy of isomorphism comes from the universality of meaning given by designers and the mastery of background knowledge when the subject appreciates works, which explains why some people cannot understand many works of art or just brush past them, and cannot feel the powerful shock of works of art.

Second, in the existing model of processing aspect-level multidimensional heterogeneous emotion analysis tasks based on the LSTM structure, the processing flow is generally to input word vectors into the LSTM structure in the order of sentences. Therefore, the LSTM structure is a process of reunderstanding and associating the visual factors in the app user interface. It is an extension of the emotional experience at the instinct and behavior levels. Skillfully applying the law of formal beauty in the design of digital media interface can make the cold machine become a paradise for emotional experience in front of users and make the color, graphics, images, and text elements in the interface design perfectly integrate with the theme of digital media interface design in form. However, the extraction of domain-independent feature representation proposed in this study is different from other scholars. Based on the previous model, the potential topic information is introduced into the semantic representation at the lexical level to improve the effect of lexical representation. On the CCF-BDCI dataset,

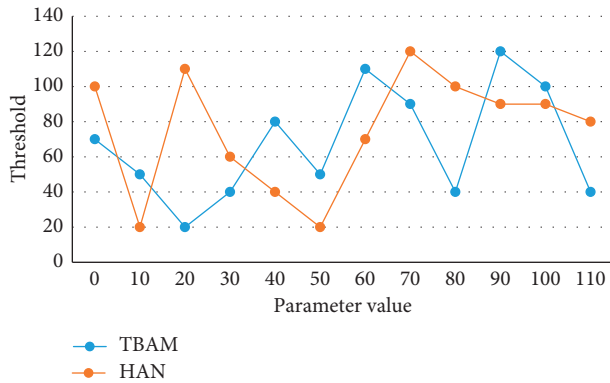


FIGURE 5: Experimental results of the CCF-BDCI dataset.

the experimental results of the TBAM model and baseline model are shown in Figure 5.

Finally, two LSTM structures are used to input contextual words from the beginning and end of the sentence to obtain the contextual word information before and after the target word. The user's experience has always been the starting point for designers to create useful interface design that meets the multilevel needs of users. Designers need to conduct appropriate usability testing in order to design more user-friendly products for users. The user interface in digital media art is mainly analyzed from four aspects to study its usability, including technical requirements, artistic content, technical implementation functions, and browsing habits, operate according to the user's expectation, rely on cognition rather than memory, reduce the user's brain thinking time, and help simplify the user's understanding of the working mode of web functions. Therefore, it is necessary to subdivide the priority for users, and the subdivision standard can be sorted according to the primary and secondary order of users. It is the emotion accepted and understood by users through the combination of three visual elements of color, graphics, and text in the design of the app user interface so that users can have a sense of control over the digital product interface, achieve users' use expectations, reduce users' visual confusion time, and reduce users' emotional waiting period.

3.2. Extraction Target Domain Feature Representation Analysis. For the private encoder of the target domain in the model, it only encodes the private features of the target domain, which often appear in the target domain but hardly exist in the source domain. For positive samples, the accuracy and recall rate of extracting target domain features are similar to those of multidimensional heterogeneous sentiment analysis. That is to say, a parameter matrix is introduced, and the attention weight matrix of the model is obtained through semantic alignment by multiplying the hidden state of contextual words by the parameter matrix and then by the word vector of the target word.

First, for the labeled data of the input source domain and target domain, the shared encoder and the target domain private encoder have extracted domain-independent public features and target domain private features, respectively.

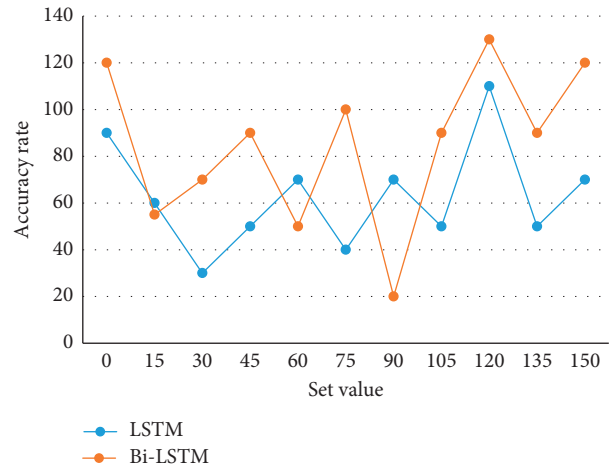


FIGURE 6: Accuracy of the LSTM model and Bi-LSTM model.

Through the rational use of these technical means, the operation will develop to a convenient and efficient form. The biggest difference between the encoder-decoder framework with attention mechanism and the above is that its fixed intermediate semantic G is replaced by C_i that adjusts attention according to the current input data. Through comparative experiments, the accuracy P and recall r of the LSTM model, Bi-LSTM model, and Bi-GRU model, and the performance of F1-score of the LSTM model, Bi-LSTM model, and Bi-GRU model are verified. The experimental results are shown in Figures 6–8.

It is required that a certain interrupt recovery mechanism should be considered in the interface design. No matter whether it is due to active or passive interruption, it should help users recover the context of the task after an interruption, such as saving the user's input, which can effectively reduce the memory burden and operation burden when the user returns after interruption. The experimental results of four classifications of each model on the dataset are shown in Table 1.

Table 2 shows the results of the ten-dimensional twitter English microblog dataset and the modified three-dimensional twitter English microblog dataset. The attention mechanism is added to the bidirectional LSTM network to make the model generate different attention weights for the hidden vectors generated in each time step, so as to pay more attention to the semantic information of contextual words closely related to the target word more effectively and accurately. For example, in recent years, microblog has become the fastest-growing platform and one of the key platforms for communication among governments, officials, users, and others. People can get important and comprehensive social information through this software.

Second, using the abundant labeled data in the source domain and a small part of labeled data in the target domain, the classifier trained can analyze the unlabeled data in the target domain and realize the migration of the multidimensional heterogeneous emotion analysis domain. In addition, it is also necessary to make detailed inquiry and observation in the two groups, and list, compare, approach, screen, summarize, and clarify from the aspects of self-

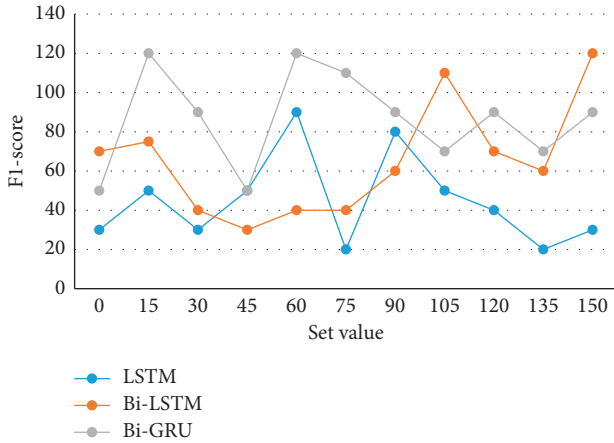


FIGURE 7: Recall rate r of the LSTM model, Bi-LSTM model, and Bi-GRU model.

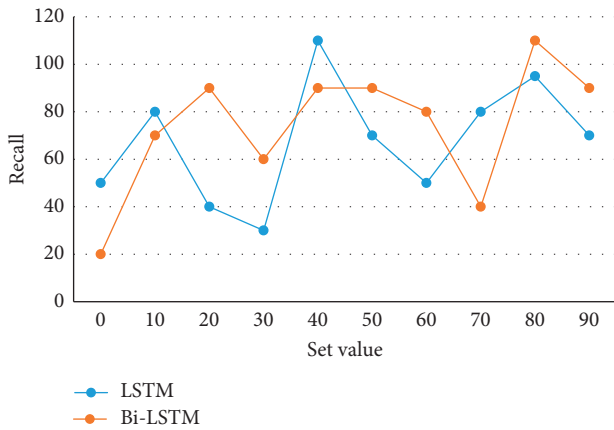


FIGURE 8: F1-score of the LSTM model and Bi-LSTM model.

TABLE 1: Data of evaluation indicators of each model in four categories.

Method	Bi-GRU	Bi-LSTM	LSTM
Accuracy (%)	50.5	54.9	57.2
P (%)	66.2	69.1	59.3
F1-score (%)	46.3	50.3	28.9

awareness, behavior habits, values, needs, and expectations, so as to create appropriate user roles. During the operation of users, digital media products will appear in different forms of operation reminders such as text prompt, voice broadcast, or interactive demonstration. These humanized emotional designs are designed to bring users a better experience in the process of use. A supervised learning framework is used to train the model in an end-to-end way. The loss function is derived from all parameters through backpropagation, and the AdaGrad optimization method is used to train and update the parameters in order to minimize the value of the loss function. By introducing digital media technology into our work, we can break through the

TABLE 2: Comparative experimental results of ten-dimensional and five-dimensional Twitter datasets.

Model	AttBiLSTM	BERT	TBAM
Twitter 10	19.5	29.3	34.7
Twitter 5	39.4	33.6	45.3

limitations of time and space, and understand and watch the information content we are interested in at any time.

Finally, the emotion analyzer is trained by combining the domain-independent public features with the target domain private features. User's instinctive emotional perception is the cognition of things accumulated in social practice for a long time, and there are certain differences among users of different levels in the cognitive process. Advocating designers to use div + css as a standard web page code writing method is based on the usability engineering theory. The advantages of this writing method are that it can be compatible with various browsers, improve browsing and loading speed, and conform to the inclusion of search engines. The short text comment data represented by distributed word vectors are input into the CNN classifier, and the corresponding emotional polarity tags are output. The gating mechanism is used to determine which information needs to be forgotten and which information needs to be memorized and transferred to the next GRU unit. It can also be said that the information capacity received by users in the product channel is even larger, and the displayed content will not be limited by space factors, and the number of transmissions in a certain period of time will increase in the form of geometric numbers.

4. Conclusions

In today's digital age, artworks show diversified forms of expression, and interface design has become a key link in its design. The resulting development, application, research, and evaluation are all levels we pay attention to. The internet makes the relationship between media, design, and art closely linked. The application of emotion analysis in digital media interaction design should follow three principles: the consistency principle of design elements and emotional memory, the differentiated design principle of target users, and the principle of technical assistance. The user interface design has become the core of the communication between its digital media products and users. Only by integrating a large number of emotional design ideas into the interface design of digital media products, the communication between it and users is comfortable and smooth. In this study, the digital media product interface design optimization based on user multidimensional heterogeneous emotion analysis allows users to obtain more emotional experiences while obtaining information. In order to apply the emotion analysis results to customer demand identification and product optimization design, this study proposes to extract domain-independent feature representation and target domain feature representation. Interactive product design in digital media technology needs to fully consider the influence of multiple factors such as environment and object in

the working process, so as to improve user satisfaction and achieve the design goal of human-computer interaction. It is of great significance to use the principle of emotional design to guide the interface design of digital media and meet the user's emotional experience to the greatest extent.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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