Research on Intelligent Test Paper Based on Improved Genetic Algorithm

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Abstract. At present, under the current quality education, the examination is still one of the main measure of teachers' teaching ability and student achievement. At the same time, different levels of examination are different to the test paper. Aiming at the multi-combination of constraints in the test paper, an improved genetic algorithm is proposed, which combines the constraints of the papers effectively, so that the test papers can be maximized to meet the needs of the users.

Keywords: Restrictions · Intelligent test paper · Genetic algorithm Convergence speed

1 Introduction

Nowadays, the examination is one of the important ways to assess individual ability and talent selection [1]. Among them, the test paper is an important part of the entire test and the quality of the test paper determines the quality of the examination results, the traditional manual method does not work well to ensure the quality of the papers and the scientific rationality of the examination [2]. Based on the above research background, this paper presents an improved genetic algorithm. The algorithm improves the initial population of the test paper by introducing the chaos theory, which ensures a good convergence rate of the test paper population.

2 Analysis of Intelligent Test Paper

The research results of this paper are an improved intelligent test paper based on genetic algorithm. In order to better describe the research results of this paper, the problem of intelligent test is analyzed.

2.1 Constraints on Smart Packets

In fact, the papers are composed of different types of questions, questions and other constraints of the combination of questions, each question has a different attribute constraints [3]. Assuming that a set of papers is made up of questions, each question contains a property, so the test paper can use a matrix, each row represents a question, each column

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represents a property of the question. In this paper, the attributes of each question are: difficulty, knowledge points, scores, questions, cognitive level, time, exposure.

2.2 The Objective Function of Intelligent Test Paper

The problem of group volume is a multi-constrained multi-objective combinatorial optimization problem [4]. Before the test paper, set the expected value for the attributes of each test questions. It is hoped that each test question in the composition paper will meet the preset expectation value. However, in the actual process, the actual value will be caused by some reason and user expectations do not match [5]. According to the characteristics of the test paper, the difficulty degree, the cognitive level and the knowledge point constraint condition are selected, and the objective function of the intelligent test group is set as the sum of the constraint error weight in the paper. The formula is (1):

$$f = w_1 \times \mathrm{E}_D + w_2 \times \mathrm{E}_R + w_3 \times \mathrm{E}_Z \tag{1}$$

In Eq. (1), we represent the weight of the index and the sum of the weights is 1, E_D is the error value of the difficulty constraint, E_R is the error value of the cognitive level constraint, and E_Z is the error value of the knowledge point constraint. For each indicator of the weight, the user can be adjusted according to actual needs.

3 Improved Genetic Grouping Algorithm

In this paper, the global convergence rate of the algorithm and the early convergence phenomenon are optimized. By introducing the chaotic selection method, the individual variables of the chaotic test paper are satisfied according to the given test paper constraints and the initial test paper population is composed, These initial test paper population is a rough selection of the individual papers and thus can speed up the genetic algorithm convergence rate.

In the genetic algorithm, the chaotic selection method is introduced in the population initialization of the test paper, the individual variables of chaotic papers are generated by full mapping, and the formula is (2):

$$p_{i+1}(R(m)) = 1 - p_i^2(R(m)) \tag{2}$$

In Eq. (2), m is the number of constraints, $R(m)$ represents the sum of the values of each constraint.

The process of generating the initial population by the chaos selection method is:

(1) Set the initial value of the chaos. Determine the number of constraints on the requested problem is m, and calculate the sum of the values of each constraint as the initial value of chaos.
(2) Produce chaotic individuals. Substituting the initial value of chaos into formula (2) produces a chaotic individual and to determine whether to meet the set constraints, if the agreement is retained, otherwise eliminated.

(3) Until the chaotic sequence conforming to the initial population size is generated, the length of the chaotic sequence is the size of the initial population.

Through the above process, the selection of the individual is directed, the initial population of the test paper is fast and the individual is related to the problem.

4 Experimental Verification

1. In the same experimental parameters set, and asked the number of papers produced each experiment consistent, respectively, SGA, CGA, NCAGA conducted 50 repeated experiments, and randomly selected 10 times.

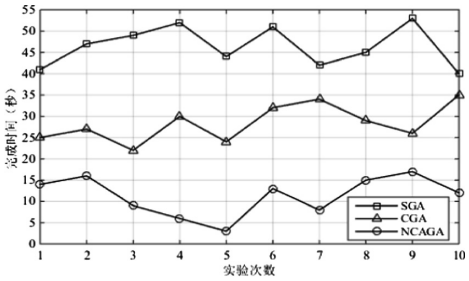

Fig. 1. The average completion time of the three test methods

It can be seen from Fig. 1 that the SGA, CGA and NCAGA show different fluctuations with the increase of the number of experiments. The overall average of the SGA-based method is the highest, the CGA-based method, The method is minimal. Thus, the NCAGA-based method of generating a test paper is faster.

2. Using SGA, CGA, NCAGA three test methods were carried out 50 times repeated experiments and each time only to generate a set of papers, the statistical results shown in Fig. 2.

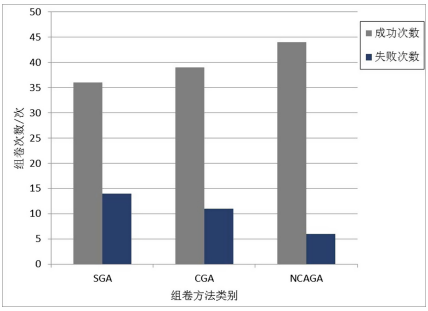

Fig. 2. The results of the three test methods

It can be seen more intuitively from Fig. 2 that the relative difference between the number of successes and the number of failures of each test method is the largest, and the third method has the largest relative difference, which indicates that the success rate of the third method is more Well, the success rate based on the NCAGA method is better than the other two methods.

5 The References Section

The results show that the improved genetic algorithm is a good performance advantage in the success rate of package, time of test paper, quality of test paper, etc., and it is possible to meet the actual needs of users as much as possible.

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