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Research Article

Student Physical Health Information Management Model under Big Data Environment

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Health is considered an important foundation for students' success. However, with the accelerated pace of life, rising pressure from various parties, weak health awareness, lack of exercise time, and other reasons, students' physical quality is generally declining, the incidence of health diseases is increasing, and the onset age tends to be younger. With the development of the concept of "health first," health management continues to expand and extend and students' health management has attracted more attention from many aspects. Due to the late and low starting point of health management research and the lack of professional theoretical support, a complete, mature, and effective health management service system has not been established to deal with the students' health. In order to make student health management more scientific, normative, and effective, this article has proposed big data technology to build the student health information management model. The first step of the approach is to store and analyze the data of students' physical health. It is necessary to combine the data collection, supervision, data analysis, and data application of students' physical health and gradually improve the national monitoring and evaluation system of students' physical health. Student health check-up management platform is mainly used in realizing the school student information management and student health information relationship between system, science, standardization, and automation, and its main task is to use a computer to perform daily management of all previous medical information of students, such as query, modify, add, delete, and enhance the physical health of students information management ability given the large data analysis of useful information. In addition, we have built a doctor recommendation model based on online questions and answers to give specific health recommendations for students of different physiques.

1. Introduction

In recent years, the physical fitness [1–3] of domestic students has generally been poor. Although the concept of "green health" continues to take root in the hearts of the people, the rate of adolescent obesity, myopia rate, depression rate, and prevalence rates are still increasing year by year. At the same time, the physical health literacy of young people, especially college students, has declined overall, their social adaptability has continued to decline, and their psychological endurance has become increasingly weak. After entering society, it is difficult to cope with work intensity and interpersonal relationships, psychological pressure cannot be effectively resolved, and depression and suicide incidents of college students are endless. The physical health of college students is not only an issue of concern to their parents but also an issue that has received attention from all walks of life [4, 5].

However, through the investigation of college students' life and study, we found that the reasons for the decline of college students' physical quality [6] year by year are mainly in the following two aspects: one is that the students' self-restraint is weak so that they have no time to eat and sleep and for indulgence. For example, irregular work and rest, often staying up late, unhealthy diet and eating junk food, and the arrangement between learning and sports being not appropriate all constantly push the physical health level of college students to the second (sub-)health state, and even “senile disease” body is not rare [7]. Nowadays, the vast majority of people rely on their youth, often ignore their health, and wantonly squander their physical fitness. Secondly, in terms of teaching in colleges and universities, most schools no longer offer PE classes after the junior year, leaving only the routine morning run. The time for physical exercise is constantly compressed, and even the standards of physical examination are changed again and again. Therefore, the weak sports consciousness, lack of exercise time, and other problems have led to the fall of our country’s education field into a vicious circle of focusing on intellectual education and high scores and ignoring physical education, low ability, and weak physic, which to a certain extent explains the urgency, necessity, and difficulty of establishing health management service system in college physical education teaching [8, 9].

The significance of this study is to build an effective health management service system for colleges and universities with the help of the era background of information big data and provide a theoretical reference for promoting the development of student physical health management services. At present, the assessment index system of college physical education is mainly composed of “scores” and “attitudes,” and the evaluation methods have not undergone substantial changes. Lack of “knowledge” and “physical fitness” and other important indicators that can show physical health, body shape, physical function, and mental state cannot fully reflect the guiding concept of “health” and cannot fully reflect the physical and health status of students, so there are obvious shortcomings. Students only complete the physical exercise required by the school and related tasks assigned by the physical education teacher in order to obtain high scores and good grades. This inherent thinking leads to insufficient health awareness of students, low subjective and conscious initiative, and low efficiency of physical education courses. The young people in our country are gradually getting younger disease. In the era of highly developed information technology, modern management technology [10] has not been fully developed and used. The current university student health management service system lacks good management and monitoring, and problems such as monotonous management methods, insufficient theoretical innovation, and incomplete monitoring mechanisms are prominent. Therefore, it is particularly important to further improve the index system of health management and establish a comprehensive, scientific, and practical health management service system [11].

The main contributions of this article are as follows:

(1) It builds a student health information management model based on big data technology. The first step is to store and analyze the data of the students’ physical health and then combine the data collection, supervision, data analysis, and data application of the students’ physical health to improve the student’s physical health monitoring and evaluation system.

(2) It proposes to build a student health check management platform, which is mainly used for school student information management, system, science, standardization, and automation of student health information relationship, and can use computers in daily management to manage all previous medical information of students.

(3) This article conducts experiments, and the experimental results proved the effectiveness of constructing a student health information management model based on big data technology. The methodology of the article is briefly given in section 3.

The article is structured as follows: Section 2 discusses the background of the study with the existing related work. Experiments and results of the proposed study are discussed briefly in section 4. The article is concluded in section 5.

2. Background

The exploration of health management [12] has always existed. From the beginning of the use of fire to ancient medicine and then to modern medicine, people have constantly been fighting against various diseases in order to better maintain the health of life. With the development of history, human knowledge continues to accumulate, and modern health management has been gradually developed and improved under the impetus of the market economy. In the 1950s, the US economy developed rapidly and people’s living standards improved rapidly. People’s attention and importance to health were gradually put on the agenda. Under such a social background, health management as a new term came into being in the United States, and in just a few years, it has rapidly developed into an independent discipline and a special industry.

The importance of health management has been widely recognized in American society, so it is extremely urgent to construct a reasonable and effective health management mechanism. The American government divides the student health management system into three parts: physical health, health education, and health promotion. The first two levels are easily disturbed by various factors, the management cannot be carried out in a comprehensive way, and the results are relatively poor. Under such circumstances, the term “health promotion system” has slowly emerged [13]. In the 1980s, the concept and basic connotation of the health promotion system were gradually clarified. Some comprehensive schools further proposed the transformation of the school health system into a health promotion system in the health promotion plan for college students and gradually refined the school health system from the initial three parts to eight parts.

In the context of the prevailing concept of European health management [14], Finland also launched a large-scale exploration of health management models in the 1960s and 1970s based on its own national conditions. The Finnish government tried a new health management model to make full use of community health services. A pilot study was conducted in 1972, based on mutual cooperation among communities, to guide people to change their original bad behaviors and basic lifestyles and choose healthy lifestyles. After 25 years of practice, the smoking rate, cholesterol, lung cancer, coronary heart disease, and other cardiovascular disease mortality rates in men aged 25-26 have decreased by 50%, 20%, 71%, 73%, and 71%, respectively. It can be seen that the pilot study of the health management model has a significant effect, and it can be promoted and applied. Finland's health management model based on community services has had a significant impact not only in the country but also in countries around the world, providing them with a wealth of valuable experience.

With the rapid development of Internet technology, various management tasks of student health examinations have gradually entered the era of information management. Practice has also proved that the intervention of computers and information-based management can indeed make the school's various tasks more scientific, more systematic, more complete, and more humane, with high efficiency, good quality, and easy preservation and communication. Now, schools have basically entered the age of computer office, and computers have quickly entered ordinary households. Therefore, the management of student health examination will change from paper management to computer network management. The student health examination management platform is mainly used for school student information management to realize the systematization, scientification, standardization, and automation of student health information relations. Its main task is to use computers for daily management of students' previous physical examination information, such as inquiries, modifications, and additions, deleting and analyzing useful information for big data, and designing a student health information management system for these requirements. The implementation of the application of the school's student health management system is an important measure to further promote the standardization and electronic management of student information and to improve the level of education and student health [15].

3. Methodology

3.1. Analysis of the Functional Requirements of the System. This article uses the BS structure to achieve the related requirements to ensure the security, reliability, and scalability of the management system; the relative independence of each module makes the system convenient according to the need for adding new functional modules. Based on the demand of care on the health information management system, the system is divided into eight function modules (as shown in Table 1), respectively, for the students' basic information collection, physical examination, physical examination data storage, information search, information maintenance, statistical data analysis, comprehensive health assessment, data export, system settings module, and log management module.

The health management system for primary and middle school students is designed with four user roles: students, teachers, medical staff, and website administrators. Student users have the authority to register and log in, query student status information, query physical examination information, and view physical examination notification operations. The specific user functions are shown in Figure 1.

After the teacher role logs into the system, it has the authority to view the medical examination notice, maintain student status information, view student medical examination data, and view statistical report information. After physical examination, medical staff logs in to the system, which contains the functions of viewing physical examination notifications, maintaining student physical examination data and viewing statistical report information. After the website administrator logs into the system, he has the right to add users, assign permissions, issue medical notices, and maintain website data.

3.2. Systematic Business Process Analysis. The health management system [16] of primary and middle school students in this article is a set of complete website applications, which has experienced a complete project cycle in the development process. Software development model uses rapid prototyping models and allows the requirements analysis phase of the demand for software to carry out the preliminary analysis and definition of not completely rapid design developed prototype software system (showing all or part of the function and performance of software to be developed, user testing the prototype evaluation, specific improvement opinions, and plenty of detailed software requirements for developers to modify). The development program of design patterns uses MVC design pattern; MVC is the abbreviation of model-view-controller, a software design model, using a method of separation of business logic, data, and interface display organization code, gathered in a business logic component, which tries to improve and personalize custom interface and user interaction at the same time and does not need to write the business logic. MVC enables the same program to use different representations to achieve code separation. The hierarchical pattern is shown in Figure 2.

The advantage of the layered architecture is that it achieves a certain degree of separation of concerns, which is conducive to the reuse of the logic of each layer; it normalizes the calling relationship between layers and can reduce the dependency between layers; if the interface design between layers is reasonable, then it is not difficult to replace the original level of realization with a new one.

We also use tokens to prevent duplicate submissions of data. There are two situations in which information is repeatedly submitted while information is being entered. (1) After the user completes the operation, click Back to return to the page and submit again. (2) Refresh the current page after the user completes the operation. How it works: before processing the client's request, the server side compares the value of the token contained in the request to the value saved in the current session to see if it matches. After the request is processed, and before the information reaches the client, a new token is generated. The token value replaces the token value in the current session and is passed to the client. This way, if the user goes back to the submit page and commits

Table 1: System function module division.

Module	Introduction
User registration	The new user completes the registration operation
User login	The user completes the login operation on the login page
User password modification	Users can modify their own password after logging in
User information view	Basic user information view
Student basic information maintenance	Complete entry, modification, and deletion of basic student information
Student basic information query	Complete the conditional query operation for student information
Physical examination information maintenance	Complete the entry, modification, and deletion of the student's physical examination data
Physical examination information query	Complete the conditional query operation on the student's physical examination data
Big data analysis of physical examination information	Complete the intelligent scoring operation of the medical examination data
Maintenance of medical notice announcement information	Complete the input, modification, and deletion operations of the student's physical examination notification information
Announcement information query of medical examination notice	Complete the conditional query operation on the notification information of the student's physical examination
Health check notification information reminder	Complete the rest of the operation for the notification information of the student's physical examination
User authority information management	Complete the assignment and management of user authority information
User operation log record	Record the user's operation information in detail, and generate a log
User login record	Record the user's login information in detail and generate a log

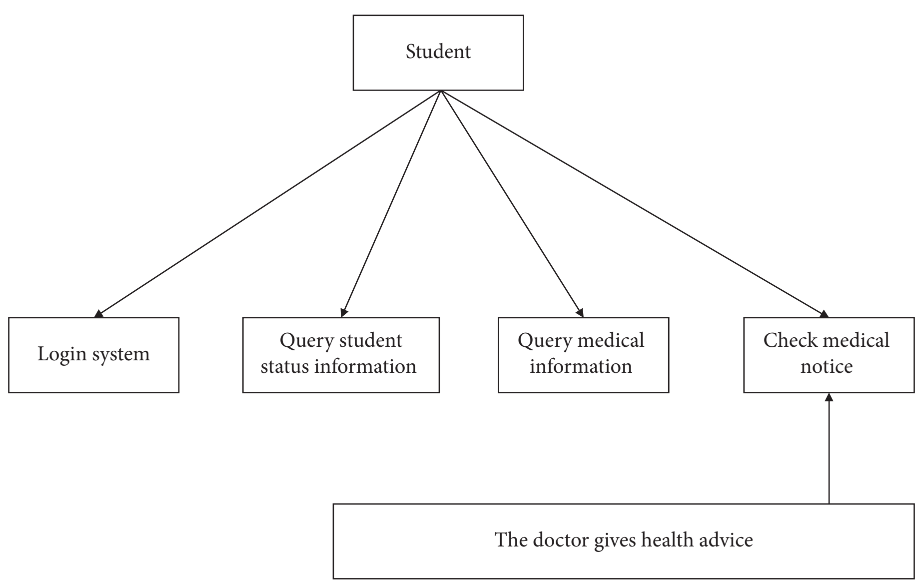

Figure 1: Student behavior use case diagram.

again, the token passed by the client does not match the value of the token in the service, thus effectively preventing the commit.

3.3. Feasibility Study of the System. Systems Development Life Cycle (SDLC) is the life cycle of software until it is scrapped or discontinued. There are problem definition, feasibility analysis, overall description, system design, coding, debugging and testing, acceptance and operation, and maintenance and upgrading to obsolescence in the cycle. In other stages, this time-based method of thinking is a principle of thinking in software engineering, that is, step by step. Each stage must have definition, work, review, and document formation for communication or reference to improve the quality of the software. The feasibility analysis stage is divided into technical feasibility, operational feasibility, and economic feasibility. This project focuses on user needs and feasibility analysis to illustrate the necessity of the design and production of this project.

In the preliminary investigation of the student health management system, it is found that people are more likely to accept the BS structure website system rather than the CS structure software system. It is becoming increasingly mature based on the current Internet technology and deeply penetrated into People's Daily life, so people are happy to accept the website system. This project is based on the decision to adopt the BS architecture of the website system. To build a

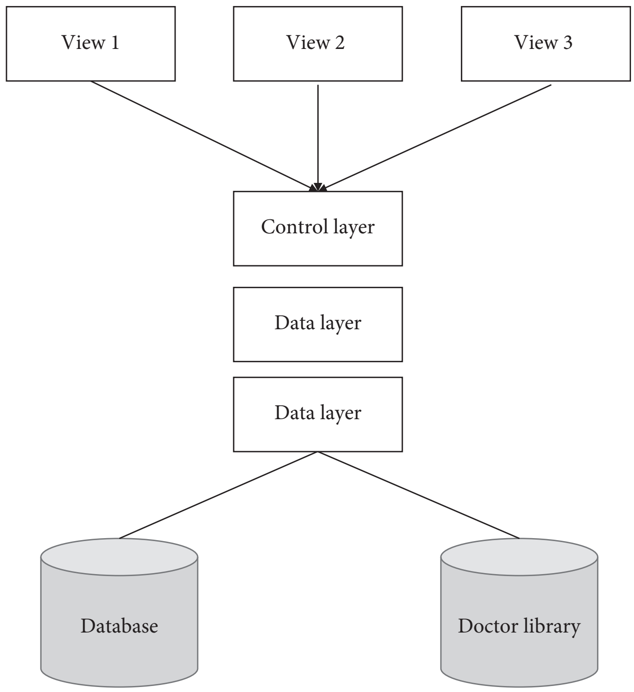

Figure 2: System hierarchical structure.

website, we should consider all aspects of hardware, software, and technology. Set in the technical feasibility, development process operating system uses the familiar Windows 7 ultimate operating systems; web applications run software adopts tomcat7 open-source software; web load balancing uses Nginx 1.8 open-source application software; development program uses the Java programming language; web project framework uses *J* final speed development framework, using SQL database using the MYSQL open-source software structured development language. The front-end display page uses HTML5 technology with JavaScript script verification language and CSS style language to write code and the front-end dynamic display page uses JSP technology to display. The development software uses MyEclipse10 to build the website framework and write the code. The database uses SQLYOG Enterprise to create the database and write and execute the SQL language.

3.4. Doctor Recommendation Model. Doctor recommendation framework consists of four stages: data collection, data preprocessing, model training, and doctor recommendation. The recommendation model is called DRGAN (GAN-based Doctor Recommendation).

3.4.1. Data Preprocessing. The data source of this article is question and answer data between students and doctors. Data preprocessing mainly prepares feature vectors as input for the model training phase of the framework. Data preprocessing includes two steps: word segmentation and feature extraction.

For numerical features, this section directly splices all numerical features of students (or doctors) together. For personal attributes, this article uses One-Hot coding. For example, the gender of the questioner is represented by a vector with three dimensions ["male", "female", "unknown"] (that is, female can be represented as [0, 1, 0]). Because there are not many categories in the dataset in this article, such as age, region, and doctor's title, the impact of the sparseness of One-Hot coding is not significant. However, if the text content data also use On-Hot coding (i.e., the bag-of-words method), a very large and sparse feature vector will be generated, which will significantly affect the performance of the deep learning model. In addition, because the content of the question and answer text is usually shorter and fewer sentences as shown in the example, unlike the data in the disease text topic classification chapter, which is mainly long text, the use of the TFIDF method in this section will also produce very sparse feature vectors. Although the original word embedding representation method (such as Word2-vector) requires a lot of training data as described in the introduction, the idea of representing words can be used for reference. In this section, each word after the text content segmentation is expressed as k dimensions (such as 100 dimensions) random initialization vector and then through the GAN-based model [17, 18] to vector the content of the question and answer text.

3.4.2. Model Training. This article proposes a model based on the GAN method to train doctors recommendations. For a given query q_i, there is the best response (doctor's answer) r_{true} among all the response results R. Compared to making an absolute correlation judgment on a certain response, the model is easier to judge the relative correlation between a pair of responses through comparison. Therefore, this section uses a pair-by-pair setting to sort the responses corresponding to each query.

For each query q_i, this article sets a pair of responses $P = \{ < r_{\text{true}}, r_i > | r_{\text{true}} > r_i \}$, where $r_{\text{true}} > r_i$ indicates that r_i is not as relevant to q_i as r_{true}. In this section, let $g_\theta(r_i | q, r_{\text{true}})$ and $d_\varphi(P|q)$ denote the generative model and discriminant model of GAN, respectively.

Generator: for a given query q and real response r_{true}, it tries to select the response most relevant to the real response from the candidate response list to generate a response pair P. This article uses the soft max function to describe the process of generating the model as follows:

$$\begin{aligned} p(r_i | q, r_{\text{true}}) &= g_\theta(r_i | q, r_{\text{true}}) \\ &= \exp\left(-\left| f_\theta(r_{\text{true}}, q) - f_\theta(r, q) \right| \right). \end{aligned} \tag{1}$$

Discriminator: try to distinguish the correlation between the response generated by its corresponding generative model and the real response to P. This article uses the sigmoid function to estimate the probability that the response to P is correctly distinguished by the model is expressed as follows:

$$\begin{aligned} & p(< r_{true}, r_i > | q) \\ & = d_\varphi(P|q) = \frac{1}{1 + \exp\left(-\left(f_\phi(r_{\text{true}}, q) - f_\phi(r_i, q) \right) \right)}, \end{aligned} \tag{2}$$

where $f_{\theta}(r,q)$ and $f_{\varphi}(r,q)$ are scoring functions that measure the relevance of query and response, which will be described in the following part. In the final form, this article uses the standard cross-function to unify the two functions to obtain the objective function as follows:

$$O^{G,D} = \min_{\theta} \max_{\varphi} \sum_{i=1}^{n} \left\{ \begin{array}{c} r_{true}\left[\log\left(d_{\phi}(P|q)\right)\right] \\ +r_{g_{\theta}}\left(r_i|q, r_{\text{true}}\right)\left[\log\left(1-d_{\varphi}(P|q)\right)\right] \end{array} \right\}, \tag{3}$$

where n is the number of queries. In order to optimize the discriminant model that is actually a binary classifier, this article can use the stochastic gradient descent method to update and obtain the optimal parameter φ in the case of a fixed generative model.

In the part of data preprocessing, this chapter mentions that the dataset contains numerical features, personal attribute features, and text content features. Because the dimensions of the first two features are less, in this section, numerical features and personal attribute features are directly combined and collectively referred to as (profile) features. However, in the feature extraction of the text content, a large number of words with k-dimensional vectors are obtained, and the dimensionality of the vectors obtained by directly concatenating the word vectors is too high. Therefore, it is necessary to apply more effective methods to represent the text content.

The relevance score of a doctor's response to a health question consultation is defined by the use of cosine similarity as follows:

$$S_{qa} = \text{cosine}\left(v_q, v_a\right) = \frac{v_q^T v_a}{\left|v_q\right|\left|v_a\right|}. \tag{4}$$

Scoring function A: the representation process of scoring function 1 is shown in Figure 3. First, the profile feature of the query and the profile feature of the corresponding response are combined into a joint feature vector v and passed into the input layer of a two-layer neural network [19–22]. The process of this neural network can be expressed as follows:

$$\begin{aligned} S_{\text{profile}} &= w_2^T \tan h\left(W_1 v_j + b_1\right) + b_2, \\ \tan h(x) &= \frac{e^x - e^{-x}}{e^x + e^{-x}}, \end{aligned} \tag{5}$$

where W_1 is the fully connected weight matrix of the input layer and the hidden layer, b_1 is the bias value of the hidden layer, w and b are the weight and bias value of the second hidden layer (i.e., output layer) node, and tan $h(x)$ is one type of activation function. The text content of the query and response can be expressed as Stext according to the QA-CNN method on the right side of Figure 3. Finally, this article combines S_{profile} and S_{text} into a two-dimensional vector and again implements a two-layer neural network to output score S_{nn} that measures the correlation between the query and the response.

Scoring function 2: in scoring function 1, this article firstly models the same type of features and finally outputs the result through a neural network [23–26]. The scoring function 2 (as shown in Figure 4) is another idea; that is, first use a neural network to model the same input source (query source vs. response source) and then use cosine similarity to output the result. Scoring function 2 no longer uses the QA-CNN model for the last step of text content modeling for health consultation (cosine similarity calculation) and only uses the hidden layer representation vector of the text content obtained, such as v_{qt} and v_{rt} in the image. The query and response profile vectors v_{qp}, v_{rp} and their corresponding v_{qp}, v_{rp} are combined to form a joint feature vector, which will be passed into the input layer of another single hidden layer neural network. Finally, this article obtains the joint feature vector v_q and v_r of the hidden layer from the neural network and calculates the cosine similarity $S_{\cos}$ of these two vectors as the correlation score between the query and the response. The process can be expressed mathematically as follows:

$$\begin{aligned} v_q &= \tan h\left(W_1'\left[v_{qp}, v_{qt}\right] + b_1'\right), \\ v_r &= \tan h\left(W_2'\left[v_{rp}, v_{rt}\right] + b_2'\right) \\ S_{\cos} &= \text{cosine}\left(v_q, v_r\right) = \frac{v_q^T v_r}{\left|v_q\right|\left|v_r\right|}. \end{aligned} \tag{6}$$

3.4.3. Doctor Recommendation. After the generative model and the discriminant model were trained against each other, all the parameters optimized in the training process were used to evaluate the model performance in the experiment. For each questioner (e.g., students), the trained model based on GAN (choose to generate models or discriminant model corresponds to the parameter set depending on which model has better assess performance) output questioner query and response focusing all response points, scored again through the response to sort, finally recommended response of the first N a doctor.

4. Experiments and Results

4.1. Experimental Environment. The experiments with all the algorithms were performed on a computer equipped with a single NVIDIA GTX1080TI GPU (16 GB). We have implemented the model construction through the PyTorch deep learning library, the programming language we use is Python, and we batch processed 100 samples each time.

4.2. Dataset. The datasets in this article are from the websites Ask120.com and Xywy.com. After data cleaning, a limited amount of data is obtained, and the ratio of 4 : 1 is used to randomly divide the data according to the number of queries. Since each query in the real dataset has one optimal response and several fewer other responses, for the convenience of testing, this article constructs a candidate response pool containing 10 responses by randomly selecting some responses corresponding to the original query from all response sets.

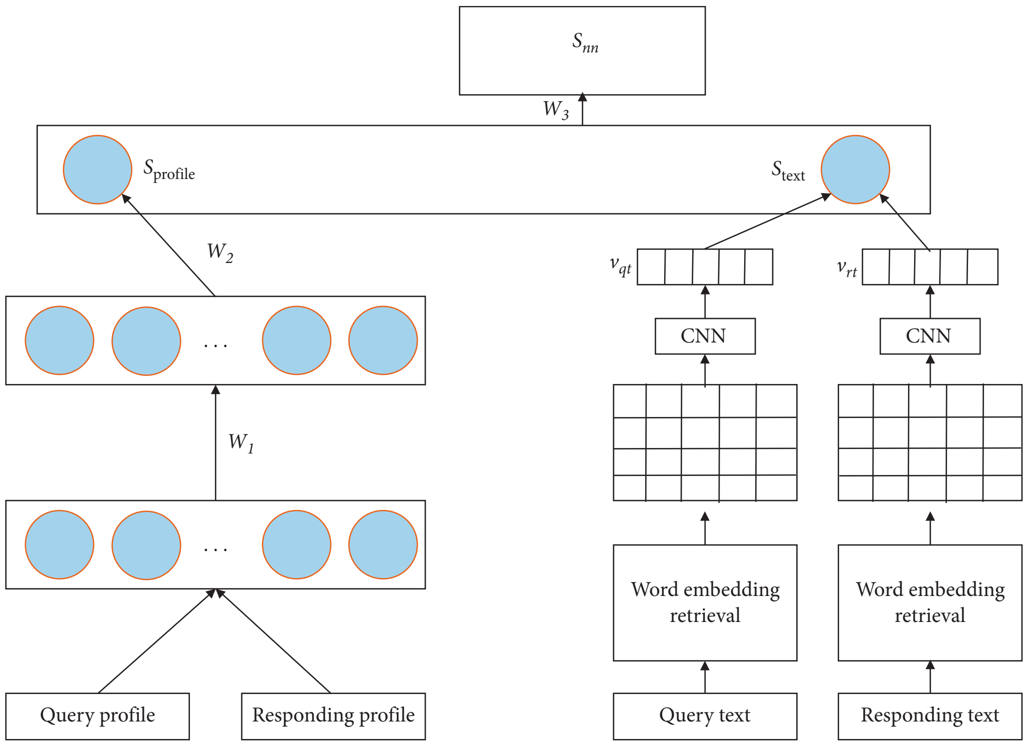

FIGURE 3: Structure diagram of scoring function A corresponding to query and response.

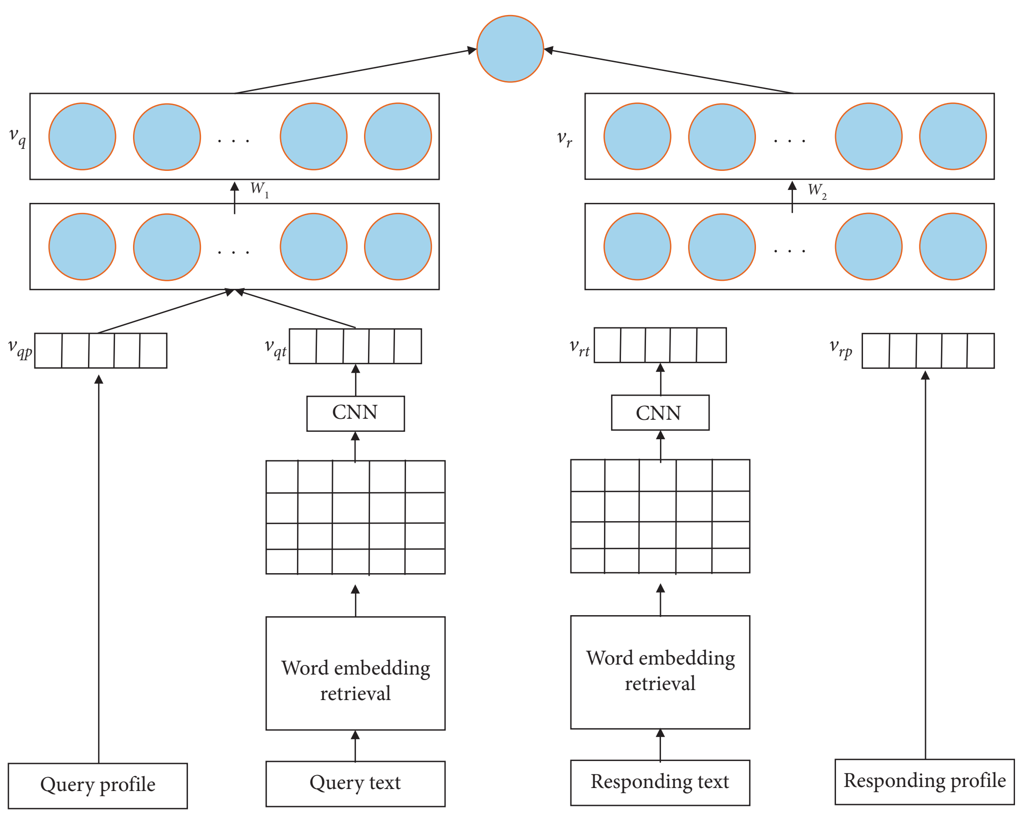

FIGURE 4: Structure diagram of scoring function 2 corresponding to query and response.

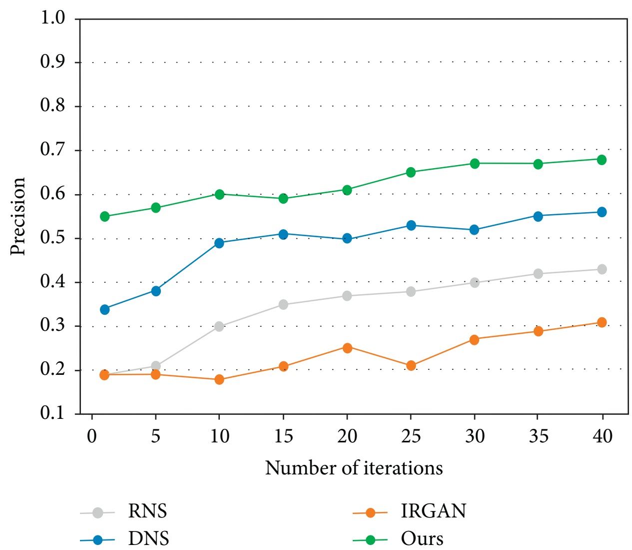

Figure 5: Results of comparative experiments using precision evaluation.

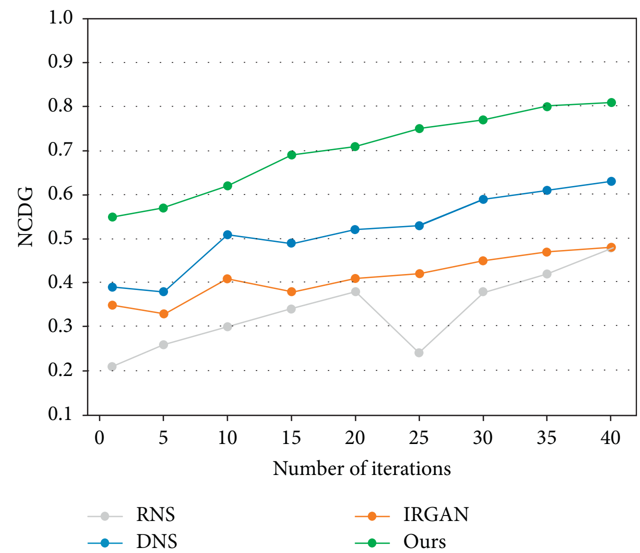

Figure 6: Results of comparative experiments using NCDG evaluation.

4.3. Evaluation Index. In the experiment of this article, the indicators used to evaluate the recommended performance are precision, normalized deviation cumulative gain, and average accuracy (MAP). The definitions of these three evaluation indicators are as follows:

$$\text{Precision} = \frac{|\text{true items}|}{N}, \tag{7}$$

where N is the first N number of recommended responses, and the numerator represents the number of true responses in the recommended response.

$$\begin{cases} \text{rel}(k) = \begin{cases} 1 & \text{if response } k \text{ is true with query} \\ 0 & \text{else} \end{cases} \\ \text{DCG} = \displaystyle\sum_{k=1}^{N} \frac{\text{rel}(k)}{\log_2(k+1)} \\ \text{NDCG} = \dfrac{\text{DCG}}{\text{DCG}_\pi} \end{cases}, \tag{8}$$

where $\text{rel}(k)$ represents whether the kth response in the recommended ranking response list is related to the query (the best response) and π represents the response list sorted according to actual relevance, that is, the best-case ranking response list.

$$\begin{cases} \text{AveP} = \dfrac{\sum_{k=1}^{C} \text{precision} \times \text{rel}(k)}{|\text{true items}|} \\ \text{MAP} = \dfrac{\sum_{q=1}^{O} \text{AveP}(q)}{|Q|} \end{cases}, \tag{9}$$

where c is the total number of recommended responses and Q is the recommended response list set corresponding to multiple queries.

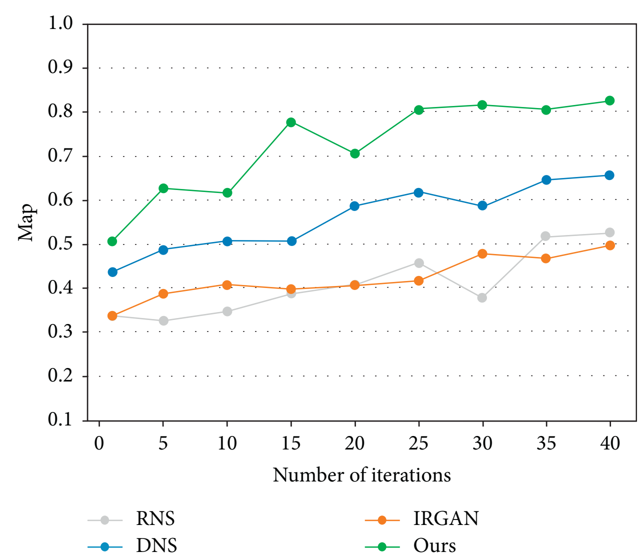

Figure 7: Results of comparative experiments using MAP evaluation.

4.4. Comparative Experiment. Figures 5–7 show the performance changes of all models on the precision indicator on the dataset. The performance of the proposed model is significantly better than benchmark comparison methods, including the DRGAN-nn model. As for the unstable performance curve, it is caused by more random sampling processes in the generation model during the training process of GAN. In fact, when training the generative model, it is necessary to perform the Softmax operation on the full set of responses, which is a very time-consuming operation. In the experiment, a compromise solution was adopted; that is, a smaller candidate response set was sampled from the complete set of responses for each query.

This article also summarizes the best performance results of the proposed model and benchmark method in the dataset

Table 2: Comparative experiment results.

Method	Precision	NCDG	MAP
RNS	0.43	0.48	0.53
DNS	0.56	0.63	0.66
IRGAN	0.31	0.48	0.50
DRGAN	0.51	0.59	0.62
Ours	**0.68**	**0.81**	**0.83**

1 of the performance indicators in the training process, as shown in Table 2. It can be seen that the method in this article is superior to the benchmark method in all evaluation indicators. It shows that the proposed scoring function (especially the scoring function (2)) is effective.

5. Conclusion

Health is considered to be an important foundation for students' success. With the fast-tracked pace of life, weak health awareness, increasing pressure from various parties, lack of exercise time, and other reasons, students' physical quality is usually declining, the incidence of health diseases is increasing, and the onset age tends to be younger. In this article, we build a student health information management model based on big data technology. The first step is to store and analyze the data on the students' health. It is necessary to integrate the data collection, supervision, data analysis, and data application of students' health to gradually improve the national student health monitoring and evaluation system. The student health check management platform is mainly used for school student information management and system, science, standardization, and automation of student health information relations. Its main task is to use computers in daily management to manage all previous medical information of students, such as query and modify, add, delete, and useful information for big data analysis to enhance students' health information management capabilities. In addition, we constructed a doctor recommendation model based on online question and answer and provided specific health advice for students of different physiques.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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