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Research on Portable Intelligent Terminal and APP Application Analysis and Intelligent Monitoring Method of College Students' Health Status

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Abstract

As a carrier of college students' health status monitoring, portable intelligent terminal APP, the study of its APP application analysis not only provides a new way for college students' extracurricular physical exercise, guides college students to actively participate in extracurricular physical activities using intelligent terminal APP software, but also promotes college students' physical health monitoring and enhancement in various aspects. Aiming at the current portable terminal APP college students' health monitoring application analysis method research exists low precision, real-time poor and other problems, through the analysis of the basic functional framework and functional characteristics of the portable intelligent terminal APP, the establishment of the portable intelligent terminal APP analysis index system applied to college students' health monitoring, combined with the heuristic optimisation algorithm and the improvement of deep learning algorithms, the construction of the marine predator based heuristic optimisation algorithm and the attention mechanism to improve the gating control loop. Combining the heuristic optimisation algorithm and the improved deep learning algorithm, we construct the portable intelligent terminal APP application analysis method for college students' health monitoring based on the marine predator heuristic optimisation algorithm and the attention mechanism improved gated recurrent unit neural network. Through simulation analysis, the results show that the proposed method meets the real-time requirements while improving the prediction accuracy of the portable smart terminal APP application analysis method, and significantly improves the efficiency of portable smart terminal APP analysis.

Keywords: portable intelligent terminal APP application analysis, intelligent detection of university students' health status, attention mechanism, gated recurrent unit neural network, intelligent optimisation algorithm

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1. Introduction

As the backbone of the country, college students are responsible for the development and strength of the country, and their physical health status affects the future development of the country [1]. Currently, the physical health monitoring data of college students released by the government shows that the overall physical health of college students is in a declining trend [2]. With the booming development of the current society, the development of Internet technology and artificial intelligence technology, mobile phone intelligence and fullfeatured, increasing the frequency of people's use of mobile phones, bringing a positive impact on people's lives, but also bring negative obstacles [3]. In order to appropriately encourage and guide students to carry out exercise, through the introduction of portable intelligent exercise APP, to assist colleges and universities to carry out extracurricular exercise activities [4]. Portable intelligent terminal APP as the carrier of college students' health status monitoring, the study of its APP application analysis not only provides a new way for college students' extracurricular physical exercise, guides college students to actively participate in extracurricular sports activities using intelligent terminal APP software, but also promotes college students' physical health in various aspects of monitoring and enhancement [5]. Therefore, it is very meaningful to study the application method of portable intelligent terminal APP in college students' health monitoring. Portable intelligent terminal APP generally refers to the human body wearable devices, and equipped with intelligent sports APP, which is mainly used to record the user's sports and health data, guide the user's sports learning, participate in sports discussions, and share sports data [6]. The application analysis research of portable intelligent terminal APP in students' health status monitoring mainly includes the analysis of sports health monitoring [7], portable terminal APP application analysis [8], APP use analysis model [9] and other aspects of research. According to the investigation and analysis of students' physical health status, the sports health monitoring analysis is mainly carried out from the aspects of body form, physiological function, physical quality and health status [10]. Portable terminal APP application analysis is generally carried out from three perspectives, such as APP function analysis, APP principle analysis, APP application effect analysis, etc. [11].The analysis model of APP on students' physical health is divided into APP impact analysis on students' body morphology according to the monitoring content [12], APP impact analysis on students' physical function [13], APP impact analysis on students' physical quality [14], etc. Literature [15] ensures incentives to improve students' ability to maintain a healthy form by studying the impact of after-school running APP use on students' body form; Literature [16] intervenes in exercise in combination with the Le Running APP, analyses the results of height, weight, and BMI indexes, and proposes corresponding measures for controlling the body form; Literature [17] compares the results of physical fitness tests before and after the use of the Campus APP, and the results show that Adherence to physical exercise will make students' lung capacity increase; Literature [18] studied the effect of mobile phone APP software on college students' physical fitness level, and through statistical analysis, found that the lung capacity of students adopting APP was improved; Literature [19] analysed the effect of KEEP exercise software on students' physical fitness, enhanced the application of sports theory knowledge, and helped students develop good habits of exercise; Literature [20] constructs an analytical model for APP use by analysing the effect of exercise APP software use on the influence of college students' physical fitness indicators. From the current literature analysis and questionnaire results statistics, it can be seen that the existing APP application analysis methods have the following defects [21]: 1) less research on portable terminal APP use effect analysis methods and lack of quantitative analysis; 2) portable terminal APP use effect analysis model lacks of efficiency, and the evaluation system is not sufficiently scientific and systematic. With the development of big data technology and artificial intelligence technology, the data recorded on the use of portable terminal APP has been accumulating, resulting in a large amount of data not being sufficiently utilised, mainly due to the fact that the use of data mining technology is not extensive enough and the data analysis system is not objective enough [22]. With the rapid development of artificial intelligence theory and applications, deep learning algorithms have been widely used in data mining applications and have successfully solved data-driven problem models. Therefore, the use of deep learning algorithms to solve the APP usage analysis problem has become a human hotspot for Yaju scholars [23].

Aiming at the problems of the current research on the application analysis method of portable terminal APP for college student health monitoring, this paper combines the intelligent optimisation algorithm to add the attention mechanism into the gated cyclic unit network, and proposes a portable terminal APP application analysis method based on the improved deep learning algorithm, taking into account the systematic college student health monitoring impact indicator system. The innovation of this paper is that in the portable terminal APP application analysis model based on college students' health monitoring, considering the influence of various health monitoring APP analysis indexes on the use of the effect analysis model, combining the bio-heuristic optimisation algorithm, introducing the attention mechanism, constructing the portable terminal APP application analysis model based on the improvement of the gated recurrent unit network, and adopting the relevant indexes to evaluate the analysis performance of the hybrid model , using APP record data set to observe whether the proposed method is effective and enhanced.

2. Portable Intelligent Terminal APP Function Analysis

2.1. Portable Intelligent Terminal APP Basic Functional Framework

This paper takes portable intelligent terminal health APP as the object of analysis, and analyses and describes the basic functional framework of portable intelligent terminal APP.

The basic functions of portable intelligent terminal APP in the application of college students' health status monitoring are divided into three aspects, such as body form, body function, and physical quality [24], and the specific functional framework is shown in Figure 1.

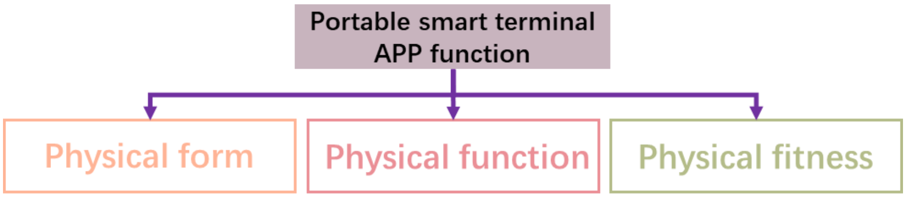

Figure 1 Basic function framework diagram of APP for portable intelligent terminal

2.2. Portable Intelligent Terminal APP Function Analysis

In order to construct the portable intelligent terminal APP analysis index system applied to college students' physical health monitoring, the portable intelligent terminal APP application analysis factors are mainly extracted from the perspective of portable intelligent terminal APP function to analyse the indexes [25]. According to the portable intelligent terminal APP function analysis, the portable intelligent terminal APP analysis indexes applied to college students' physical health monitoring specifically include the following: 1) Body shape monitoring aspect. Select height, weight, BMI as the body shape analysis index of APP for college students' health monitoring; 2) Physical function monitoring. Lung capacity is chosen to assess the function of college students using the portable intelligent terminal APP body function monitoring; 3) physical quality monitoring. Vertical long jump, pull-ups, sit-ups, 50 metres, 800 metres, 1,000 metres, and seated forward bending are selected to assess the physical quality monitoring function of college students using the portable intelligent terminal APP. According to the extraction of analysis indexes, this paper constructs the portable intelligent terminal APP analysis index system applied to college students' physical health monitoring, as shown in Figure 2.

Var.	Description	Var.	Description
X1	Height	Z1	Standing long jump
X2	Weight	Z2	Pull-ups
X3	BMI	Z3	Sit-ups
Var.	Description	Z4	50 meters
Y1	Vital capacity	Z5	800 meters
		Z6	1000 meters
		Z7	Sitting forward bends

Figure 2 Analysis index system of the portable intelligent terminal APP applied to college students' physical health monitoring

3. APP application analysis evaluation index function

In order to better evaluate the performance of the APP application analysis method of portable smart terminal applied to college students' physical health monitoring, this paper adopts the mean absolute error (MAE), root mean square error (RMSE), and mean absolute percentage error (MAPE) as the evaluation index function of APP application analysis effect [26], and the specific calculation formula is as follows:

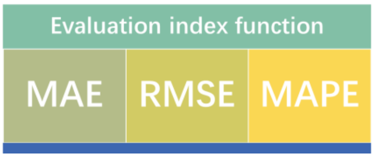

Figure 3 Schematic diagram of the evaluation indicator function

$$MAE = \frac{1}{M}\sum_{i=1}^{M}\left|\hat{y}_i - y_i\right| \tag{1}$$

$$RMSE = \sqrt{\left(\sum_{i=1}^{M}\left(\hat{y}_i - y_i\right)^2\right)\Big/M} \tag{2}$$

$$MAPE = \frac{100\%}{M}\sum_{i=1}^{M}\left|\frac{\hat{y}_i - y_i}{y_i}\right| \tag{3}$$

Where M is the number of observed samples, $\hat{y}_i$ and y_i denote the true and predicted values of the sample i respectively.

4. Related Technologies

4.1. Neural Networks for Door Control Loop Units

Recurrent Neural Network (RNN) provides an effective solution to the time series prediction problem, but suffers from the problem of gradient explosion and gradient vanishing when dealing with long term time series problems.LSTM and GRU, as the advanced version of RNN, effectively solve the gradient problem of RNN. Compared with LSTM, GRU it has a simpler structure, fewer parameters, and introduces the gate structure, which consists of update gates and reset gates [27].The schematic diagram of GRU network is shown in Figure 4, and the specific model structure is as follows:

$$r_t = \sigma(W_{hr}h_{t-1} + W_{xr}x_t + b_r) \quad (4)$$

$$\tilde{h}_t = \tanh(W_{r\tilde{h}} \square (r_t * h_{t-1}) + W_{x\tilde{h}}x_t + b_{\tilde{h}}) \quad (5)$$

Where r_t is the reset gate, which determines how much of h_{t-1} 's historical memory is retained. $\tilde{h}_t$ is the latest information of the Caddidate hidden layer at the current moment, is the hidden layer information of the cell state at and respectively, , , , and are the right to reset. h_{t-1} The information of h_t is the hidden layer information of the cell state at the moment of $t-1$ and t respectively, $W_{r\tilde{h}}$, $W_{x\tilde{h}}$, W_{xr} , W_{hr} are the weights, b_r , $b_{\tilde{h}}$ are the biases.

$$z_t = \sigma(W_{hz}h_{t-1} + W_{xz}x_t + b_z) \quad (6)$$

$$h_t = (1 - z_t) * h_{t-1} + z_t * \tilde{h}_t \quad (7)$$

Where W_{hz} , W_{xz} are weights and b_z is bias. z_t is a forgetting gate, which serves to combine the input hidden layer information h_{t-1} at the previous moment with the candidate hidden layer information at the current moment to get the output cellular hidden layer information h_t . When $z_t = 0$, the hidden layer directly outputs the hidden layer information of the previous moment h_{t-1} , and when $z_t = 1$, the candidate hidden layer directly outputs the current hidden layer information h_t .

$$y_t = \sigma(W_{yt}h_t) \quad (8)$$

Where W_{yt} denotes the weights between the current hidden layer output h_t and the final output layer.

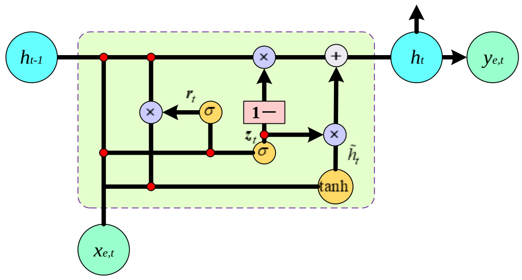

Figure 4 GRU network

4.2. Attention-GRU neural network

(1) Attention mechanism

APP APPLICATION ANALYSIS The importance of impact factors in application analysis is different. More attention needs to be paid to the more meaningful impact factors in app analysis. Attention mechanism (Attention) [28] can scan the global image to obtain the target region that needs to be focused on, and then focus on this region to obtain more feature information and reduce the information of other irrelevant influence factors. Attention mechanism gives different weights according to the degree of importance of the input influencing factors, so as to optimise the input influencing factors.The specific calculation principle of Attention mechanism is shown in Figure 5, and the detailed steps are as follows:

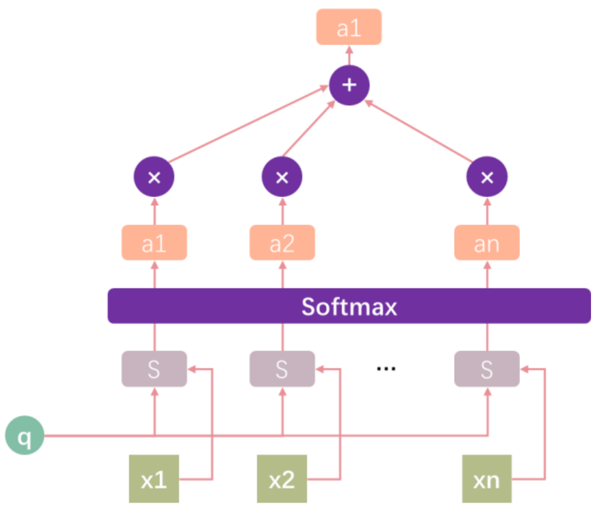

Figure 5 Schematic diagram of the attention mechanism

Step 1: Calculation of Attention Distribution α_n . Calculate the attention distribution on the input influence factor information to get the weight coefficients.

$$\alpha_n = p(z=n \mid X,q) = soft\max\left(s(x_n,q)\right) = \frac{\exp\left(s(x_n,q)\right)}{\sum_{j=1}^{N}\exp\left(s(x_j,q)\right)} \quad (9)$$

Where, X denotes the input vector, q denotes the query vector related to the task, α_n denotes the degree of interest of the n th input vector, z denotes the index position, and $oft\max(\cdot)$ denotes that it is a real-valued transformed bit probability value function.

Step 2: Calculation of the attention scoring function $s(x,q)$. The tanh function is used to calculate the similarity score between the input and output values as follows:

$$s(x,q) = v^T \tanh(Wx+Uq) \quad (10)$$

Where W denotes the weights of the input vector X , U denotes the weights of the query vector q , and v denotes the weight vector of the score calculation.

Step 3: Weighted average. Calculate the weighted average of the input information based on the attention distribution.

$$att(X,q) = \sum_{n=1}^{N}\alpha_n x_n \quad (11)$$

Where α_n denotes the degree of interest of the n th input vector and x_n denotes the n th input vector.

(2) Attention-GRU neural network

In this paper, Attention mechanism and GRU network structure are introduced, the Attention mechanism is introduced into the GRU implicit layer, and after extracting the influence factors of APP application analysis indexes, the weight influence analysis is carried out, and the fused Attention-GRU neural network structure is shown in Figure 6.

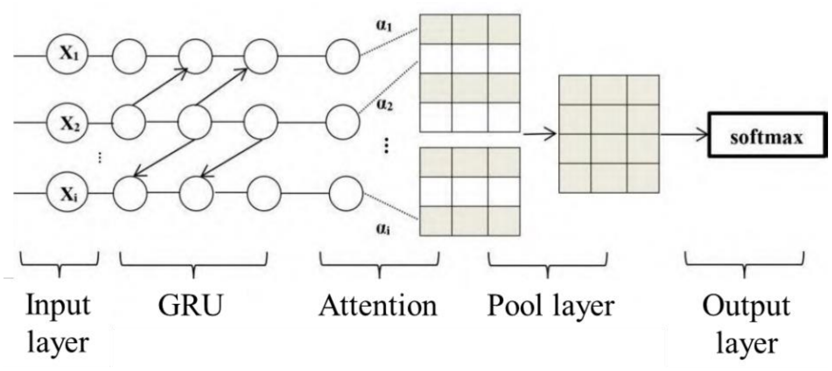

Figure 6 Attention-GRU network structure

4.3. Marine Predator Algorithm

(1) Marine Predator Algorithm

Marine Predators Algorithm (MPA) [29] is a novel meta-heuristic optimisation algorithm inspired by the theory of survival of the fittest in the ocean, where a marine predator chooses the optimal foraging strategy by choosing between Lévy wandering or Brownian wandering, as shown in Figure 7. The algorithm finds the optimal solution by simulating the foraging behaviour of marine predators. Its main features include strong ability to find the optimal solution, fast convergence speed, and easy implementation. The algorithm has been applied in several fields, such as wireless sensor network coverage optimisation.

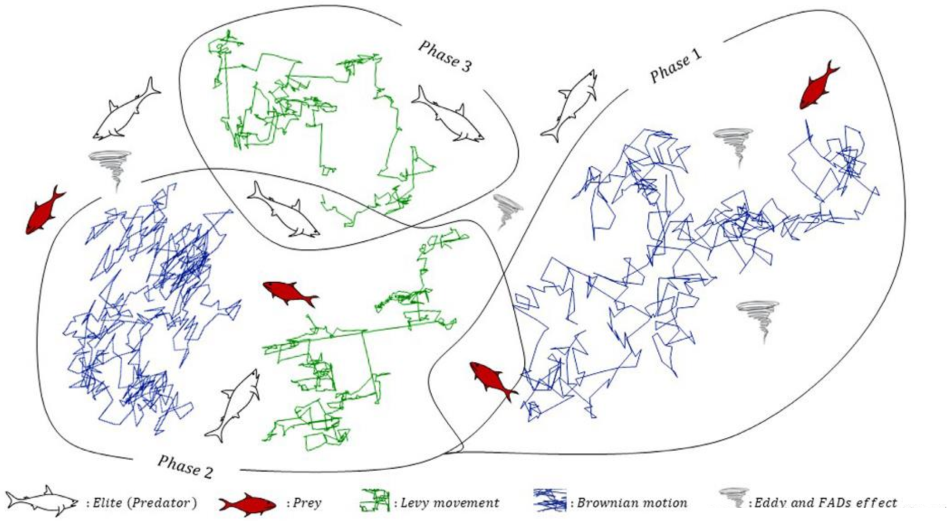

Figure 7 Schematic diagram of the marine predator algorithm decision

The Ocean Predator algorithm is an intelligent population-based optimisation algorithm where the initial solutions are distributed as uniformly as possible in the search space in order to ensure the quality of the search.

$$\boldsymbol{X}_1 = \boldsymbol{X}_{\min} + rand(1,\dim)\times(\boldsymbol{X}_{\max} - \boldsymbol{X}_{\min}) \quad (12)$$

where $X_{\min}$ and $X_{\max}$ denote the upper and lower boundaries of the search space, respectively, and dim denotes the dimension of the population.

The MPA is divided into three main phases: the exploration phase, the balancing phase, and the development phase, which take place before, during, and after the merit-seeking process, respectively.

Exploration phase: this phase usually occurs at the beginning of the iteration, in order to search for more space, the predator's action mainly obeys the Brownian motion, which has a large step size in favour of the algorithm's exploratory ability. The mathematical model of the exploration phase is shown below:

$$While\ iter < \frac{1}{3} iter_{\max}$$

$$\boldsymbol{stepsize}_i = \boldsymbol{R}_{\mathrm{B}} \times (\boldsymbol{Elite} - \boldsymbol{R}_{\mathrm{B}} \times \boldsymbol{Prey}_i) \quad i=1,...,n \quad (13)$$

$$\boldsymbol{Prey}_i = \boldsymbol{Prey}_i + P.\boldsymbol{R} \times \boldsymbol{stepsize}_i \quad (14)$$

where $iter$ is the current iteration number and $iter_{\max}$ is the maximum iteration number. $\boldsymbol{R}_{\mathrm{B}}$ is a random vector with normal distribution based on Brownian motion, $\boldsymbol{Prey}_i$ denotes the position information of the first i individual, $\boldsymbol{Elite}$ is the global optimal individual position information, P is a constant with the value of 0.5, and $\boldsymbol{R} \in (0,1)$ is a uniformly distributed random vector.

Equilibrium phase: in this phase, the predator balances the exploration and exploitation of the search space, and therefore divides the population into two parts, one relying on the large step size of the Brownian motion for a wide range of searches, and the other utilising the smaller step size of the Levy distribution for deeper searches. The mathematical model for this phase is described below:

$$While\ \frac{1}{3} iter_{\max} \le iter < \frac{2}{3} iter_{\max}$$

For the first part of the population, exploitation behaviour is mainly carried out:

$$\boldsymbol{stepsize}_i = \boldsymbol{R}_{\mathrm{L}} \times (\boldsymbol{Elite}\text{-}\boldsymbol{R}_{\mathrm{L}} \times \boldsymbol{Prey}_i) \quad i=1,...,n \quad (15)$$

$$\boldsymbol{Prey}_i = \boldsymbol{Prey}_i + P.\boldsymbol{R} \otimes \boldsymbol{stepsize}_i \quad (16)$$

where $\boldsymbol{R}_{\mathrm{L}}$ is a random vector obeying a Lévy distribution.

For the second part of the population, exploratory behaviour was predominant:

$$\boldsymbol{stepsize}_i = \boldsymbol{R}_{\mathrm{B}} \times (\boldsymbol{R}_{\mathrm{B}} \times \boldsymbol{Elite}\text{-}\boldsymbol{Prey}_i) \quad i=1,...,n \quad (17)$$

$$\boldsymbol{Prey}_i = \boldsymbol{Elite} + P.CF \times \boldsymbol{stepsize}_i \quad (18)$$

$$CF = \left(1\text{-}\frac{\mathrm{iter}}{iter_{\max}}\right)^{2\frac{\mathrm{iter}}{iter_{\max}}} \quad (19)$$

where CF is an adaptive parameter that controls the predator step size.

Exploitation phase: in the final phase of the search, the predator locally exploits the search space, which is mathematically modelled as follows:

$$While\ iter > \frac{2}{3} iter_{\max}$$

$$\boldsymbol{stepsize}_i = \boldsymbol{R}_L \times (\boldsymbol{R}_L \times \boldsymbol{Elite}\text{-}\boldsymbol{Prey}_i) \quad (20)$$

$$\boldsymbol{Prey}_i = \boldsymbol{Elite} + P.CF \times \boldsymbol{stepsize}_i \quad (21)$$

In addition, Fish Aggregating Devices (FADs) are susceptible to being used as food by predators, thus losing the real prey. Therefore to avoid FADs, a larger step size is used for movement. The mathematical model of this behaviour is described below:

$$\boldsymbol{Prey}_i = \begin{cases} \boldsymbol{Prey}_i + CF[\boldsymbol{X}_{\min} + \vec{\boldsymbol{R}} \times (\boldsymbol{X}_{max} \text{-} \boldsymbol{X}_{\min})] \times \boldsymbol{U}, & if\ \ rand \le FADs \\ \boldsymbol{Prey}_i + [FADs(1\text{-}r) + r](\boldsymbol{Prey}_{r1} \text{-} \boldsymbol{Prey}_{r2}), & if\ \ rand > FADs \end{cases} \quad (22)$$

where $FADs = 0.2$, denotes the probability of being affected by FADs, and $\boldsymbol{U}$ is a binary vector including either 0 or 1. When a random vector of 0 to 1 is generated and is less than 0.2, all the vector elements are changed to 0, and vice versa. $\boldsymbol{Prey}_{r1}$ and $\boldsymbol{Prey}_{r2}$ are two randomly selected individuals.

(2) MPA algorithm steps and pseudo-code

According to the optimisation strategy of MPA algorithm, the flowchart of MPA algorithm is shown in Figure 7. During each iteration, an initial solution is randomly generated and the final optimal solution is continuously obtained by evaluation with greedy selection strategy.The optimisation steps of the MPA algorithm are shown below:

Step 1: Initialise the number of MPA populations with the number of iterations;

Step 2: Initialise the MPA population. Initialise the MPA population using the random uniform distribution strategy, calculate the fitness value, or obtain the current optimal value and optimal solution;

Step 3: Based on the number of iterations, the search phase is selected.The MPA algorithm selects the exploratory phase, equilibrium phase and exploitation phase search strategies to update the population location before, during and after the iterations, respectively;

Step 4: Calculate the fitness value and use the selection strategy to select and retain the better solution;

Step 5: Determine whether the number of iterations reaches the maximum number of iterations. If it reaches, output the optimal solution and optimal value; otherwise, return to step 3.

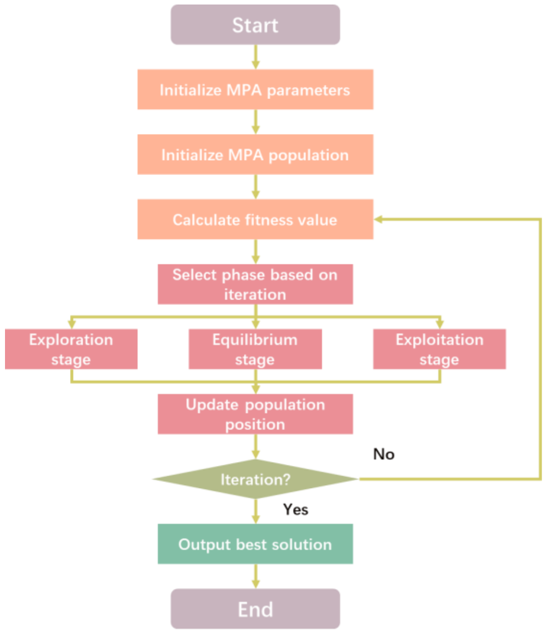

Figure 8 Marine predator algorithm

5. Intelligent detection of university students' health status based on MPA algorithm optimised Attention-GRU network

(1) Decision-making variables

To avoid the optimisation falling into local optimum, which leads to the failure of network training, this paper considers the MPA algorithm instead of the Adma algorithm to obtain the optimal parameters of the network and to achieve the training of the Attention-GRU network.

θ is the parameter matrix, i.e., $[W_{yh}, W_{xi}, W_{hi}, b_i, W_{xf}, W_{hf}, b_f, W_{xc}, W_{hc}, b_c, W_{xo}, W_{ho}, b_o, W, U, V]$, and $W_{yh} \in \mathbb{R}^{m\times q}$, $W_{xi} \in \mathbb{R}^{m\times p}$, $W_{hi} \in \mathbb{R}^{m\times m}$, $b_i \in \mathbb{R}^{m\times 1}$, $W_{xf} \in \mathbb{R}^{m\times p}$, $W_{hf} \in \mathbb{R}^{m\times m}$, $b_f \in \mathbb{R}^{m\times 1}$, $W_{xc} \in \mathbb{R}^{m\times p}$, $W_{hc} \in \mathbb{R}^{m\times m}$, $b_c \in \mathbb{R}^{m\times 1}$, $W_{xo} \in \mathbb{R}^{m\times p}$, $W_{ho} \in \mathbb{R}^{m\times m}$, $b_o \in \mathbb{R}^{m\times 1}$, $W \in \mathbb{R}^{m\times 1}$, $U \in \mathbb{R}^{m\times 1}$, $V \in \mathbb{R}^{m\times 1}$, where m denotes the number of hidden neurons, p i.e., $timestep$, and q denotes the number of steps into the future to be predicted.

(2) Objective function

In order to improve the Attention-GRU training accuracy, the RMSE is used as the objective function of the MPA algorithm and is calculated as follows:

$$\min fitness = \sqrt{\left(\sum_{i=1}^{M}(\hat{y}_i - y_i)^2\right) \Big/ M} \quad (23)$$

(3) Steps and Processes

The portable intelligent terminal APP analysis method applied to college students' physical health monitoring based on the MPA algorithm optimised Attention-GRU network mainly takes the analysis index as input and the APP application analysis value as output, and analyses the mapping relationship between the index and the APP application analysis value. The flowchart of the portable intelligent terminal APP analysis method applied to college students' physical health monitoring based on MPA-Attention-GRU algorithm is shown in Figure 9. The specific steps are as follows:

Step 1: Construct the APP application analysis index system; divide the data set into training set, validation set and test set;

Step 2: Encode the Attention-GRU initial parameters using the MPA algorithm, and also initialise the algorithm parameters such as the population parameters and the number of iterations; initialise the population and calculate the objective function value;

Step 3: Select exploration phase, equilibrium phase, and development phase search strategies to update the location information of MPA populations before, during, and after the iteration;

Step 4: Calculate the fitness function value and update the global optimal solution;

Step 5: Determine whether the termination condition is satisfied, if so, exit the iteration, output the optimal BiLSTM network parameters, and perform step 3, otherwise continue to perform step 6;

Step 6: Decode the optimised Attention-GRU parameters based on the MPA algorithm, obtain the optimal Attention-GRU network parameters, and construct the portable intelligent terminal APP application analysis model based on MPA-Attention-GRU;

Step 7: Use the trained portable intelligent terminal APP application analysis model to perform usage analysis on the current test set and output the corresponding analysis results.

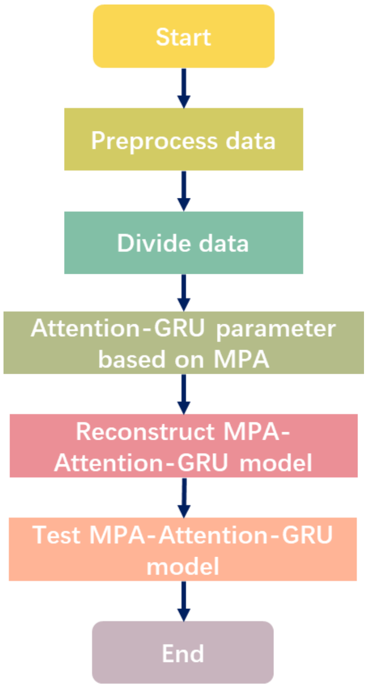

Figure 9 Portable Smart Terminal APP Application Analysis based on MPA-Attention-GRU algorithm

6. Experiments and analysis of results

In order to verify the advantages and disadvantages of the APP application analysis method proposed in this paper, three analysis methods are selected for comparison, and the specific parameters of each algorithm are set as in Table 1.The experimental simulation environment is Windows 10, with a CPU of 2.80GHz, 8GB of RAM, and the programming language Matlab2019a.

Table 1 Parameter settings of the analysis methods used by APP

arithmetic	parameterisation
GRU	The number of hidden layer nodes of GRU network is 50 and Adam optimisation adjusts the weights
Attention-GRU	Attention-GRU network with 50 hidden layer nodes and Adam optimisation to adjust the weights
MPA-GRU	The number of nodes in the hidden layer of the GRU network is 50 and the MPA algorithm optimally adjusts the weights
MPA-Attention-GRU	The number of nodes in the hidden layer of the Attention-GRU network is 50, the MPA algorithm optimally adjusts the weights, and the MPA algorithm population is given by Section 6.2

6.1. Introduction to data

The dataset is mainly derived from the portable smart terminal APP network platform data, APP using basic information management module through the Internet of Things, cloud computing, etc. to collect the gymnasium, physical fitness data testing, physical education course results and other physical activity data.

The dataset is normalised using normalisation process to standardise the data and it is divided into training set, validation set, and test set with a division ratio of 7:1:2.

6.2. Parameter impact analysis

In order to analyse the impact of the population size of MPA algorithm on the portable smart terminal APP application analysis method for college students' health status monitoring, this paper compares and analyses the performance of the portable smart terminal APP application analysis method for college students' health status monitoring under different population size conditions. Figure 10 and Figure 11 give the results of the impact of different population sizes on the prediction accuracy and time of the portable smart terminal APP application analysis method for college students' health status monitoring.

From Figure 10, it can be seen that as the number of MPA algorithm populations increases, the prediction accuracy of the portable smart terminal APP application analysis method for college students' health status monitoring also gradually increases. From Figure 11, it can be seen that as the number of MPA optimisation algorithm populations increases, the prediction time of the portable smart terminal APP application analysis method for college students' health status monitoring also increases gradually. In summary, the population size of the intelligent optimisation algorithm selected in this paper is 60.

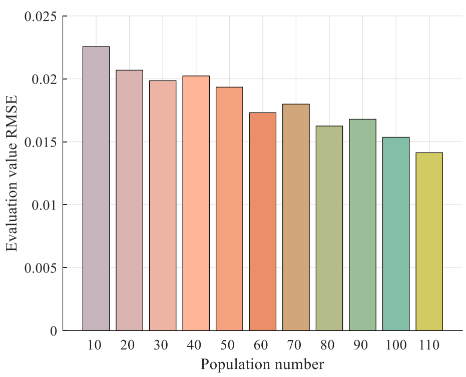

Figure 10 Different population sizes on the precision of analyses

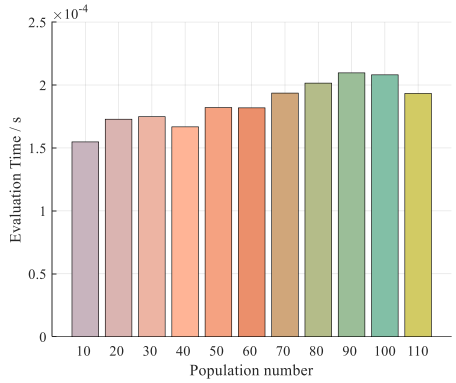

Figure 11 Different population sizes on analysis time

6.3. Effectiveness analysis

In order to verify the effectiveness of the portable intelligent terminal APP application analysis method for college students' health status monitoring based on MPA-Attention-GRU algorithm, the portable intelligent terminal APP application analysis method for college students' health status monitoring based on MPA-Attention-GRU algorithm is compared with the portable intelligent terminal APP application analysis method based on MPA-GRU, Attention-GRU and GRU. GRU, GRU, GRU based portable intelligent terminal APP application analysis method for college students' health status monitoring is compared, and the performance results of each model are shown in Figures 12 and 13.

Figures 12 and 13 give the predicted value and relative error results of portable smart terminal APP application analysis for college students' health status monitoring based on each algorithm, respectively. From Figure 12, it can be seen that the predicted value of portable intelligent terminal APP application analysis method for college students' health status monitoring based on the MPA-Attention-GRU algorithm is the closest to the true value, followed by MAP-GRU, Attention-GRU and GRU. from Figure 13, it can be seen that the predicted relative error of the Portable Smart Terminal APP application analysis method for college students' health status monitoring predicts the smallest relative error, which is controlled within the range of 0.02.

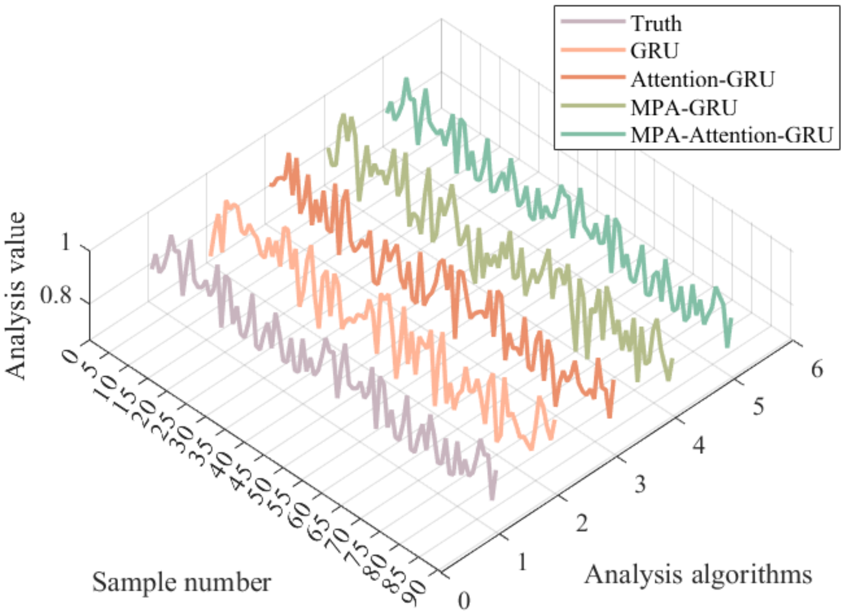

Figure 12 Prediction results of portable smart terminal APP application analysis method for college students' health status monitoring based on each algorithm

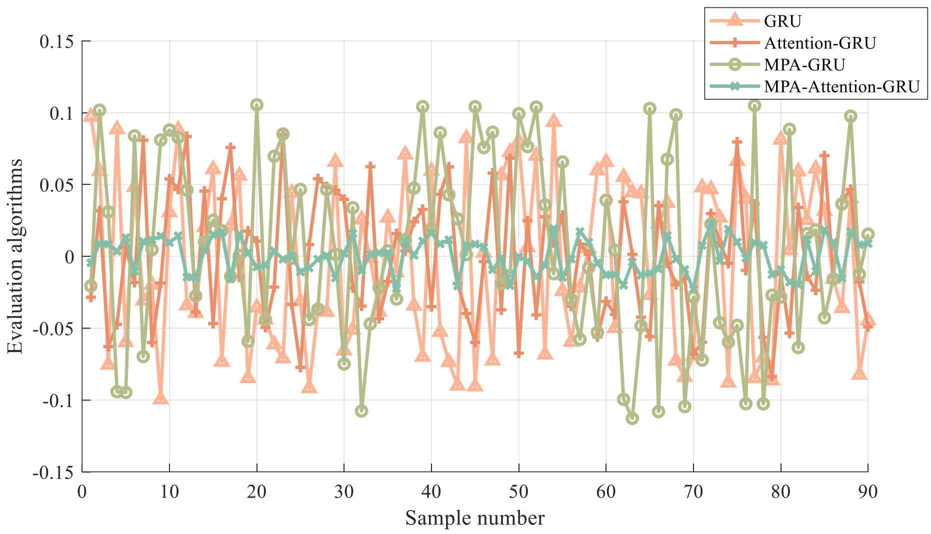

Figure 13 Relative error results of the prediction of the portable smart terminal APP application analysis method based on each algorithm for college students' health status monitoring

6.4. Robustness analysis

In order to verify the superiority and robustness of the portable smart terminal APP application analysis method based on MPA-Attention-GRU algorithm for college students' health status monitoring, the analysis and prediction performance of each algorithm will be compared under different working conditions, and the performance results of each model are shown in Figs. 14, 15 and 16.

The RMSE, MAE, and predicted elapsed time results of portable smart terminal APP application analysis methods based on each algorithm under different working conditions are given in Figs. 14, 15, and 16, respectively. From Figure 14, it can be seen that the RMSE ranking of each algorithm under different working conditions is MPE-Attention-GRU, Attention-GRU, GRU, and MPA-GRU in order. from Figure 15, it can be seen that the MAE ranking of each algorithm under different working conditions is MPE-Attention-GRU, Attention-GRU, GRU From Figure 16, it can be seen that the ranking of the prediction time consuming of each algorithm under different working conditions is MPE-Attention-GRU, MPA-GRU, Attention-GRU, GRU in order.To sum up, the portable intelligent terminal APP application for college students' health status monitoring based on MPA-Attention-GRU algorithm has better prediction accuracy than other algorithms. analysis method has better prediction accuracy than other algorithms and the real-time performance is the best.

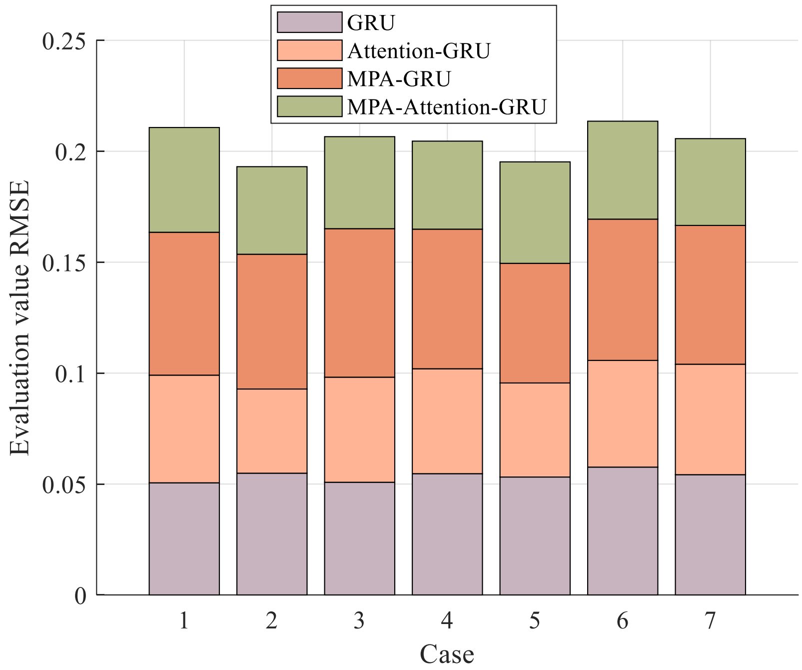

Figure 14 RMSE results of portable smart terminal APP application analysis methods based on each algorithm under different working conditions

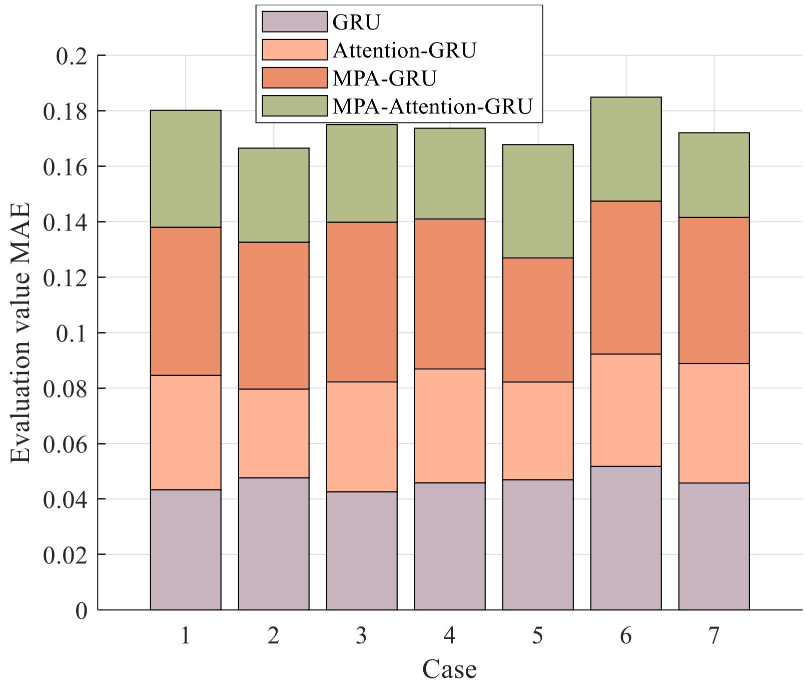

Figure 15 MAE results of portable smart terminal APP application analysis methods based on each algorithm under different working conditions

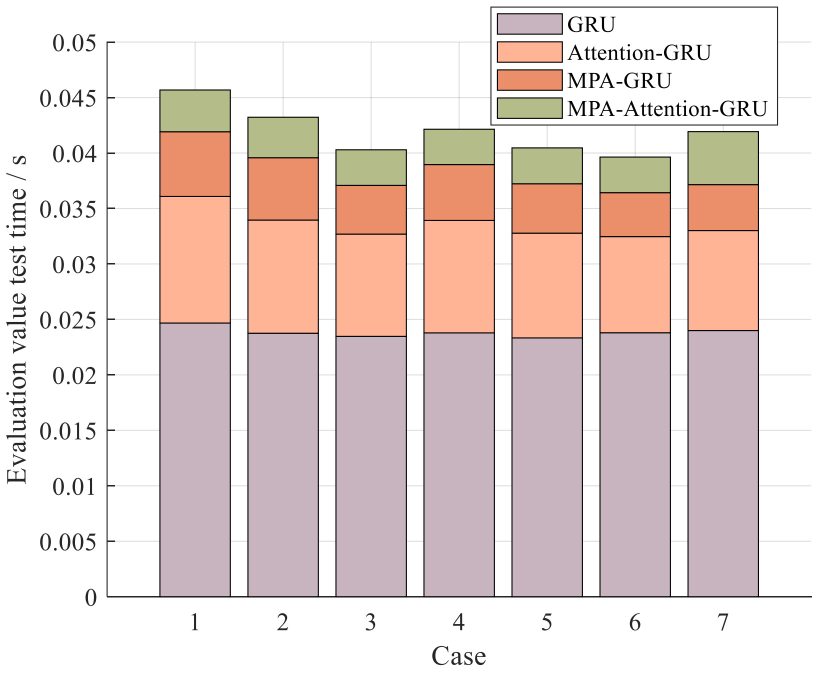

Figure 16 Predicted time-consuming results of portable intelligent terminal APP application analysis methods based on each algorithm under different working conditions

7. Conclusion

This paper studies the portable intelligent terminal APP application analysis problem for college students' health status monitoring, extracts the portable intelligent terminal APP analysis feature vector applied to college students' physical health monitoring through the basic function framework of portable intelligent terminal APP, and constructs the portable intelligent terminal APP analysis index system for college students' physical health monitoring. In order to construct the mapping relationship between portable intelligent terminal APP analysis feature vectors and indicator analysis values, combining the marine predator algorithm and the gated recurrent unit network based on the attention mechanism, a portable intelligent terminal APP application analysis method based on the MPA-Attention-GRU algorithm for college students' health status monitoring is proposed. The user data of the portable intelligent terminal APP platform are used to compare the prediction performance of the MPA-Attention-GRU model with the MPA-GRU, Attention-GRU, and GRU algorithms. Simulation and analysis results show that compared with the unimproved analysis model, the method proposed in this paper can significantly improve the portable smart terminal APP application analysis accuracy and prediction time. The portable intelligent terminal APP application analysis method in this paper does not consider the feature index extraction dimensionality reduction, and in the future, we can consider the research on the dimensionality reduction of the feature vectors of the portable intelligent terminal APP analysis on this basis, so as to make the APP application analysis accuracy higher and the prediction time shorter.

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