The Development of Group Psychology Measurement System based on Computer Multimedia Technology

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Abstract. Mental CT is a kind of new computer psychological measurement technology. In order to realize group measurement function of psychological measurement system, this paper designs particle swarm psychological measurement algorithm, enhancing the system's intelligence community mental health average level calculation and prediction function, realizing performance optimization of psychological measurement system. In order to verify the effectiveness and the reliability of the algorithm, this paper uses MATLAB toolbox to do curve fitting on the psychological test results. From the fitting results, the algorithm can calculate the population average mental health level, which is a reliable method of group psychological measurement.

Introduction

Psychological measurement technology achieves quantity analysis of psychological, and it is not only an important means to evaluate mental psychological health, but also provides a theoretical basis for the psychological activities measurement using computer technology [1,2]. In the computer simulation algorithm design case, there are many skills from biological phenomena, such as artificial neural network is a simplified model of human brain, the genetic algorithm is a simulation of the evolution of genes [3,4]. And the particle swarm optimization is a new design of bionic algorithm, which is a parody of biological system and social system, but also can be called swarm intelligence [5]. Based on local information these simulation systems may result in unpredictable group behavior. When they are applied in psychological measurement process, they can realize the psychological measurement group average calculation.
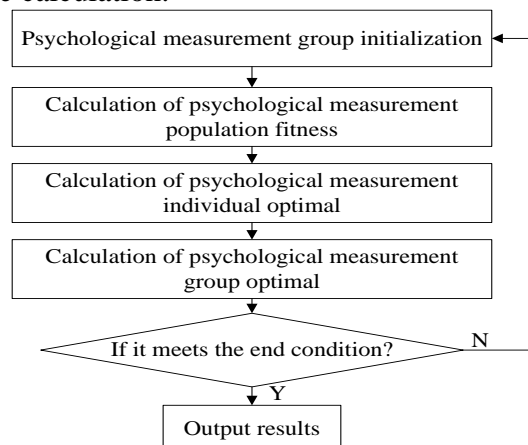

Fig. 1 Design framework of computer group psychological measurement

Figure 1 shows the overall design framework of computer group psychological measurement. The basic step is to first define the psychological measurement group, and initial the velocity and position of group, then calculate the fitness value of psychological measurement group [6,7]. When the fitness

values satisfy the calculation conditions, first calculate the individual optimal, then calculate the global optimum, if it doesn't satisfy condition, then re- initial psychological measurement group. The output result is done curve fitting by MATLAB, finally the group average mental health is obtained.

Algorithm Design of Group Psychological Measurement Particle Swarm

Suppose in D dimensional psychological measurement data search space, N psychological measurement results form a community, and the i result represents a D dimension vector.

$$X_i = (x_{i1}, x_{i2}, \cdots, x_{iD}), i = 1, 2, \cdots, N . \tag{1}$$

Where i psychological measurement speed is also a D dimension vector, denoted as:

$$V_i = (v_{i1}, v_{i2}, \cdots, v_{iD}), i = 1, 2, \cdots 3 . \tag{2}$$

Where i psychological measurement particle swarm searching optimal position is called individual extreme, denoted as:

$$p_{best} = (p_{i1}, p_{i2}, \cdots, p_{iD}), i = 1, 2, \cdots, N . \tag{3}$$

The best position of psychological measurement particle swarm searching is global optima, denoted as:

$$g_{best} = (p_{g1}, p_{g2}, \cdots, p_{gD}) . \tag{4}$$

When finding the two optimal values, particle updates the velocity and position according to the following formula:

$$v_{id} = w * v_{id} + c_1 r_1 (p_{id} - x_{id}) + c_2 r_2 (p_{gd} - x_{id}), \ x_{id} = x_{id} + v_{id} . \tag{5}$$

Where c_1 and c_2 are the study factors, also known as the constant acceleration; r_1 and r_2 uniform random number in $[0,1]$. The algorithm process is as follows:

Initialize the particle swarm, including population size N, each particle's position x_i and velocity V_i;

Calculation of each particle's fitness value $F_{it}[i]$;

For each particle, compare the fitness value $F_{it}[i]$ with individual extreme $p_{best}(i)$, if $F_{it}[i] > p_{best}(i)$, so replace $p_{best}(i)$ with $F_{it}[i]$;

For each particle, compare the fitness value $F_{it}[i]$ with global extreme g_{best}, if $F_{it}[i] > p_{best}(i)$, so replace g_{best} with $F_{it}[i]$;

Update the velocity v_i and position x_i according to the following formula (5);

If it meets the end condition (error is good enough or reaches the maximum number of cycles), it will exit, and otherwise it returns.

In order to achieve the above six steps algorithm, this paper uses the MATLAB to program the calculation [4, 5]. And the MATLAB programming is as follows:

```
figure(2)
for j=1:D
  if(rem(D,2)>0)
    subplot((D+1)/2,2,j)
  else
    subplot(D/2,2,j)
  end
  plot(x(:,j),'b*');grid on
  xlabel('particle')
  ylabel(' the initial velocity ')
  tInfo=strcat(',char(j+48),' dimension ');
  if(j>9)
 tInfo=strcat('',char(floor(j/10)+48),
char(rem(j,10)+48),' dimension ');
```

```
    end
    title(tInfo)
End
......
```

Design of Group Psychological Measurement System based on MATLAB

In order to verify the validity and reliability of psychological measurement of particle swarm algorithm designed in the second part, this paper uses the commonly used MATLAB software of computer multimedia technology as the core computing software to verify the algorithm [8,9]. The MATLAB toolbox opening is as shown in Figure 2.
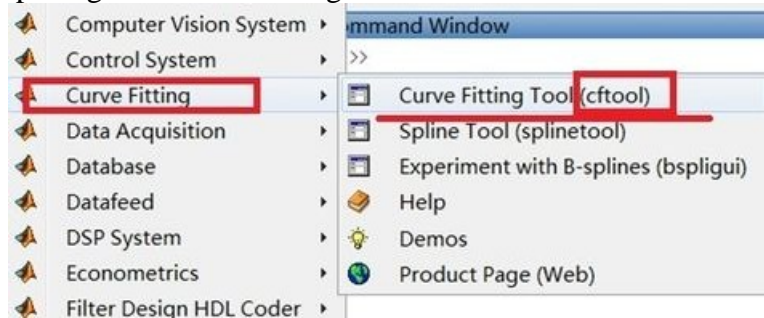

Fig. 2 Opening of the MATLAB toolbox

In the main MATLAB window, click start--toolboxes, it will list all the toolbox MATLAB has been installed, so you can choose the toolbox according to need. Figure 2 shows the curve fitting toolbox of mental health statistical data. Firstly it defines particle initial position of psychological measurement group.
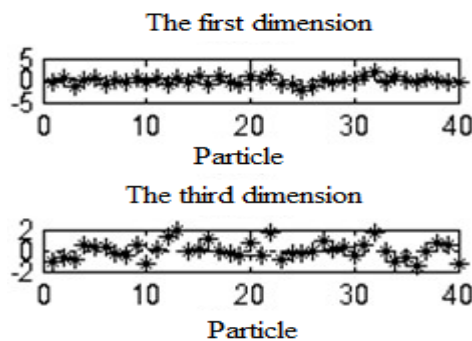

Fig. 3 Group psychological measurement initialization

Figure 3 shows the location initialization of population psychological measurement. The population uses multidimensional initialization mode [10]. Initialize the particle swarm includes population size, each particle's position and velocity. Through calculation the group psychological measurement fitness values are shown in Figure 4.
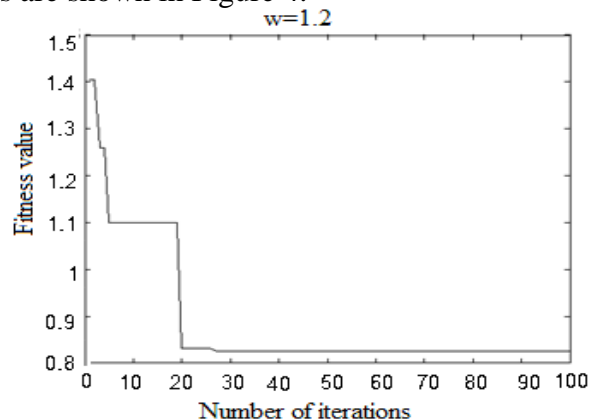

Fig.4 Fitness value computation results

Figure 4 shows the fitness value of psychological measurement particle swarm by the iteration calculation [11]. When the fitness value is 0.8, the results are optimal. From the chart it can be seen, when iteration step is 20, it already meets the computational requirements. Through calculation the results are obtained as shown in Table 1.

Table 1. The calculation error statistics

Source of variance	Square sum	Freedom degree	Mean square	F ratio
Factor	0.43212	3	0.14404	64.4418
Error	0.04734	20	0.00236	
Sum	0.47946	23		

Table 1 shows the results of group effect significant test of psychological measurement. It can be seen from Table 1, $F_{0.05}(3,20) = 6.10000 < 64.4418$. In H_0 parameter changes have significant influence on the results of the program, so the calculating result is valid, final result of calculation uses the MATLAB to do curve fitting, as shown in Figure 5.
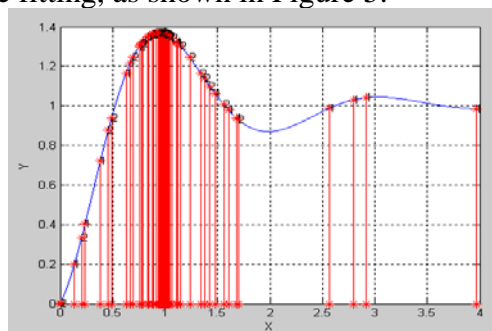

Fig. 5 Group psychological group measuring results

Figure 5 shows the group mental health t results for 800. The results use curve fitting to map out the general trend of mental health [12]. From the chart it can be seen, the highest health index is 1.4, and the lowest health index is 1. 1800 test of the psychological health is at general level.

Summary

This paper designs particle swarm optimization algorithm of computer psychological measurement, through 6 steps it show the detailed realization of the algorithm, and uses the MATLAB toolbox to program group psychological measurement algorithm. Through the MATLAB simulation, it defines the initial amount of psychological measurement, and the fitness value of group psychological measurement is obtained. Through the curve fitting, the average results of group psychology measurement are obtained. The results show that, the computer group measurement system can calculate average level of group psychological health effectively.

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