www.cadanda.com Computer-Aided Design AND APPLICATIONS

Computer-Aided Recognition Algorithm for Students' Mental Health Problems using K-means Clustering

Yiwei Chen[1] and Jiayin Li[2*]

[1]Xiaoshan College, Zhejiang Open University, Hangzhou, 311200, China
[1]yieweichen17@outlook.com,
[2]Fine Arts Academy of Northeast Normal University, Changchun 130118, China,
[2]lijy891@nenu.edu.cn

Corresponding Author: Jiayin Li, lijy891@nenu.edu.cn

Abstract. In order to improve the recognition and management effect of students' mental health problems, this paper uses K-means clustering algorithm to study the recognition algorithm model of students' mental health problems. Moreover, this paper uses the particle swarm algorithm to identify students' expressions to determine the mental health problems of students, analyzes the convergence of the particle swarm algorithm, and obtains the result that the particle swarm algorithm can converge on the psychological solution problem. In addition, this paper analyzes the improved method of particle swarm algorithm, and obtains the improved particle swarm algorithm with faster solution efficiency and higher precision, and uses MATLAB software to design the program. The experimental results show that the recognition algorithm of students' mental health problems based on K-means clustering proposed in this paper has a certain effect in the mental health management of college students.

Keywords: K-means clustering; students; mental health; problem recognition; Computer-Aided Recognition Algorithm
DOI: https://doi.org/10.14733/cadaps.2024.S9.19-37

1 INTRODUCTION

In recent years, the crime of college students has been decreasing year by year, but the severity of crime has been increasing, and the problem of violent tendencies has gradually become prominent. Through careful exploration of the reasons, it is not difficult to find that their crimes are caused by the accumulation of a series of habitual, persistent and serious deviant behaviors. These bad and deviant behaviors will lay hidden dangers for juvenile delinquency in the future. Therefore, understanding the deviant behavior of college students and exploring the influencing factors of college students' deviant behavior are of great significance in helping college students abide by social moral standards, develop good behavior habits, and prevent and control juvenile delinquency [1]. By combing relevant literature, it is found that scholars' research on the influencing factors of college students' deviant behavior mainly focuses on the psychological level of college students and the external environment of college students. The research on the psychological level of college students is mainly carried out from the aspects of psychology, emotion, cognition and self-esteem of college students [3]. The external environment factors of college students include family, school, social environment and so on. The research on the relationship between family factors and college students' deviant behavior focuses on family economic status, family activities, family atmosphere, parenting style, family resilience, etc. [4]. School is an important place for the socialization of college students, and the school environment also has a significant impact on the deviant behavior of college students [6]. The social environment is related to economic, political, cultural, educational and other systems. However, the occurrence of deviant behavior of college students cannot be fully explained by a single influencing factor. Moreover, each of us can really feel the current trend of social development, which is becoming more and more internationalized, information-based, and constantly innovating and upgrading. The jungle survival law of survival of the fittest still brings different pressures to every member of society today. For college students who are in the transition period between children and adults, they want to be independent and clear in a society with outstanding heterogeneity and change, and to find their future ideals and life direction, so it is not easy to withstand the pressure [8].

Any purposeful behavior is a conscious response behavior made by the subject to solve the dilemma faced by the subject, and deviated behavior is a reaction method under the self-defense mechanism opened by the behavior subject to eliminate tension and pressure. Therefore, how college students deal with stress and how to reduce the negative impact of stress on their deviant behaviors are very worthy of discussion and need to be responded to [9]. Psychological resilience can take the initiative to open a protective umbrella for individuals from the perspective of positive prevention when people perceive pressure, tension and anxiety, so that individuals can quickly get out of negative experiences with their unique positive, healthy, strong and optimistic psychological qualities. Possess the ability to deal with unfamiliar environments [13]. In addition, social support theory specifically emphasizes the degree of closeness of the individual's connection to society and leads the individual to believe that he is cared for, loved, and respected by the members of society in his environment, and the consequences of supportive interactions between people on stress have a protective effect [15]. This is to use psychological resilience and social support as a "buffer" to adjust the behavioral deviation of college students. Psychological resilience strengthens students' psychological resilience, and social support strengthens students' external resistance. Behavioral biases in growth. Therefore, based on the social work major, this study attempts to explore the influencing factors of college students' deviant behavior from the pressures faced by college students from both the individual and social levels, and explores psychological resilience and social support as protective factors in this process. It can provide effective measures and services for preventing and correcting the deviant behavior of college students in the future [16].

College students are an important period for their physical and mental development. It is a time when they need to receive knowledge education but are also prone to rebellion. They like to think about problems with the thinking of adults, but their behavior is still naive, and they are easily affected by various levels and factors. influence, resulting in deviant behavior [17]. Education should be oriented towards the 21st century, and it should also be oriented towards college students. Its development is closely linked to the destiny of the nation and the future of the country. Scholars from all walks of life should pay attention to and help them get out of the predicament. The rapid development of China's economy has provided people with opportunities to fully demonstrate their self-worth, but it has also brought unprecedented competition and pressure. These pressures can easily influence people to make deviant behaviors. Adults of sound mind are still negligent and lose their way. This attitude is even worse for fledgling college students [5]. A new generation of college students is born and raised when the country is prosperous and prosperous. They are freshly clothed and delicious, fat, sweet and warm, and pampered. They have a smooth journey from home to school. Without setbacks, they are easily nervous and emotionally unstable. Therefore, it is extremely important to explore the influence of stress on the deviant behavior of college students. For college students, learning pressure, teacher pressure, parental relationship pressure, classmate communication pressure, and self-physical and mental health pressure are the pressures they are most exposed to and have the greatest impact on them [14].computer-aided interventions can assist in addressing teacher pressure. Virtual mentoring programs, online tutoring, and educational applications can provide additional academic support, enabling students to clarify concepts and seek guidance outside the classroom. By enhancing communication and understanding between students and teachers, these interventions can reduce anxiety and improve students' confidence in their academic abilities.

The analysis from the students' own factors mainly focuses on their personality development, self-control, self-evaluation and so on. Freud put forward the concept of id, ego and superego, id is human instinct, innate, unlearned behavior, superego is the idealized goal, symbolizing perfection and no flaws , the ego acts as a moderator between the two, and it is precisely because of their existence that a complete and real person is constituted, and therefore should be kept in balance, and if the balance is lost, it will lead to deviant behavior [12]. The deviant behavior of adolescents is affected by age and insufficient self-awareness development. Adolescents are immature in terms of social adaptability and ability to deal with setbacks, and they cannot make reasonable and fair evaluations of their own thoughts and behaviors. It is biased and therefore prone to biased behavior [7]. In terms of environmental factors, scholars believe that family environment, interpersonal relationship, social environment and cultural environment will all have an impact on the deviant behavior of college students. The family environment is divided into soft environment, hard environment, internal environment and external environment. The soft environment is related to parent-child relationship, parenting style, communication style, etc.; , related to the educational concept of children [2]; the external environment is related to the environment around the family, the relationship between neighbors, and the place for external activities. The interpersonal factor is mainly reflected in the relationship with the peer group. The influence of peers even goes beyond parents and teachers. The mutual influence and role of peers is very important. Teenagers often tend to talk about their own problems, such as emotions, with their friends. , fears, doubts, etc., rather than with their own teachers and parents [18]. The influence of peer groups on college students' deviant behavior is studied from the attitudes towards peer interaction, the types of friends they associate with, the degree of support they receive from friends, the positive and negative effects of peer groups, and the norms among peer groups. The influence of social environmental factors on the deviant behavior of college students mainly comes from the conflicts of social norms and values caused by the rapid changes of the social environment and the popularization of mass media. The conflict between social norms and values brings troubles to college students, and the mass media mainly affects college students through film and television works, video game consoles, and fashion trends [10]. The rapid development of the Internet can also easily lead to adolescents indulging in it, and appear addicted or attached to online lovers, indulge in online pornography, indulge in online games and other bad behaviors [11].

This paper uses the K-means clustering algorithm to carry out the research on the algorithm model of students' mental health problem recognition. Moreover, this paper combines the surface recognition of college students and the K-means clustering algorithm to identify the mental health of college students, which provides a channel for college students to become healthy.

2 STUDENT BEHAVIOR ANALYSIS AND POSITIONING ALGORITHM

2.1 Basic Particle Swarm Algorithm

Particle swarm optimization (PSO) draws on the social behavior of birds or fish during predation. It adopts the concepts of "swarm" and "evolution", introduces a speed-position search model, and operates according to the fitness value of the individual particle swarm. This optimization algorithm has the advantages of easy implementation, high precision, and fast convergence speed, and is very effective for solving optimization problems in complex environments. At present, it has attracted the attention of academia and has been successfully applied in engineering fields such as communication, detection and power.

Particle swarm algorithm (PSO) adopts the concept of "swarm" and "evolution", and operates according to the fitness value of individual particle swarm. Each particle represents a solution in the feasible solution space, and the quality of the solution is determined by a specific fitness function. Among them, the fitness function is determined by the optimization objective. Moreover, each particle walks at a certain speed in the search space, and adjusts its own student walking according to its own student walking experience and the group's student walking experience.

In the PSO algorithm, the particles of the particle swarm represent a possible solution to the problem, which is an individual composed of two parts: velocity and position. Students walk in an n-dimensional search space. On the one hand, the particle has self-property. That is, it can judge the speed and position of the student's walking according to the self-experience. On the other hand, it is social at the same time. It can adjust the walking speed and position of its own students according to the students' walking conditions around the particles, and constantly find the balance between individuality and sociality to search for the optimal position.

The vector is $X_i = (x_{i1}, x_{i2}, ..., x_{in})$, where i=1,2,…,m, m is the size of the particle population, ? is the current position of particle i, and the vector $V_i = (v_{i1}, v_{i2}, ..., v_{in})$ is the current student walking speed of particle i. In the process of evolution, its individual historical optimal position is denoted as $P_i = \left(p_{i1}, p_{i2}, \cdots; p_{in}\right)$, also known as individual optimal particle or pbest. The optimal position experienced by all particles is called the global optimal position and denoted as $G_i = \left(g_{i1}, g_{i2}, \cdots; g_{in}\right)$, which is also called the global optimal particle or gbest. Then, the velocity update formula and position update formula of the particle are:

$$v_{ij}(t+1) = w^* v_{ij}(t) + c_1 * r_{1j} * \left[p_{ij}(t) - x_{ij}(t)\right] + c_2 * r_{2j} * \left[g_{ij}(t) - x_{ij}(t)\right] \quad (1)$$

$$x_{ij}(t+1) = x_{ij}(t) + v_{ij}(t+1) \quad (2)$$

In the velocity evolution equation described by formula (1), it consists of three parts. The first part is the previous velocity of the particle swarm, the second part is the "cognitive" part of the particle swarm, and the third part is the overall "social" part of the particle swarm. These three parts all play an extremely important role in particle evolution, but for different evolution models, their effects are not the same.

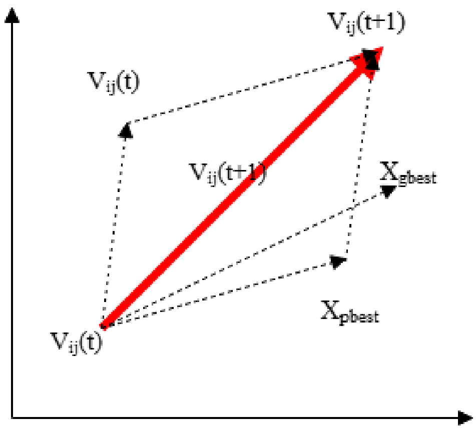

Figure 1: Schematic Diagram of Particle Movement.

In Figure 1, the principle of particle moving from position $x_{ij}(t)$ to $x_{ij}(t+1)$ according to formula (1) is described by taking a two-dimensional space as an example.

Now, we consider their respective roles:

1. Without the latter two parts, formula (1) is transformed into:

$$v_{ij}(t+1)=w^{*}v_{ij}(t) \tag{3}$$

At this point, the particle will keep walking at the current speed until it reaches the boundary. Since it can only search a limited area, it is difficult to find a good solution.

2. If there is no part 1, formula (1) is transformed into:

$$v_{ij}(t+1)=c_1*r_{1j}*\left[p_{ij}(t)-x_{ij}(t)\right]+c_2*r_{2j}*\left[g_{ij}(t)-x_{ij}(t)\right] \tag{4}$$

At this time, the speed only depends on the particle's current position and its historical best positions pbest and gbest, and the speed itself has no memory. If a particle is assumed to be in the global best position, it will remain stationary. However, other particles fly towards their own best position, and they are more like a local algorithm.

3. If there is no part 2, formula (1) is transformed into:

$$v_{ij}(t+1)=w^{*}v_{ij}(t)+c_2*r_{2j}*\left[g_{ij}(t)-x_{ij}(t)\right] \tag{5}$$

At this time, the particle has no cognitive ability, that is, only the social model. Under the interaction of particles, it has the ability to reach new search spaces. Its convergence speed is faster than that of the standard version, but it is easier to fall into the local optimum point for complex problems than the standard version.

4. If there is no part 3, formula (1) is transformed into:

$$v_{ij}(t+1)=w^{*}v_{ij}(t)+c_{1}*r_{1j}*\left[p_{ij}(t)-x_{ij}(t)\right] \tag{6}$$

To sum up, in general, we take the value $\omega=1$ (also called the standard particle swarm algorithm at this time), and $c_1=c_2=2, r_1, r_2\in[0,1]$ is a random variable that obeys a uniform distribution. The flow of the basic particle swarm algorithm is shown in Figure 2.

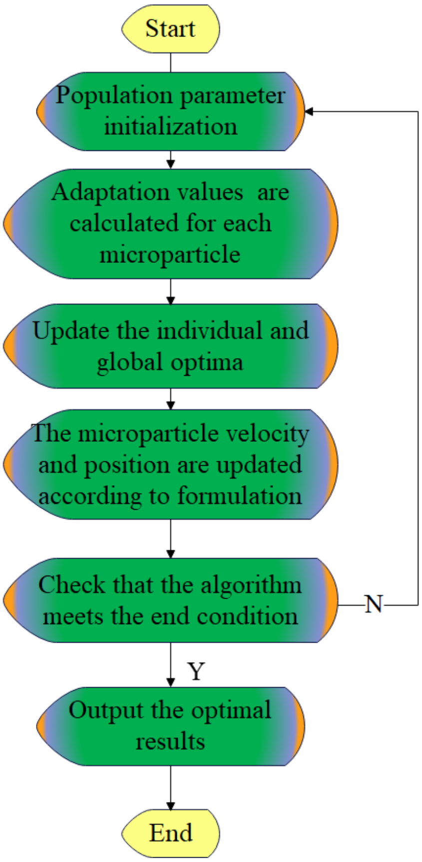

Figure 2: Flowchart of Particle Swarm Algorithm.

2.2 Convergence Analysis of Particle Swarm Algorithm

The convergence analysis of the particle swarm algorithm is as follows:

For the convenience of writing, the analysis here will be limited to the particle swarm algorithm in one-dimensional space, that is, the subscript j in equations (1) and (2) is removed, which does not lose generality.

Now, we define $\varphi_1=c_1*r_{1j}, \varphi_2=c_2*r_{2j}, \varphi=\varphi_1+\varphi_2$, and formula (1) and formula (2) can be sorted out:

$$v_i(t+1)=wv_i(t)-\varphi x_i(t)+\varphi_1 p_i(t)+\varphi_2 g_i(t) \quad (7)$$

$$x_i(t+1)=wv_i(t)+(1-\varphi)x_i(t)+\varphi_1 p_i(t)+\varphi_2 g_i(t) \quad (8)$$

$$\begin{bmatrix} v_i(t+1) \\ x_i(t+1) \end{bmatrix}=\begin{bmatrix} w-\varphi \\ w1-\varphi \end{bmatrix}\begin{bmatrix} v_i(t) \\ x_i(t) \end{bmatrix}+\begin{bmatrix} \varphi_1\varphi_2 \\ \varphi_1\varphi_2 \end{bmatrix}\begin{bmatrix} p_i(t) \\ g_i(t) \end{bmatrix} = G\begin{bmatrix} v_i(t) \\ x_i(t) \end{bmatrix}+B\begin{bmatrix} p_i(t) \\ g_i(t) \end{bmatrix} \quad (9)$$

The above equation is the standard discrete-time linear system equation. The standard PSO algorithm is a linear time discrete system. According to the stability criterion of the linear discrete-time system, the state of the particles is determined by the eigenvalues of the matrix G. A sufficient and necessary condition for the system to be stable (that is, when $t\to\infty$, $v_i(t),x_i(t)$ tends to a certain value) is that the amplitudes of all eigenvalues λ_1 and λ_2 of G are less than 1. The eigenvalues of G can be obtained from the following equations.

$$\lambda^2-(w+1-\varphi)\lambda+w=0 \quad (10)$$

Therefore, the two eigenvalues are:

$$\lambda_{1,2}=\frac{w+1-\varphi\pm\sqrt{\Delta}}{2} \quad (11)$$

In the formula,

$$\Delta=(w+1-\varphi)^2-4w \quad (12)$$

1. The situation at time $\Delta=(w+1-\varphi)^2-4w<0$

From formula (10), it can be known that when $\Delta=(w+1-\varphi)^2-4w<0$, that is, $w>(w+1-\varphi)^2/4\geq 0$, λ_1 and λ_2 are complex numbers with non-zero imaginary parts. The magnitude of λ_1、λ_2 can be expressed as follows:

$$|\lambda_1|=|\lambda_2|=\sqrt{\frac{(w+1-\varphi)^2+4w-(w+1-\varphi)^2}{4}}=\sqrt{w} \quad (13)$$

To make $max(|\lambda_1|,|\lambda_2|)<1$, there are 0<w<1. Therefore, when $\Delta<0$, the convergence condition is: 0<w<1, and the convergence region of the algorithm at this time is the shaded area in Figure 3, excluding the boundary line.

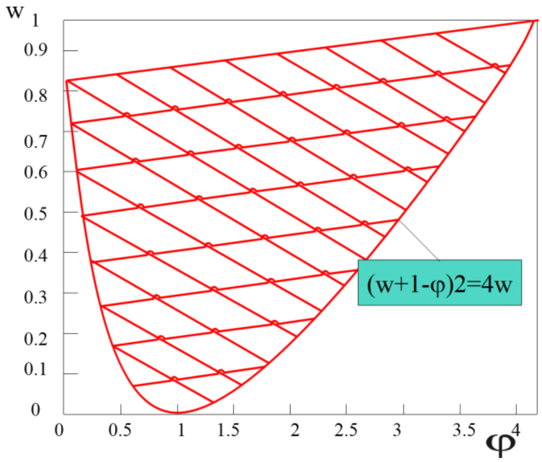

Figure 3: Convergence Area Plot at $\Delta \leqslant 0$.

2. The situation at time $\Delta = (w+1-\varphi)^2 - 4w = 0$

When $\Delta = (w+1-\varphi)^2 - 4w = 0$, that is, $(w+1-\varphi)^2 = 4w$, $w \geq 0$. At this point, λ_1 and λ_2 are two equal real roots, and there is:

$$|\lambda_1| = |\lambda_2| = \sqrt{w} \tag{14}$$

To make $max(|\lambda_1|,|\lambda_2|) < 1$, $0 \leq w < 1$ is only needed. Therefore, the convergence condition at $\Delta = 0$ is: $0 \leq w < 1$, and the convergence region of the algorithm is the parabola in Figure 3.

3. The situation at time $\Delta = (w+1-\varphi)^2 - 4w > 0$

When $\Delta = (w+1-\varphi)^2 - 4w > 0$, λ_1 and λ_2 are two unequal real roots. To make $max(|\lambda_1|,|\lambda_2|) < 1$, it is necessary to determine the size of $|\lambda_1|$ and $|\lambda_2|$, which are discussed in three cases.

(1) When $\varphi = w+1$

$$|\lambda_1| = |\lambda_2| = \sqrt{-4w}\,/\,2 = \sqrt{-w} \tag{15}$$

To make $max(|\lambda_1|,|\lambda_2|) < 1$, there are: -1<w<0. At this time, the convergence area is $\varphi = w+1$ on the (w,φ) plane, and $-1 < w \leq 0$, as shown by the dotted line in Figure 4.

(2) When $\varphi > w+1$ is known from formula (11), $|\lambda_1| < |\lambda_2|$. Therefore, only $|\lambda_2| < 1$ is required to ensure that the algorithm converges.

$$|\lambda_2| = \frac{-(w+1+\varphi)+\sqrt{(w+1-\varphi)^2-4w}}{2} \tag{16}$$

We set $y = w+1-\varphi$ and $|\lambda_2| < 1$ to get:

$$|\lambda_2| = \frac{y+\sqrt{y^2-4w}}{2} < 1 \tag{17}$$

$$\sqrt{y^2-4w} < 2+y \tag{18}$$

$$y+w+1<0 \text{ and } 2+y>0 \tag{19}$$

When it is substituted into $y = w+1-\varphi$, we get:

$$2w-\varphi+2>0 \text{ and } w<0 \tag{20}$$

The graph enclosed by the two preconditions $\Delta = (w+1-\varphi)^2-4w>0, \varphi > w+1$ and formula (19) is the area a in Figure 4 on the (w,φ) plane.

(3) When $\varphi < w+1$, it is known from formula (11), $|\lambda_1| > |\lambda_2|$. Therefore, only $|\lambda_2| < 1$ is required to ensure that the algorithm converges.

$$|\lambda_1| = \frac{w+1-\varphi+\sqrt{(w+1-\varphi)^2-4w}}{2} \tag{21}$$

We set $y = w+1-\varphi$ and $|\lambda_1| < 1$ to get:

$$|\lambda_1| = \frac{y+\sqrt{y^2-4w}}{2} < 1 \tag{22}$$

(23)

$$y-w-1<0 \text{ and } 2-y>0 \tag{24}$$

When it is substituted into $y = w+1-\varphi$, we get:

$$\varphi > 0 \text{ and } w-\varphi+1>0 \tag{25}$$

The graph enclosed by the two preconditions $\Delta=(w+1-\varphi)^2-4w>0,\varphi<w+1$ and formula (19) is the area b in Figure 4 on the (w,φ) plane.

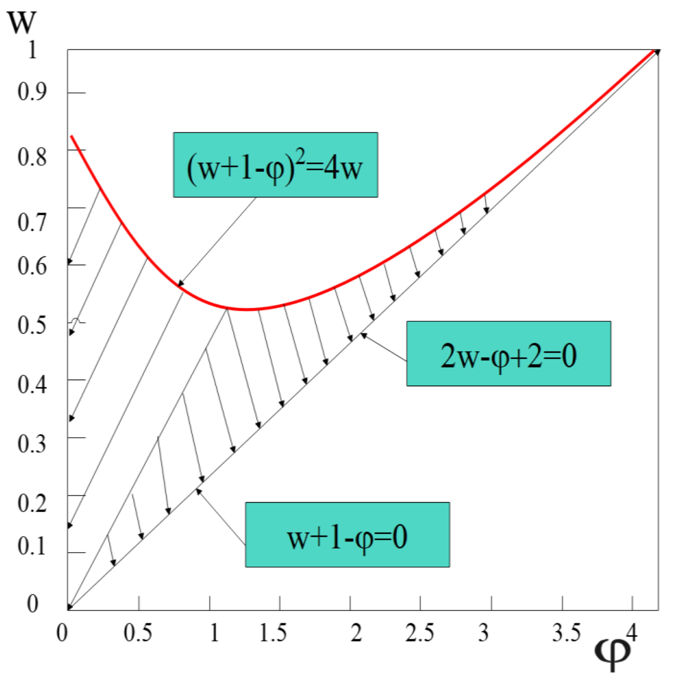

Figure 4: Convergence Area Graph When.

Combining (1), (2) and (3), it can be known that the convergence region at $\Delta>0$ is the region of $(w+1-\varphi)^2-4w>0$, $2w-\varphi+2>0$, -1<w<1 and $\varphi>0$.

Combining the three cases of $\Delta>0$, $\Delta=0$ and $\Delta<0$, the convergence region can be obtained as:

$$|w|<1,\varphi>0,2w-\varphi+2>0 \tag{26}$$

The schematic diagram of the convergence area is shown in Figure 5. When w and j take values in the above-mentioned convergence region, no matter any initial position and initial velocity, the particle will converge to the extreme point.

From the relationship of c_1, c_2 and φ, the sufficient condition for the algorithm to converge can be obtained as follows:

$$|w|<1,c_1+c_2>0,w>\frac{1}{2}(c_1+c_2)-1 \tag{27}$$

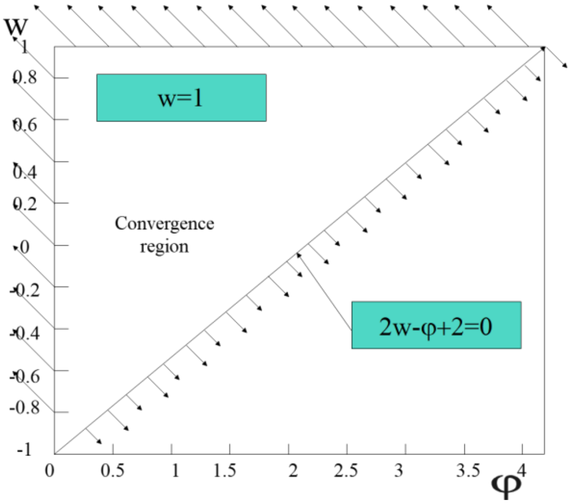

Figure 5: PSO Convergence Area.

It should be noted that the research object in this section is the simplified particle swarm kinetic system, and the linear discrete event system analysis method can be used. In fact, the unsimplified particle swarm system is a nonlinear system, but it can still be approximated by a discretized linear sequence, so the analysis method is still applicable.

2.3 Improvement and Development of Particle Swarm Algorithm

The influence of the inertia factor ω on the optimization performance is studied, and it is found that a larger value of ω is beneficial to jumping out of the local minimum, and a smaller value of ω is beneficial to the convergence of the algorithm, and two adjustment methods are proposed successively. The adaptive algorithm dynamically adjusts the parameter ω by linearly reducing the value of ω. It makes the algorithm have strong exploration ability in the early stage of iteration, and can continuously search for new areas. Since then, the development capability has gradually increased, allowing the algorithm to perform a fine-grained search around possible solutions. The fuzzy algorithm uses fuzzy rules to dynamically adjust the value of the parameter ω. The increment of inertia weight ω is determined by formulating corresponding membership functions and fuzzy inference rules for current best performance evaluation (CBPE) and current inertia weight. The results show that the method can achieve similar or even better results than the algorithm with decreasing inertia weight.

Usually, the inertia weight ω is determined by the following formula:

$$w = w_{max} - \frac{w_{max} - w_{min}}{series_{max}} \times series_{max} \tag{28}$$

w_{max} and w_{min} are the maximum and minimum values of ω, respectively, and $series_{max}$ and $series_{now}$ are the maximum number of iterations and the current number of iterations, respectively. By changing the size of the value, the influence of the previous speed on the current speed is controlled, making it a compromise between the global search and the local search. The larger the ω is, the larger the velocity V is, which is beneficial for the particle to search a larger space and may find a new solution domain. The smaller ω is, the smaller the velocity V is, which is beneficial to mining better solutions in the current solution space. Therefore, at the beginning of the iteration, $w = w_{max}$, and ω gradually decrease during the iteration until $w = w_{min}$. In this way, PSO can better control the exploration and development, search a larger solution space at the beginning of the optimization, get a suitable seed, and then gradually shrink to a better area for a finer search in the later stage to speed up the convergence speed. The research shows that with the increase of the number of iterations, the value of ω decreases linearly from 0.9 to 0.4, and a better numerical calculation result can be obtained.

The mathematical expression of the particle swarm algorithm with shrinkage factor is:

$$v_{ij}(t+1) = \lambda \cdot \left\{ w^{*} v_{ij}(t) + c_1 * r_{1j} * \left[p_{ij}(t) - x_{ij}(t) \right] + c_2 * r_{2j} * \left[g_{ij}(t) - x_{ij}(t) \right] \right\} \quad (29)$$

In the formula, $\lambda = \frac{2}{2 - w - \sqrt{w^2 - 4w}}$ is the shrinkage factor, and $w = c_1 + c_2, w > 4$.

Usually, we take the value c1=c2=2.05. At this point, $\lambda = 0.729$, and formula (29) can be transformed into:

$$v_{ij}(t+1) = 0.729 * v_{ij}(t) + 1.4962 * r_{1j} * \left[p_{ij}(t) - x_{ij}(t) \right] + 1.4962 * r_{2j} * \left[g_{ij}(t) - x_{ij}(t) \right] \quad (30)$$

$$x_{ij}(t+1) = x_{ij}(t) + v_{ij}(t+1) \quad (31)$$

Since the particles may deviate from the expected search space, the global extreme point cannot be reached within the specified algebra, so the size of the search space should be preset or the parameter $V_{max} = X_{max}$ should be set in order to limit the algorithm, so as to ensure that the convergence rate and the search performance can be improved.

In addition, the researchers also studied the influence of other parameters on the performance of the algorithm. P.N.Suganthan showed by experiments that a better solution can be obtained when the values of c1 and c2 are constant, but not necessarily 2. The initialization of the swarm also has an effect on the algorithm performance, but it is not very obvious.

The particles are given a hybridization probability, and in each iteration, particles are selected according to the hybridization probability, and the particles are then hybridized in pairs. The specific programming method can refer to the literature.

$$child_1(X_i) = p^{*} parent_1(X_i) + (1-p)^{*} parent_2(X_i) \quad (32)$$

$$child_2(X_i) = p^{*} parent_2(X_i) + (1-p)^{*} parent_1(X_i) \quad (33)$$

Among them, p is a random number uniformly distributed between 0-1, and the speed vector of the offspring is normalized by the sum of the parent vectors.

$$Child_1(V_i) = | parent_1(V_i) | \quad (34)$$

$$Child_2(V_i) = |parent_2(V_i)| \tag{35}$$

Experiments show that the hybrid particle swarm algorithm has a faster convergence speed and higher search accuracy. However, there are many adjustment parameters, which increases the complexity of the algorithm, and the corresponding calculation time also increases.

3 RESEARCH ON THE RECOGNITION ALGORITHM OF STUDENTS' MENTAL HEALTH PROBLEMS BASED ON K-MEANS CLUSTERING

Combined with the algorithm in the second part, the recognition of students' mental health problems in this paper is based on the recognition of students' facial expressions, which are determined by the tiny subcutaneous muscle activity. In fact, facial features are largely determined by the habitual pulling action of those muscles that make facial expressions on the skin above and the bones below. A person's most basic inner emotions or habitual attitudes, such as doubts or emotional impulses, self-confidence or lack of self-esteem, pessimism or misanthropy or optimism, love or hatred, can often "solidify" muscles. These habitual states can become tell-tale markers, turning faces into a three-dimensional map that helps recognize a person's true character.

(1) Partition Interpretation Method 1. Interpretation of left and right partitions. It divides the faces vertically from the middle, separating the left and right faces. It is then divided horizontally from below the eyes, separating the crown of the head, the eyes from the nose, the mouth and the chin. Then, it interprets the left area (the left area of the face), the right area, the upper area, the lower area in sequence. Usually, it is enough to interpret four parts. Of course, it is also possible to continue to divide the left area and the right area horizontally to interpret eight parts. The left and right regions of a person are different. "The reliable faceting technique in psychology provides strong evidence that the left side of the face does not reflect what the right side of the face reveals, and vice versa. If we use imaging technology to form a face from the same left area or the same right area of a person, we will find that there are two different faces. That is to say, different areas reflect different contents. Research results show that the left face is more likely to reveal people's heart. 2. Interpretation of upper and lower divisions. It divides the face in the horizontal direction, and divides the face into three parts: upper area, middle area and lower area. The upper area is on the forehead from under the bun to the eyebrows, and mainly observes the information exposed by the eyes, especially the left eye. The middle area is from below the eyebrows to the nose, mainly to observe the state of the nose. The lower area is below the nose and mainly observes the chin, which has a certain relationship with personality. The data acquisition process of this system is shown in Figure 6.

This paper adopts the network structure as shown in Figure 7. First, it is necessary to detect faces in the images to be processed, and if there are faces, follow-up steps are required. For non-standardized faces, this paper standardizes them. That is, the face image is cropped, and then the cropped image is reset to a 256*256 face image. The resized images are used as input for network training in the methods in this chapter. It should be noted that this step does not normalize the face image. The reason is that the core idea of this paper is to detect the key areas of the face and then identify different key areas by AU according to the detection results. Therefore, the benefits brought by face standardization are limited and will increase the laziness of the algorithm on the results of face standardization. The expression transfer system consists of three parts: face detection, AU detection and expression transfer, as shown in Figure 8.

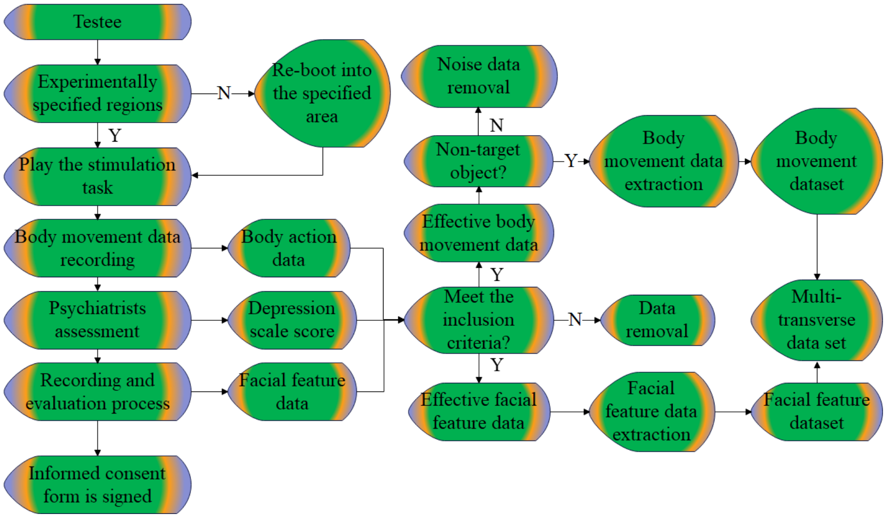

Figure 6: Data Collection and Data Set Construction Process.

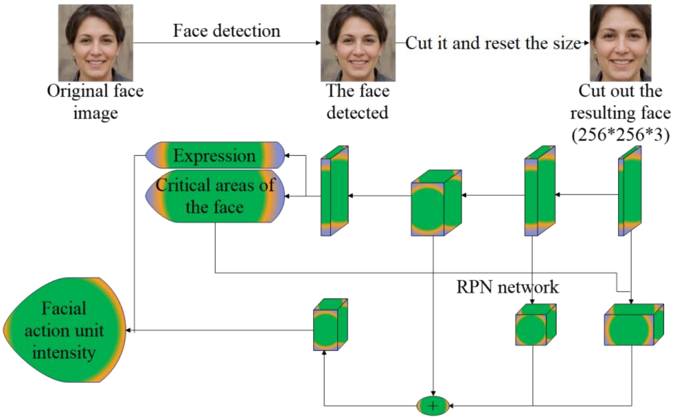

Figure 7: Overall Structure of the Network.

In this paper, K-means algorithm is used for cluster analysis of students' psychological data. Moreover, this paper analyzes the existing student work process in detail, and asks the instructors, class teachers and other front-line staff of the Department of Information Engineering to determine the basic needs, as shown in Figure 9.

Through the above model, the recognition and data processing of college students' mental problems are used to judge the recognition effect of college students' mental health problems and the effect of college students' psychological clustering. Based on the mental health test data of many college students in colleges and universities, this paper collects the facial expressions of college students, and compares the recognition results of this model with the actual data, and obtains the results shown in Tables 1 and 2.

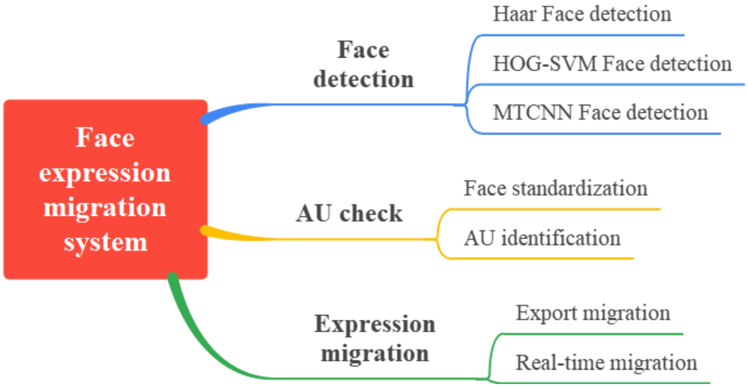

Figure 8: Expression Transfer System.

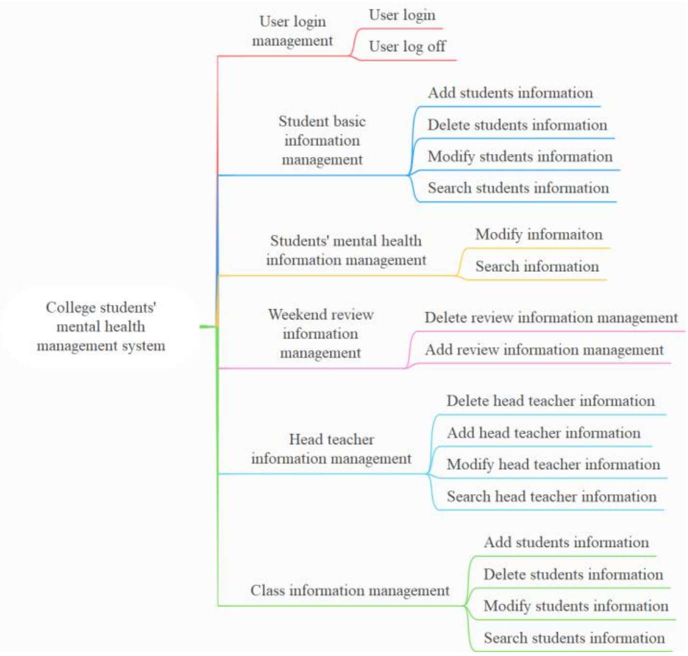

Figure 9: College Students' Mental Health Management System Based on K-Means Algorithm.

Number	*Mental recognition*	*Number*	*Mental recognition*
1	*86.29*	*19*	*81.95*
2	*74.74*	*20*	*83.03*
3	*84.73*	*21*	*75.57*

4	*81.67*	*22*	*77.20*
5	*81.85*	*23*	*75.72*
6	*85.03*	*24*	*82.40*
7	*75.66*	*25*	*77.59*
8	*75.46*	*26*	*80.32*
9	*75.81*	*27*	*76.03*
10	*80.35*	*28*	*75.76*
11	*79.20*	*29*	*82.01*
12	*80.25*	*30*	*82.17*
13	*82.49*	*31*	*79.11*
14	*78.64*	*32*	*76.44*
15	*85.85*	*33*	*76.01*
16	*74.15*	*34*	*82.95*
17	*81.14*	*35*	*80.53*
18	*77.43*	*36*	*83.84*

Table 1: Accuracy Rate of Recognition of College Students' Mental Problems.

Number	*Cluster analysis*	*Number*	*Cluster analysis*
1	*77.94*	*19*	*80.87*
2	*74.84*	*20*	*79.72*
3	*83.91*	*21*	*78.28*
4	*74.71*	*22*	*78.09*
5	*82.27*	*23*	*78.32*
6	*74.18*	*24*	*78.47*

7	*82.33*	*25*	*75.65*
8	*83.10*	*26*	*80.02*
9	*79.29*	*27*	*75.59*
10	*82.61*	*28*	*78.58*
11	*77.52*	*29*	*82.14*
12	*81.22*	*30*	*82.94*
13	*80.13*	*31*	*80.84*
14	*79.17*	*32*	*74.88*
15	*78.11*	*33*	*81.67*
16	*75.03*	*34*	*78.92*
17	*81.58*	*35*	*83.61*
18	*78.54*	*36*	*76.72*

Table 2: Clustering Effect of College Students' Mental Health Data.

Through the above research, it can be seen that the recognition algorithm of students' mental health problems based on K-means clustering proposed in this paper has a certain effect in the mental health management of college students.

4 CONCLUSION

There are currently special legal and institutional constraints for college students' deviant behavior and college students' crimes. However, they still rely more on working-study schools or public security departments to supervise and reform by means of control and preaching, which lacks humanity, so it is difficult to achieve the expected results. Social work differs from incarceration punishment passed down through history. It uses its unique civilization and delicate and warm humanistic care to try to deeply understand the inner world of college students, understand their feelings of growth, and reveal their mental journey towards deviant behavior. Based on this, it is necessary to formulate countermeasures and provide related services in a targeted manner. Therefore, from the perspective of social work, it is more valuable and meaningful to help college students correct their deviant behaviors This paper uses the K-means clustering algorithm to carry out the research on the algorithm model of students' mental health problem recognition. The experimental study shows that the recognition algorithm of students' mental health problems based on K-means clustering proposed in this paper has a certain effect in the mental health management of college students.

Yiwei Chen, https://orcid.org/0000-0002-6851-7570
Jiayin Li, https://orcid.org/0000-0001-6721-6146

REFERENCES

[1] Bali, H.; Rai, V.; Khanduri, N.; Tripathi, R.;Sapkota, B. Perceived Stress and Stressors Among Medical and Dental Students of Bhairhawa, Nepal: a Descriptive Cross-Sectional Study, Journal of Nepal Medical Association, 58(226),2020,383-389. https://doi.org/10.31729/jnma.4911

[2] Feng, B.; Zhou, P.; Dong, H.; Wang, J.: Influence of Long-Distance Running on Mental Health and Positive Sports Emotions of College Students, Revista Argentina De Clinica Psicologica, 29(2), 2020, 685-691. https://doi.org/10.24205/03276716.2020.296

[3] Feng, L.L.; Lu, T.F.; Yin, M.L.; Qi, M.L.: Application of Underwater Resistance Training with University Students: a Brief Systematic Review, Science & Sports, 36(4), 2021, 274.e1-274.e9. https://doi.org/10.1016/j.scispo.2021.02.007

[4] Fontana, M.T.: Gamification of Chemdraw During the covid-19 Pandemic: Investigating How a Serious, Educational-Game Tournament (Molecule Madness) Impacts Student Wellness and Organic Chemistry Skills While Distance Learning, Journal of Chemical Education, 97(9), 2020, 3358-3368. https://doi.org/10.1021/acs.jchemed.0c00722

[5] Fu, W.; Yan, S.; Zong, Q.; Dan, A. L.; Lv, C.: Mental health of college students during the covid-19 epidemic in china, Journal of Affective Disorders, 280(Pt A), 2021, 7-10. https://doi.org/10.1016/j.jad.2020.11.032

[6] Helminen, E.C.; Scheer, J.R.; Edwards, K.M.; Felver, J.C.: Adverse Childhood Experiences Exacerbate the Association Between Day-to-Day Discrimination and Mental Health Symptomatology in Undergraduate Students, Journal of Affective Disorders, 297(6), 2022, 338-347. https://doi.org/10.1016/j.jad.2021.10.058

[7] Lin, H.C.; Li, M.; Stevens, C.; Pinder-Amaker, S.; Liu, C.H.: Self-Harm and Suicidality in us College Students: Associations with Emotional Exhaustion Versus Multiple Psychiatric Symptoms, Journal of Affective Disorders, 280(Pt A), 2021, 345-353. https://doi.org/10.1016/j.jad.2020.11.014

[8] Martinez, S.; Kalaydjian, S.; Ritchie, L.; Nazmi, A.; Prather, A.: 0238 Campus Food Pantry Assistance is Related to Better Physical and Mental Health Through Adequate Sleep Among College Students in a Public University System, Sleep (Supplement_1), 2020, A91-A92. https://doi.org/10.1093/sleep/zsaa056.236

[9] Oswalt, S.B.; Lederer, A.M.; Chestnut-Steich, K.; Day, C.; Halbritter, A.; Ortiz, D.: Trends in College Students' Mental Health Diagnoses and Utilization of Services, 2009–2015, Journal of American College Health, 68(1), 2020, 41-51. https://doi.org/10.1080/07448481.2018.1515748

[10] Rudorfer, M.V.: Psychopharmacology in the age of "Big Data": the Promises and Limitations of Electronic Prescription Records, CNS Drugs, 31(5), 2017, 417-419. https://doi.org/10.1007/s40263-017-0419-y

[11] Shatte, A.B.; Hutchinson, D.M.; Teague, S.J.: Machine Learning in Mental Health: a Scoping Review of Methods and Applications. Psychological Medicine, 49(9), 2019, 1426-1448. https://doi.org/10.1017/S0033291719000151

[12] Singh, D.S.; Roy, P.M.D.; Sinha, C.; Parveen, C.; Joshi, C.: Impact of covid-19 and Lockdown on Mental Health of Children and Adolescents: a Narrative Review With Recommendations, Psychiatry Research, 293(1), 2020, 113429. https://doi.org/10.1016/j.psychres.2020.113429

[13] Sontag-Padilla, L.; Dunbar, M. S.; Ye, F.; Kase, C.; Fein, R.; Abelson, S.; Stein, B.D.: Strengthening College Students' Mental Health Knowledge, Awareness, and Helping Behaviors: the Impact of Active Minds, a Peer Mental Health Organization, Journal of the American Academy of Child & Adolescent Psychiatry, 57(7), 2018, 500-507. https://doi.org/https://doi.org/10.1016/j.jaac.2018.03.019

[14] Sun, M.; Wang, D.; Jing, L.; Zhou, L. Changes in Psychotic-Like Experiences and Related Influential Factors in Technical Secondary School and College Students During Covid-19, Schizophrenia Research, 231(4), 2021, 3-9. https://doi.org/10.1016/j.schres.2021.02.015
[15] Sun, X.; Wang, Z.J.; Li, Y.Y. ; Chan, K.Q.; Miao, X.Y.; Zhao, S.: et al. Trends of College Students' Mental Health from 2005 to 2019 and its Rural–Urban Disparities in china, Journal of Affective Disorders, 302(11), 2022,160-169. https://doi.org/10.1016/j.jad.2022.01.042
[16] Wei, W. A.; Mw, B.; Qian, H.C.; Pw, D.; Li, L.D.: Suo, J.: Upward Social Comparison on Mobile Social Media and Depression: the Mediating Role of Envy and the Moderating Role of Marital Quality – Sciencedirect, Journal of Affective Disorders, 270(6),2020, 143-149. https://doi.org/10.1016/j.jad.2020.03.173
[17] Yang, Y., Liu, W.: The Influence of Public Physical Education Curriculum on College Students' Physical Health, Revista Brasileira De Medicina Do Esporte, 27(spe), 2021, 83-86. https://doi.org/10.1590/1517-8692202127012020_0099
[18] Zhang, J.: A Study on Mental Health Assessments of College Students Based on Triangular Fuzzy Function and Entropy Weight Method, Mathematical Problems in Engineering, (10), 2021, 1-8. https://doi.org/10.1155/2021/6659990