Hindawi
Scientific Programming
Volume 2022, Article ID 9669689, 10 pages
https://doi.org/10.1155/2022/9669689

*Research Article*

# A Chaotic Fish Swarm Algorithm-Based Model for Assessing the Mental Health Status of Older Adults

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Received 23 December 2021; Revised 28 February 2022; Accepted 1 March 2022; Published 8 April 2022

Academic Editor: Sheng Bin



In this paper, the chaotic fish swarm algorithm is used to conduct in-depth research and analysis on the assessment of the mental health of the elderly. Firstly, the principle, search method, and characteristics of the harmonic search algorithm are analysed, and it is proposed to use the excellent local fine-tuning ability of the harmonic search algorithm to improve the local search accuracy of the artificial fish swarm algorithm. Then, the concept of chaos factor is introduced to improve the global search of the artificial fish swarm algorithm efficiency, using its global search capability without repeated traversal to form a new hybrid fish swarm algorithm. The comparison of experimental results shows that the improved algorithm can effectively guide the robot to avoid obstacles and quickly find the best path or a better path. The improved hybrid algorithm is more efficient and reliable than other algorithms in path planning and can handle more a complex environment model. When considering sample selection bias, ordinary least squares (OLS) regression may underestimate the extent to which social participation affects the mental health of older adults. Further research found that there is heterogeneity in the influence of social participation on the mental health of the elderly. In addition, different types of social participation have different effects on the mental health of the elderly. Simply making friends, physical exercise, and recreational participation in social activities can significantly improve the mental health of the elderly. The improvement is the strongest.

## 1. Introduction

Methods such as self-rating scales, hormone measurements, and physiological parameters are the most used methods available for mood assessment. Mood changes usually affect different physiological systems of the body, which leads to changes in physiological parameters. Since the effect of emotional changes on physiological systems are objective and plausible, the emotional changes within can be better understood by monitoring the changes in physiological parameters [1]. A more objective and scientific approach to accurately understand the emotional changes in an individual can help to a certain extent in the prevention as well as diagnosis of related psychological disorders [2]. Thus, the development of emotion recognition techniques is of great importance in preventing the development of diseases and maintaining physical and mental health.

OLS regression estimates are biased if there is reverse causality in the mental health of socially engaged older adults, so to make an accurate assessment of the causality of depression levels in socially engaged older adults, we need to know how depressed an older adult is in both states of socially engaged nonparticipation, but cross-sectional surveys can only obtain data in one state [3]. Therefore, this paper uses propensity score matching methods for counterfactual causal identification of the research question. Respondents were divided into an “intervention group” and a “control group,” with the “intervention group” being socially engaged and the control group. There is uncertainty and subjectivity, so a scientifically objective way of diagnosing and evaluating this problem is needed. The propensity score matching model identifies differences in depression between the two groups by matching socially engaged older adults with another group of older adults who share the same characteristics but are not socially engaged; that is, the "intervention group" and the "control group" are not socially engaged [4]. The impact effect of social engagement was assessed by comparing the difference in depression levels between the intervention and control groups after matching [5].

The rapid development of today's sensor technology has been able to achieve portable and noninvasive collection of various physiological information of the human body, which is undoubtedly a great help to the study of physiological information emotion recognition, but also makes its application areas more extensive. In life, people are under various external pressures for a long time, which often leads to physiologically or psychologically unhealthy, accurate analysis of emotional changes and gives reminders, to a certain extent, can achieve the purpose of emotional management and prevention of mental diseases. In the commercial field, online sales and shopping on the Internet have become the mainstream marketing model, and combining physiological information emotion recognition with a product recommendation framework can better match consumers' willingness to choose and promote commercial development.

## 2. Related Work

A new cluster rewriting method is proposed based on incremental solution algorithm and the mapping of 3D graphical element constraints to point constraints, which can well solve the rigid and nonrigid clusters in 3D geometric constraint systems [6]. A 3D modelling tool is given that feeds geometric constraints to the user in multiple forms and can help the user define geometric constraints and create correct 3D models. The use of geometric knowledge is proposed to solve the homogeneous method applied to 3D geometric constraint systems, through which geometric knowledge can prove the correctness of the solution and lead the search for new solutions [7]. A simple and effective random geometry generator is presented which can produce any possible geometric model, which can be either a strongly or weakly decomposed graph. A complex geometric constraint system is first reduced, then the reduced graph is solved using a recombination algorithm, and finally, the final solution of this geometric constraint problem is obtained by combining the solutions of the reduced constraint system [8].

Although existing research has achieved high classification accuracy, it is more by enabling an increase in the number of physiological signal channels, which in turn increases the number of features of the extracted signals, thus improving the final classification accuracy [9]. It cannot be overlooked that with the increase in signals, the difficulty of signal acquisition continues to increase and the computational efficiency decreases, leading to an increase in computational complexity and thus making it difficult to apply to the research and development of portable or wearable devices [10]. These ultimately make some impact on the real-time and portability of emotion recognition as well as sleep staging [11]. Therefore, it is possible to better understand the emotional changes in the heart by monitoring changes in physiological parameters. Through more objective and scientific methods, accurate understanding of personal emotional changes can help prevent and diagnose related mental diseases to a certain extent. In this thesis, by using the physiological signals of the internationally recognized emotion dataset as well as the physiological signals of sleep staging, the key features of the signals are extracted and combined into a feature set by using a smaller number of signal channels, and by filtering the feature set, machine learning algorithms are used to achieve a high classification accuracy [12]. The relationship between elderly people's living style and their mental health was investigated using a multilayer linear model to come and the results showed that older people living alone had higher levels of depression and those living with their children had the lowest levels of depression [13]. The study showed that coresidence of parents and children can improve the mental health of the elderly. Using the widowed elderly as the study population, the study showed that the living style of the widowed elderly was closely related to their mental health, with social support factors playing a mediating role [14].

Through a review of the literature related to social participation in older people's mental health, this type of research has been a hot spot in academic research and has achieved a wealth of research results, but there is still room for improvement and expansion in terms of content and methodology, so this paper tries to add to the existing research results. Given this, this paper, based on the study of the impact of social participation on the mental health of the elderly, classifies social participation activities into five major types: simple friendship type, public welfare participation type, exercise type, association participation type, and recreational participation type, which can compare the heterogeneous impact of each type of social participation on the mental health of the elderly in a more comprehensive way.

## 3. Analysis of the Chaotic Fish Swarm Algorithm Mental Health State Assessment Model for Older Adults

*3.1. Chaotic Fish Swarm Algorithm Design.* The schooling behaviour of fish is natural and is used to maintain survival rates when the school encounters predators or when the fish are feeding. Each artificial fish follows its internal behavioural guidelines: firstly, it tries to move to the centre of the school that is as close as possible; secondly, it avoids crowding. In turn, the phenomenon of group aggregation is synthesized from the mutual behaviour of individuals [15]. It is important to note that fish aggregation behaviour does not require a leader. Suppose the artificial fish has a real-time state $X_i$, search for the number of companions and their central location $X_c$ within the current domain, and if the concentration of the central location of the partners is high and not very crowded $Y_c/\eta_f \leq \delta Y_i$, it represents a higher adaptation at $X_c$, moves one step forward towards its centre, and the fish gathers towards the state $X_c$; otherwise, it continues to perform the foraging behaviour. The mathematical expression for the central location $X_c$ is

$$X_c = \frac{\sum_{i=1}^{n_f} X_i}{n_f^2}. \tag{1}$$

The movement towards $X_c$ can be expressed by

$$x_i = x_j - \text{rand}\,(\,) \cdot \text{Step} \cdot \frac{x_c + x_i}{\left|x_c - x_i\right|}. \tag{2}$$

When a school of fish moves, if a small group of individuals finds food, other individuals in the vicinity follow them towards the food, and this behaviour is called tail-chasing behaviour. Assume that the artificial fish has a real-time state of $X_i$, search for the number of fish in the current field of view $n_f^2$, and find $X_{\max}$ within which $Y_c$ is the maximum value. If the food concentration at the small partner $X_{\max}$ is higher and less crowded than the previous one, it moves one step towards $X_{\max}$ and vice versa to adopt the foraging behaviour. The movement towards $X_{\max}$ can be expressed by

$$x_j = x_i - \text{rand}\,(10) \cdot \text{Step} \cdot \frac{x_c - x_j}{\left|x_c + x_j\right|}. \tag{3}$$

The above equation is the position vector of offspring produced by the $i$th individual of the $j$th generation.

After the maximum number of foraging behaviours of the fish is reached, if there is no change in the adaptation, a random behaviour is executed. It can be specifically described as taking a random state within the field of view of the artificial fish as the next target state. This behaviour solves the problem of the artificial fish being trapped in a local optimum and facilitates the search for a globally optimum solution. The behaviour can be expressed by

$$x_j = x_i - \text{rand}\,(10) \cdot \text{visual} \cdot \text{Step} \cdot \frac{x_c - x_j}{\left|x_c + x_j\right|}. \tag{4}$$

The artificial fish swarming algorithm was created based on research on the behaviour of biological fish groups. Concerning group collaboration, each artificial fish will actively gather towards the centre of the school or follow individuals with higher fitness than itself when feeding, a behaviour known as the clustering effect. To a certain extent, the purpose of emotional management and prevention of mental illness can be achieved. In medical treatment, doctors can understand the emotional changes of patients with language barriers, physical disorders, and mental illnesses through physiological characteristics, to formulate more targeted treatment plans and rehabilitation training plans. The rest of the artificial fish will also follow the better individual or gather towards the centre of the group, and each artificial fish in the algorithm is like the biological fish in the school to collaborate and learn.

The solution of the artificial fish swarming algorithm depends on the centre of the fish population in the extreme value neighbourhood, and this centre varies depending on the fish behaviour, with the possibility of missing the optimal solution at the end of the iteration [16]. Therefore, the concept of the bulletin board is introduced to record the optimal state of the artificial fish. In the process of searching for the optimal, the artificial fish then evaluates its fitness and compares it with the historical optimal value on the bulletin board every time it completes the search and determines whether the bulletin board needs to be updated, and if the condition is not satisfied, the original state of the bulletin board is maintained.

In a population of organisms, individuals that can adapt quickly to their environment have a higher degree of adaptation and a higher survival rate compared to other individuals. Individuals with low adaptability are unable to adapt quickly to their environment and are gradually replaced and discarded in the evolutionary process. Based on the evolutionary theory, the group with higher adaptability in the artificial fish population is called the elite fish population, which contains the effective artificial fish individuals, and the internal relationship is shown in Figure 1. A culling strategy is used to eliminate the less adapted individuals in the population, and certain cloning rules are used to replicate the elite population and produce new individuals to ensure the dynamic balance of the initial population. This system can be referred to as the elite retention and inferior culling strategy, hereafter referred to as the elite fish population strategy.

In the process of finding the best artificial fish, for each completed iteration, the updated artificial fish individuals are ranked in descending order of fitness. According to the strategy followed, the population with low fitness is eliminated, while the elite population with the highest fitness value is cloned according to the set cloning ratio. After this operation, both the fitness level of the population can be increased and the dynamic balance of the population size can be maintained; the rules for calculating the evolutionary idea are shown in the following equation.

$$X_{c,i,j} = X_{p,i,j} - r \cdot n_1^2. \tag{5}$$

The above equation is the position vector of offspring produced by the $i$ individual of the $j$ generation, where $i = 1, 2, \ldots, N_{\text{ap}}$ and $l = 1, 2, \ldots, N_{ac}$; $N_{ap}$ and $N_{ac}$ are the total number of parents and offspring involved in cloning, respectively, $r$ is the cloning coefficient; ln is a Gaussian distributed random number with mean 0; and $X_{c,i,j}$ and $X_{p,i,j}$ are the vector of parents and the vector of offspring involved in cloning, respectively. To maintain the dynamic balance and diversity of the fish population, the stock elimination needs to be accompanied by dynamic replenishment of new stocks and to ensure the effectiveness of the new born stock, a new criterion for calculating the clonality coefficient is used.

$$r^* = \left(1 - \frac{e_{\text{ij}}}{e_{j\_\max}^2}\right) \times \frac{r}{{}^{1+ln}\sqrt[j]{J}}. \tag{6}$$

Chaos refers to an unpredictable, irreducible, and indeterminable trajectory of motion that is often exhibited in a system. In nonlinear dynamical systems, it manifests a peculiar state of stable evolution. Chaos is widely present in

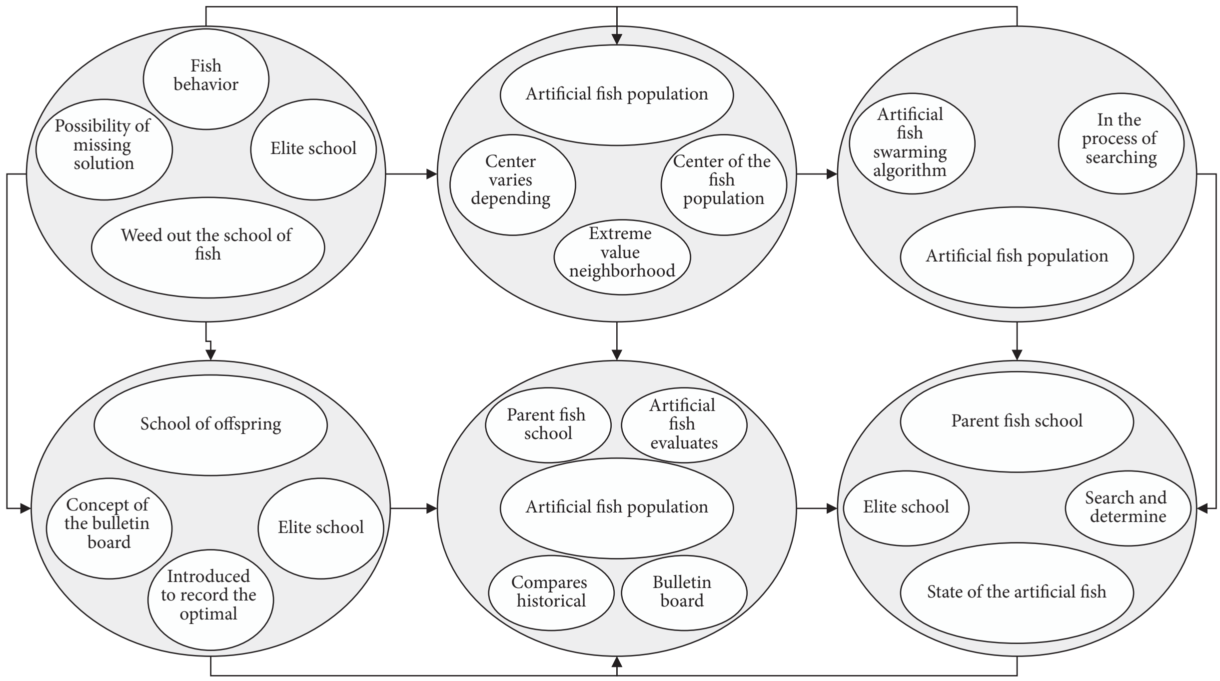


Figure 1: Schematic diagram of the phase-out and retention mechanism.

natural phenomena and complex motions that appear disordered but are ordered. Such as the rising smoke, the flowing streams, the flags flying in the wind, the clouds floating in the air, the unpredictable weather, and even the fluctuations of the rapidly growing population and national economy are some chaotic phenomena that seem to have no rules on the surface but have internal laws of motion. Randomness and sensitivity to initial values are properties of chaos, and this property gives it a wide range of applications in the field of artificial intelligence and cryptography [17].

Introduce the concept of bulletin board to record the optimal state of artificial fish. In the optimization process, every time the artificial fish completes a search, it evaluates its own fitness and compares it with the historical optimal value on the bulletin board to determine whether the bulletin board needs to be updated. Even if some small changes occur in the initial state, the chaotic system may expand it continuously and have a great impact on its final state. Since the trajectory of chaotic phenomena in chaotic systems is very sensitive and unstable to the initial state, it is impossible to predict the entire trajectory of chaotic phenomena accurately. From the beginning to the end of the chaotic phenomenon, the trajectory of the chaotic phenomenon will go through a long process, and if a parameter changes during the process, the trajectory will also change, as shown in Figure 2.

In AFSA, if the search range is large, there may still be a portion of artificial fish located in areas with very low food concentration, and allowing these artificial fish to continue to iterate is of little significance to the algorithm's optimality-seeking results. To enhance the evolution and survival of the population, the artificial fish with very low food concentration is treated by elimination and rebirth, and after each iteration of the fish population

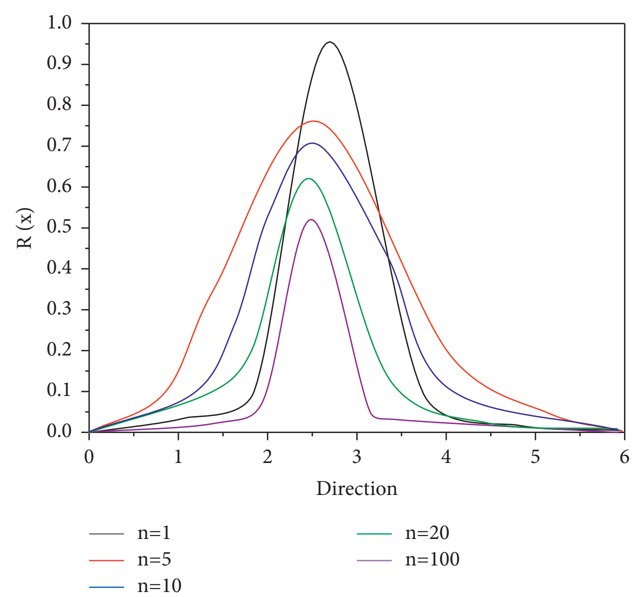


Figure 2: $t$-distribution curve.

algorithm, a food concentration threshold $s > 0$ determined by the current number of iterations and the optimal food concentration value under the current number of iterations is defined, and then the artificial fish whose food concentration value does not satisfy the threshold are superiorly executed, while the number of artificial fish recorded on the bulletin board is the same as that are generated at the location, and the adaptive $t$-distribution mutation operation is executed for the newborn artificial fish as in equation (7), $Z \sim t(G)$ with the degree of freedom of the current number of iterations $G$.

$$X_i = X_i(1 - Z), \quad (7)$$

$$f_z(x) = \frac{\Gamma(G+1)/2}{\sqrt{\pi G}\Gamma(G/2)}\left(1 - \frac{x_i^2}{G}\right). \quad (8)$$

The probability density function of $Z$ is shown in (8), and the shape of the $t$-distribution curve has a certain correspondence with the degrees of freedom as a gamma function. At the early stage of the algorithm, the number of iterations $G$ is relatively small, the shape of the $t$-distribution curve is flat, the middle is slightly lower and the sides are elevated, the variation step is larger, and the reborn artificial fish is located in the farther range of the optimal fish, which is conducive to the comprehensive search of the whole range in the early stage; at the later stage of the algorithm, the number of iterations $G$ is larger, the middle part is elevated, and the tails on both sides tend to be 0, which is the variation step is smaller, and the reborn artificial fish are located near the optimal fish. The artificial fish keep pursuing better solutions; at the middle process of the algorithm, the $t$-distribution can be self-adjusted according to the number of iterations so that the reborn artificial fish are located at the proper position. Different types of kernel functions can be combined to generate new hybrid kernel functions, which can obtain different classification effects.

The Gaussian radial basis kernel function is one of the kernel functions with the widest applicability, not only because it can adapt to various dimensional and sample size requirements, but also because its convergence range is relatively wide, and good performance metrics and excellent generalization can be obtained by using the Gaussian radial basis kernel function on SVM and TWSVM.

$$K\left(x_i, x_j\right) = \tanh\left(v\left(x \cdot x_j\right) - c\right). \quad (9)$$

The psychological community has never stopped discussing the definition of emotions, and the criteria for classifying emotions have become a point of debate among scholars. Some of the more recognized theories of emotion classification are the basic emotion theory and the dimensional spatial emotion theory [18]. The basic emotion theory holds that emotions have archetypal forms in their occurrence; that is, there are several pan-human basic emotion types. Each type in the basic emotion theory has its unique experiential properties, physiological arousal patterns, and epiphenomenal patterns, and their different combinations with all human emotions.

Dimensional spatial emotion theory attempts to describe emotions in a continuous space; the core idea is to distribute emotions in a dimensional space and view changes in emotions as continuous changes in dimensions; common emotion dimensions are two-dimensional emotion space and three-dimensional emotion space. The two-dimensional emotion space includes two dimensions: valence and arousal. Valence refers to the positive and negative degree of emotion, and arousal represents the intensity of emotion characterized by the individual. The three-dimensional emotion space has an additional dimension of dominance compared to the two-dimensional emotion space, which represents the individual's ability to control. The two-dimensional emotion model is highly discriminative and the model is also well suited to the neurological level; the three-dimensional emotion model is also operationalized by identifying certain emotions in space in a numerical pattern when they cannot be explicitly named.

*3.2. Model Design for Assessing the Mental Health Status of Older People.* Propensity score matching (PSM) is a method for assessing causal effects using nonexperimental data. Its advantage is that multiple dimensions of a covariate are downscaled and reduced to a one-dimensional score, which is then matched using the one-dimensional score. For our study population, everyone can only be in one intervention state, and propensity score matching is used to compare and estimate the treatment effect using the individual's counterfactual state with the intervention object. For the member in the intervention state, the counterfactual is the potential outcome of being in the control state, and for the member in the control state, the counterfactual is the potential outcome of being in the intervention state. The potential outcomes here are virtual and do not occur. In a chaotic system, the trajectory of the chaotic phenomenon is very sensitive to the initial state and is extremely unstable, which leads to the inability to accurately predict the entire trajectory of the chaotic phenomenon. Simply put, propensity score matching is the process of calculating the probability of entering the intervention state for each sample, matching the intervention and control groups based on the same or similar propensity values, and obtaining the treatment effect by comparing the differences in the outcome variables between the two sample groups.

The data in the database are grouped into physiological information categories (ECG, SC, and RSP), and the four chaotic characteristic parameters of complexity, box dimension, approximate entropy, and information entropy are obtained for different emotional states, respectively, and the values of the characteristic parameters of the three different physiological information obtained are saved in three Excel table files named ECG-Data, SC-Data, and RSP- Data so that there are 300 data in each file, 100 for each emotion, and the data storage format is shown in Figure 3.

That is, for the three physiological pieces of information of ECG, ECG, and respiration, the respective chaotic characteristic parameter values do not show a very obvious phase-stratified distribution under different emotional states, indicating that it is not possible to classify the three emotions through simple numerical distributions, and thus fail to achieve the purpose of emotion recognition. This result also further corroborates the chaotic nature of human emotions, where the expression of physiological information under different emotions cannot be classified and identified by simple interval division.

By comparing the peripheral physiological signals such as respiratory signal and body temperature signal in the dataset, it is found that the PPG signal in the dataset has the best overall quality, relatively low noise, and simple feature extraction [19]. Therefore, the PPG signals from the

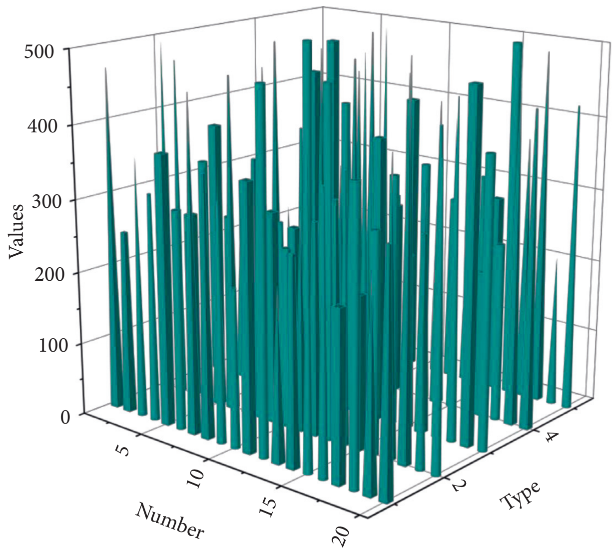


Figure 3: ECG feature parameter data storage format.

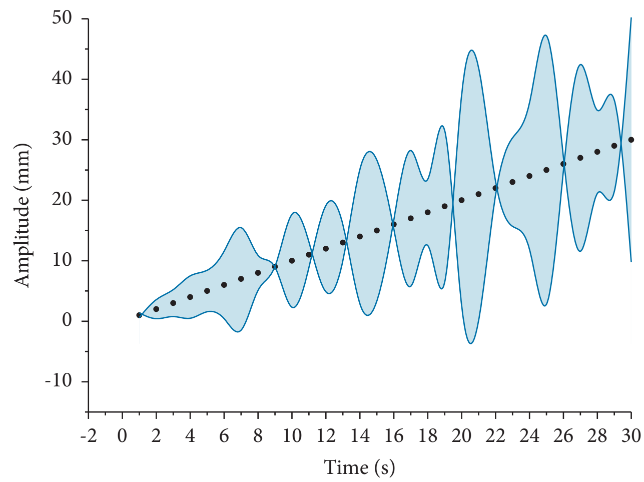


Figure 4: Standard respiratory signal waveform diagram.

peripheral physiological signals were selected for further study in this paper. In the comparison of the PPG signals in the dataset, there are 32 files in the python packet of the DEAP emotion dataset, because the signal quality between the first 23 folders of the PPG signals and the last 9 files is large, and there is too much noise interference in the last 9 packets, resulting in no obvious signal waveform, and finally the time domain features of the PPG signals cannot be extracted from them. Therefore, the first 23 packets are finally selected as the original signals in this paper.

The exchange of gases between the human body and the outside world is an important physiological process that ensures that all physiological functions of the human body are normal, and humans achieve the exchange of gases between the internal homeostasis and the external environment through respiration. During each respiration process, the human thorax rises and falls regularly in response to the inhalation and exhalation processes. These regular undulations are mapped and recorded in medicine to obtain the respiratory signal of the human body, and the standard respiratory signal waveform is shown in Figure 4.

The respiratory cycle of a person consists of two phases: the inspiratory phase and the expiratory phase, and the number of gas exchanges per unit time is called the respiratory rate, and the rise and fall of the chest cavity during the gas exchange is called the respiratory amplitude. The respiratory rate of a normal person ranges from 0 to 0.35 Hz, and the duration of each gas exchange in a normal adult is 3 to 4 s. The $t$-distribution can adjust itself according to the number of iterations so that the artificial fish is in the right position after rebirth. Different types of kernel functions can be combined with each other to generate new mixed kernel functions to obtain different classification effects. The respiratory rate of a normal adult is 16 to 20 breaths per minute.

The raw respiratory signals and recordings acquired by existing thoracic or patch devices are subject to different noise interferences such as EMG, baseline drift, noise at the electrode contact, and industrial frequency interference of the instrument, like the ECG signals mentioned above [20]. Therefore, some preprocessing of the obtained raw signal is required before the signal is analysed and processed to weaken the effect of noise on the accurate extraction of the valley and peak points of the final signal.

The raw PPG signal waveform obtained from the medical acquisition device is disturbed by the possible presence of baseline drift and other noise. If the signal is not preprocessed such as filtering, it will affect the quality of the signal and will eventually interfere with the feature extraction. The main interference of the PPG signal acquisition in the dataset comes from baseline drift, industrial frequency interference, and high-frequency noise. Baseline drift in the PPG signal is mainly due to the influence of some other external light sources when the photoelectric sensor acquires the signal, which leads to upward or downward fluctuations in the obtained PPG signal, which is not conducive to the next step of signal processing.

## 4. Results and Analysis

*4.1. Analysis of Algorithm Performance Results.* In the experiment, 70% of the samples were selected as the training set and the remaining 30% were used as the test set.

Since the results obtained by the heuristic algorithm may not be identical for each run cycle, each algorithm was run five times and the parameter combination corresponding to the best fitness value from the results of the five runs was taken as the final parameters, followed by using the full training set for constructing the parameter-optimized TWSVM model and testing the remaining 30% of the data. Figure 5 gives the parameter-seeking convergence process curves for the optimal IAFSA-TWSVM over five runs of the six data sets.

Figure 5 shows the comparison results of classification accuracy and average parameter finding time for the test sets of the eight algorithms; the actual numerical ratios are listed in parentheses, where we can see that the proposed IAFSA-TWSVM has the best classification accuracy and the shortest

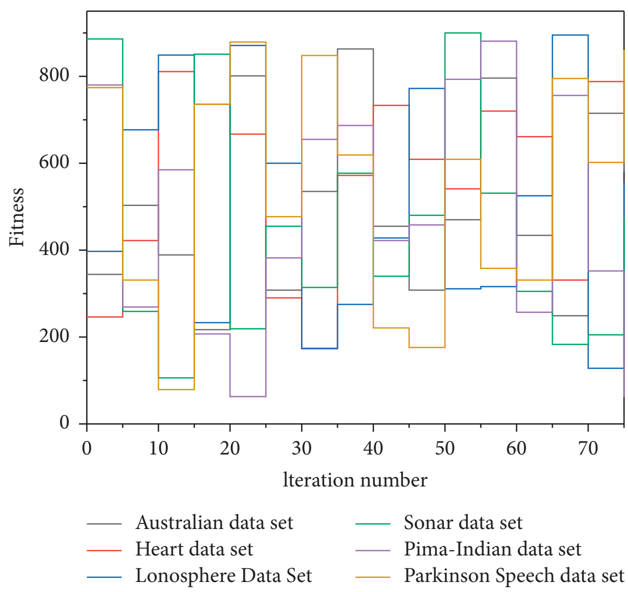


Figure 5: IAFSA-TWSVM parameter finding process curves on different data sets.

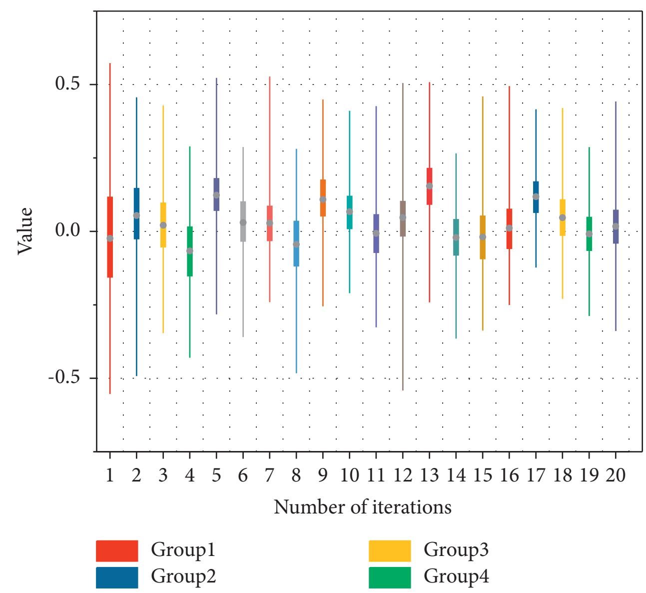


Figure 6: Comparison of four sets of data under different number of iterations.

parameter finding time among the eight algorithms for all six test datasets. This is because the improved AFSA has significantly improved the optimization-seeking ability, which can quickly jump out of the local optimal solution to approximate the global optimal solution of the parameters, thus reducing the parameter-seeking time and improving the classification accuracy of the TWSVM.

A change in the cloning coefficient of an individual artificial fish affects the accuracy of the solution but hardly affects the algorithm execution time. Compared with the two-dimensional emotional space, the three-dimensional emotional space adds the dimension of dominance, which represents the individual's control ability. The emotion model in the two-dimensional space is highly recognizable, and the model is also very suitable for the nervous system level; the emotion model in the three-dimensional space can also identify some emotions in a number pattern in the space when they cannot be clearly named, strong operability. If the cloning coefficient of the individual artificial fish is increased, the accuracy of the global optimal solution is increased accordingly. When the cloning ratio increases to a certain level, the algorithm remains stable, and the global optimal solution accuracy and stability cannot continue to improve. Since the efficiency of cloning will no longer improve if the number of cloned artificial fish exceeds the number of its parent elite population during the iteration, as the parent of the clone contains a nonelite population, there is also a possibility that it may hurt the execution of the algorithm. Thus, when the cloning factor grows within a certain range, it will improve the performance of the algorithm.

Four different clone coefficient parameters are used to test the function, respectively, except for the different clone coefficients other parameters are the same; compare the effect of different clone coefficients on the performance of the algorithm, take the function weights, experimental average time as the result. Figure 6 shows the comparison of the path length and experimental average time of the search under a different number of iterations.

The artificial fish swarm algorithm has the global search ability with fast early search speed, but it is easy to be premature and cannot give the optimal value precisely; the harmonic search algorithm has outstanding local searchability, diverse harmonic library, and is very suitable for integration with other algorithms. To address the problems of the original artificial fish swarm algorithm, such as the scattering of fish individuals and affecting the global search accuracy, an elite strategy is introduced, the concept of the elite fish swarm is proposed, and a cloning and elimination system is developed to form a new algorithm based on the idea of biological evolution. The elimination and retention mechanism in this strategy improves the performance of the fish population algorithm by eliminating inferior individuals and cloning elite individuals. However, the cloning mechanism tends to cause homogenization of the population, which makes it difficult for the fish population to jump out of the local optimum.

A new hybrid algorithm is formed by introducing a chaos factor and a harmonic search algorithm into the original artificial fish population algorithm, adding two new behaviours of chaos search and harmonic search. The nonrepetitive global traversal capability of the chaotic factor is used to build a fish memory for the artificial fish population, and the small-scale fine-tuning capability of the harmonic algorithm is used to improve the local merit-seeking capability of the hybrid algorithm. Therefore, the parameter optimization time is shortened and the classification accuracy of TWSVM is improved. The HS algorithm, the AFSA algorithm, and the new HAFSA algorithm are analysed by three functions, and the results conclude that the new hybrid algorithm has better global convergence and better local merit-seeking

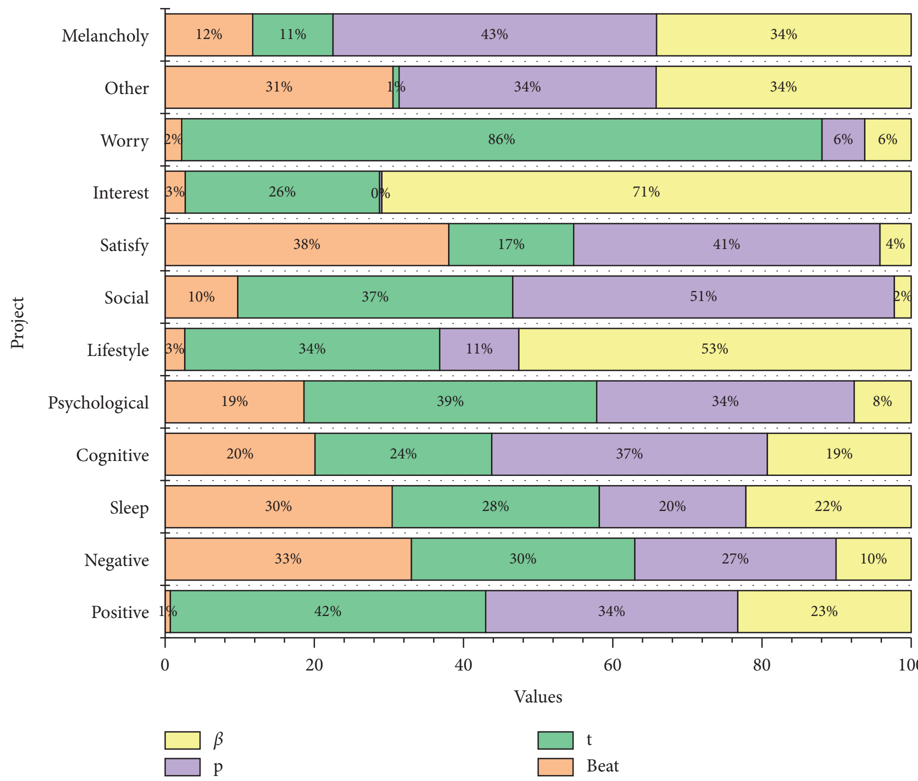


Figure 7: Multiple stepwise regression analysis of psychological resilience of elderly patients with chronic diseases.

ability, and the algorithm efficiency and accuracy are improved.

*4.2. Results of the Analysis of the Mental Health Status of Older People.* The results showed that a total of 11 significant variables entered the regression equation among all independent variables; namely, positive coping style, negative coping style, sleep quality, satisfaction with life satisfaction and interest, worry about health, other support, depressed or pleasant state of mind and cognitive ability, psychological status, behavioural lifestyle, and social environment in chronic disease self-management were significant predictors of psychological resilience in older patients with chronic disease ($p < 0.05$); the multivariate correlation coefficient was 0.671 that the amount of variance that could be jointly explained was 0.445, as shown in Figure 7.

Only by understanding the risk factors of the disease can we improve the daily management and reduce the suffering caused by chronic diseases in the elderly. The most influential factors mentioned by patients during the interviews were sleep and anxiety. Poor sleep after the disease, constant dreams, and bad rest affect seriously, usually dizziness and disorientation; the effect of the medication is not good; there has been a drop in blood pressure falls so that patients panic about the disease. Since participating in the unit organization medical examination, the doctor has established a long-term relationship with the rescue, treatment compliance has improved; in a reasonable diet, appropriate exercise has changed, and sleep quality has also improved.

Qualitative research can be demonstrated based on quantitative data; that is, quantitative research proves whether the studied relationships exist, while qualitative research helps us understand the mechanisms and causes of these relationships. This study facilitates the theoretical basis for future guided practice interventions on protective factors of psychological resilience in elderly patients with chronic diseases through a preliminary model of protective factors of psychological resilience in elderly patients constructed from a combination of quantitative and qualitative studies. The core of this model is to promote the level of psychological resilience in elderly patients with chronic diseases in long disease management with positive adaptation and effective coping to improve the individual psychological resilience, thereby delaying the onset of disease progression. The results of the quantitative and qualitative studies of the model were compared and analysed, and two key factors of psychological resilience of elderly patients with chronic diseases were derived as the theoretical model, as shown in Figure 8.

The results of our study showed elderly patients with chronic diseases in comprehending the social support dimensions scores in the comparison of high- and low-resilience psychological group scores; the results showed the psychological resilience of elderly chronic diseases in family support, friend support, social support, and total social comprehending support scores with significant differences. Eliminating the concerns and other unfavourable psychological factors of elderly patients, enhancing their psychological tolerance, and fully mobilizing their motivation can increase their sense of security and psychological resilience.

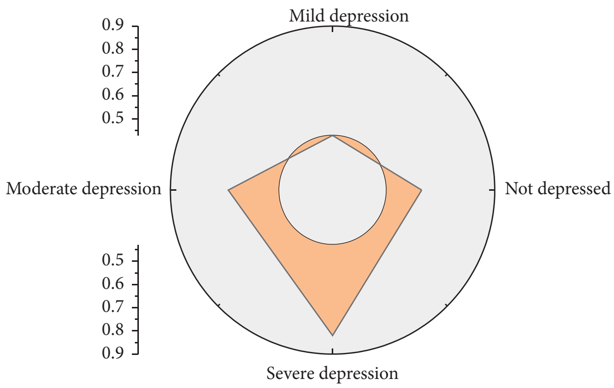


Figure 8: Social participation of older people with different levels of depression.

Some foreign scholars have shown that in addition to the emotional needs of the elderly, the desire for affection is also on the rise with age. Emotional support from loved ones and friends is extremely important in the disease progression of chronic diseases.

Family and peer support and encouragement were important protective factors for psychological resilience in elderly patients with chronic diseases in the results of this study. Elderly chronic disease inpatients have a high psychological need for family visits, especially in the two areas of emotional communication and psychological support. In addition, the overall subjective well-being of elderly chronic disease patients themselves was also an important protective factor for psychological resilience, and patients in the higher-resilience psychological group were better than those in the low-resilience psychological group in terms of worry about health, energy, depressed or pleasant state of mind, control over emotions and behaviour, relaxation and tension, and total subjective well-being scores, with statistically significant differences.

## 5. Conclusion

In response to the shortcomings of the above improvement methods, this paper also proposes an improved hybrid fish swarm algorithm based on the harmonic algorithm, which improves the local search ability and global search ability of the basic fish swarm algorithm by using the local fine-tuning ability of the harmonic algorithm and the repetition-free traversal property of the chaotic factor. Based on the identified emotion elicitation methods, the acquisition and preprocessing of multiphysiological data were carried out using the existing equipment in the laboratory, and the final test data were imported into the platform, and the recognition capability and the overall operation process of the platform were debugged, and the research results showed that the designed platform can perform emotion recognition relatively accurately. The symptoms of dizziness and stupor usually appear; the medication effect is not good, and the phenomenon of blood pressure drops and falls have occurred, which makes the patient panic about the disease. The influence of social participation on the mental health of older adults of different genders is heterogeneous. Descriptive statistics on the social participation of older adults of different genders found that the proportion of social participation of female older adults was significantly lower than that of males. A subsample matching of male and female older adults found that social participation contributed more to the improvement of mental health of female older adults. Overall, although the proportion of social participation was lower for females than for males, social participation contributed significantly more to the enhancement of mental health of female older adults than did males.

## Data Availability

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

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

## Acknowledgments

This work was supported by the Heilongjiang Philosophy and Social Science Research Planning Project Foundation (project no. 18RKC228).

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