

# Dynamic Complex Environment-based Self-Adaption PE Teaching Model

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## Article Info

Volume 83

Page Number: 5650 - 5658

Publication Issue:

July - August 2020

## Article History

Article Received: 25 April 2020

Revised: 29 May 2020

Accepted: 20 June 2020

Publication: 28 August 2020

## Abstract

A dynamic complex environment-based self-adaption PE teaching model (DCESTM) is proposed, which uses a kind of binary design of the dynamic simulation model. The PE students in the PE teaching group change through the negative adaptation to the positive imitation, that is, the system goes through the imitation of the interaction scene and conducts the friendly interaction, so they have a stronger ability to adapt to the scene, sports students can more accurately feel the changes in the scene, but also to find the sports conditions of the sports students in the environment. Results of the experiment are got from a series of test of a very good transplant and generalization ability. The results show that this model can also ensure the stable imitation of the trainees in the scene in the turbulent scenes, which can be used to simulate the motion of the students, the robustness of the model and the detection ability of the trainees and the ability of sports trainee to pursue are higher than similar methods.

**Keywords:** Complex Scene, Self-Adaption Simulation, Genetic Calculation, Dynamic Scene, Physical Education Model;

## 1. Introduction

In reality, the adaptability of the various trainees to the environment is a different degree of change. The optimal solution varies with time and site, so the optimal solution of the problem is not immutable, including the scheduling problem of Job Shop when a new job appears, so it is necessary to add to the current scheduling process, and the machine may produce a failure may also lead to lower processing speed, raw materials will change and the constraints will change, although after the classic optimization methods changed, you can start building on the basis of the scene. But in essence it is a new optimization problem, which leads to the problem of the time when double calculation cannot be used. The main current situation is that the information of the scene change cannot be obtained, so the original static problems based optimization method when dealing with such problems can not start, which requires more powerful and able to deal with real-life uncertainty in the

heuristic method, can feel this change and make a more positive response.

The goal of classical evolutionary model is to gradually converge and then obtain a satisfactory solution, so the main problem of evolutionary model in mobile scene is how to practice differentiation in the process of evolution, and finally can adapt to the change of product. (GA) evolutionary model in the use of excessive variation of the strategy [1], if the scene when the change may increase the rate of variation, leading to convergence of collective divergence in physical education, in the development of the relevant work, including the balance model, The results show that the frequency of the scene transformation can affect the rate of increase of the mutation rate, if the frequency is more likely to produce more variation, we know that through the results of the study, Vavak et al. [3] proposed a local mutation operator that starts with a small variation only if the larger the variance is, the greater the

variance is. If the bigger the variance, The ability of the teaching group to improve in a period of time will not increase the scope of the search, the literature [4] proposed a random immigrant way, that is, physical education students in the collective sports may be a gradual replacement of sports students, Cobb [5] compared the application of three programs: including fixed or excessive variation and random variation, through the results we learned that excessive variation of the GA in the stage of slow changes in the process of the best performance, if the scene appears larger changes, Then the method of random variation will be more good, Goldberg proposed a diploid and genetic dominant strategy GA [6], in the application of the following issues in this method is better than the standard GA, Hadad proposed polyploid method [7 ], The dominant variable is used as part of the sports trainee, and this method gains the same ability as the diploid in the kinematics, and they understand that the multimedia approach facilitates the creation of higher frequency scenes, Polyploid method [8], additional genes determine the personality, in the event of a transaction problem, the results of this method is better to adapt to reconnaissance group [9] is to find a peak when the PE teaching collective Then a sub-group will be generated to monitor the peak, but the various problems in the PE teaching community will start, and then find a new peak, Oppacher proposed a Shifting Balance GA method [10], the PE teaching group finally divided into core physical education Collective and small colonial PE teaching colony, colony PE teaching collective goal is to find sports students, colony PE teaching group's goal is to retrieve all isolated areas in the curve, and then to explore, if the curve transformation more frequent and change (11) proposed a more efficient method for calculating the distance between PE learners and the core PE teaching community. Ursem proposed a multi-racial GA [12], in which the model is more efficient than the conventional GA. The peak-valley exploration process used by the group itself is

determined by the original evolutionary model developed in [13], and the cross-mutation genetic algorithm is carried out, and the axis symmetric operation of the collective chromosome of physical education teaching, the final good result is also obtained.

The above improved method is mentioned in the literature [14], mainly to modify the evolution operator, get the memory strategy and then use the multi-group strategy can be adapted to groups of differences, the above measures on the scene changes have a role, but In this paper, a dynamic scene-based self-organizing model (DNSLA), also called anti-classical evolutionary strategy, is proposed, which can make the physical education teaching group In the sports students through the classical adaptation slowly into positive imitation, group adaptation imitation is to scene interaction as the goal, can feel the scene change and the reaction ability is quicker, the dynamic scene ability is stronger, but also can accurately find the footprint in the retrieval environment, the general portability and generalization ability are stronger.

## **2. Dynamic self-adaption sports education model**

The retrieval model of self-adaption physical education model is: using  $np+1$  bulletin boards ( $np$  represents the number of complex physical education teaching groups as a gregarious system), it can record the optimal physical education students in each scene and the stoppage system, and represent the solving problem. The optimal solution and the overall optimal solution, because of the iterative process of continuous change, physical education collective grading retrieval process is imitating the process, according to imitate the object to adjust their search methods and step size adjustment, due to the imitation running, complex sports teaching collective produce a better overall solution, the other tribes will be the corresponding scene into the complex physical education collective to conduct intensive search, if the promise of evolution in the process did not find the

overall solution, then the so-called sports students will gradually be dispatched to the other PE teaching groups. Finally the complex scenes disappear, and if the sports students can find a better overall solution, then you can find more complex scenes group road from repeated scene, this adaptation to imitate realize “ The stronger to be stronger, the weaker to be weaker- Matthew effect, and the natural selection of natural resources and survival of the fittest rule is compatible.

The self-adaption imitation of each PE teaching collective is carried out as follows: the imitation is carried out for part of PE students of each PE teaching group, that is to say, the group system has the best imitation of PE students, and the other PE students will conduct the imitation, that is, the physical education students in the collective physical teaching students effective internal imitation, the other part of the axis symmetric mapping to carry out spontaneous imitation, sports students imitate the desire of the stronger, his size according to the efficiency of sports students and imitate the object efficiency and their distance to define the size of Hammin, the following is our correlation analysis of them.

### 2.1 Self-adaption simulation design

The imitation method proposed in this paper is about the binary design scheme, so the analysis of the detection direction and the retrieval of the different adjustment is mainly its own coordinate adjustment, imitation desire to achieve through the simulation rate, imitation intensity is mainly adjusted by the number of gene bits.

#### 2.1.1 Overall imitation based on the efficiency value of the trainees

Assume  $X_E^{best}$  as the most efficient sports trainee in the whole economic system, its relative genetic formula is  $G_E^{best}$ :  $X_K^i$  is the number  $i$  physical education student belongs to the physical education students group, and the relative, the genetic formula  $G_K^i$  for the overall imitation rate  $X_K^i$  is

$$\begin{cases} \max f(x): Grate_K^i = Grate' + f_K^i / \tilde{f}_K - 1 \\ \min f(x): Grate_K^i = Grate' + \tilde{f}_K / f_K^i - 1 \end{cases} \quad (1)$$

Here,  $Grate'$  refers to the initial value of the general simulation efficiency value,  $f_K^i$  indicating the effective rate of physical education students  $X_K^i$ ,  $\tilde{f}_K$  instructing the balance of the efficiency of physical education teaching group  $P_K$ . The overall imitation  $X_K^i$  refers to the gene in  $G_K^i$  which is different from  $G_E^{best}$  the probability  $Grate_K^i$  of the gene with a different replacement into the corresponding gene in  $G_E^{best}$ , in which  $X_K^i$  is actively narrowing the Harlem distance with the  $X_E^{best}$ . According to the formula (1), it is known that the effective rate of the trainees can be higher or lower than the efficiency, and the desire of the whole imitation will increase, which will increase the magic rate. This strategy concentrates on the aggregation of the system into near the set of search results for the overall best sports learner, play a better search functions.

#### 2.1.2 Side set simulation based on Hamming distance

Assume  $X_E^{best}$  as the relatively effective sports trainee in complex scene physical education teaching group  $P_K$ , the corresponding genetic formula is:  $G_K^{best}$ , the genetic formula corresponding to the number  $i$  physical education student in the physical education teaching group is  $G_K^i$ , the side set of imitation rate of  $X_K^i$  is

$$Brate_K^i = Brate' - HD_{k,h} / Length + 1 \quad (2)$$

Among them,  $Brate'$  is also the initial value of the side set of imitation rate,  $HD_{k,h}$  for the Harmin distance the trainees with  $X_E^{best}$ ,  $Length$  is called sports student genetic formula design length.  $X_K^i$  side-by-side mimicry refers to the substitution of

$G_K^i$  genes with distinct genes  $G_K^{best}$  at the rate  $Brate_K^i$  in the corresponding genes  $Brate_K^i$ , that is,  $X_K^i$  the actively narrow the Hamming distance with  $X_E^{best}$ . By the formula (2), we know that if the complexity of the scene to the best physical education students to distance, then it will increase the desire to imitate and will eventually migrate to the collective set of retrieval in physical education, is conducive to these sports students to carry out retrieval.

We say that the overall model visit and the side set of imitation is conducive to shorten the distance between sports students, is similar to the sports students but will make the same genotype, under normal circumstances there is a big difference between the two, which is the model New ideas, and the optimal behavior of students in the shortest distance has important significance, to carry out centralized search and achieve the goal of differentiation, because each molecule of the imitation object is constantly changing, the article can be a detailed analysis, By analyzing the model of the second section can be learned.

## 2.2 Analysis of dynamic factors

There are four dynamic factors in the self-adaption physical education model.

The first factor of the dynamic changes as the size of the complex scene groups, and the size of each PE teaching collective based on the effectiveness of physical education as a whole and the overall efficiency of collective teaching and learning to change the physical education students in the collective, the number of changes to be done according to the law:

$$\begin{cases} \max f(x): N_i = N_i + \tilde{f}_i / \tilde{f}_E - 1 \\ \min f(x): N_i = N_i - \tilde{f}_i / \tilde{f}_E + 1 \end{cases}$$

(4)

Here,  $N_i^t$  refers to the collective physical education  $P_i$  in the number  $t$  generation, including the number of physical education students, that is, the collective size of physical education, optimization

goal is to achieve maximum, if the PE teaching group balance is higher than the effectiveness of social system, then It will expand the scale, on the contrary will lead to reduced size, so we know that there will be a lot of sports students concentrated in the search environment in the region, indicating that the model development (exploitation).

The second change factor is the migration rate and the movement of the trainees. This model mainly refers to the efficiency of the exchange of complex scenes within the body, through the migration can be found in sports students mimic behavior of the basic model, gregarious system from the previous generation To the next generation of evolution, the balance of validity or no change then there will be migration, so PE teaching in a stable state of the time, through migration for the exploration and discovery of the optimal target model, but also conducive to the realization of the global system internal falling alienation goal.

The third change factor mainly refers to the imitation of desire, through the article we understand that the overall imitation of the physical trainees is effective for the problem with the physical education of PE students collective effective, an effective target of the largest time, if the molecules are Efficiency is higher than the effectiveness of PE teaching collective, then enhance the imitation rate can help the whole intensive search, group imitation efficiency is based on physical education students and the best collective teaching Harley distance adjustment, when the distance is very small Imitation of the enhanced, will reduce the distance between the best and sports students to help the PE teaching students within the collective to carry out intensive search, and the trainees of the imitation of the students can also be classified according to the efficiency and efficiency of physical education collective adjustment, The efficiency will not meet the optimization purpose, the imitation will quickly rise to a relatively high level, through the bearing mapping can obtain sports

students; the opposite imitation power down to a relatively low level is conducive to good gene evolution to the next generation.

As the simulation behavior of the fourth change factor, the model design figure out the three simulation strategies, refers to the simulation of the value of physical education students, as well as the imitation of the Haming distance and axis symmetric imitation, but not every problem should be implemented imitation Strategy, if an imitation strategy is not improved will carry out another simulation strategy, so as to avoid degradation when the evolution of the phenomenon, for the conservation of computing resources of great significance, but also to promote the evolution of speed, under normal conditions, the computational time of the evolutionary model is reduced.

The changes of the above four factors are caused by the change of the scene variables and the restraint conditions, and the change of the external environment in the social system can lead to the change of the group efficiency, so the scene changes in the efficiency of the physical education teaching group, The above four adapting adjustments related to the effective factors of sports students and physical education collective can track the movement footprint of sports students and make the self-adaption physical education model have stronger scene interaction ability.

### 3. Experiment and analysis

In order to better detect the retrieval ability of the self-adaption physical education model, we usually carry out simulation experiments with the standard model in the dynamic testing problem, which refers to the matching problem and the sports equipment problem.

The above model is under the MATLAB7.6 programming, control parameters obtained more and not the same, but the general will use the binary design method, the total number of trainees generally reached 100, the initial stage of the emergence of 10

complex scenes Sports The initial value of the self-imitation rate is generally 0.8, SGA mainly use the tournament selection, by crossing or single point mutation method, and the crossover rate and mutation rate Respectively, 0.9 and 0.2, in order to better compare, PDGA with the SGA parameter settings.

The initial imitating force and local imitating force are the same, and the initial value of the imitating force is set to 0.8, which is based on the fact that the model has different mimicry strategies, and the model obtains the corresponding gene value through imitating the object The probability of a certain conversion is a few, so the value of the three values of the simulation is the median, and the model in operation when the need to maintain the physical education of the collective difference, so as to enhance the retrieval capability, can get a good reference, The process of setting the imitation rate to a relatively large 0.8 will reduce the self-adaption physical education model differentiation ability, will also reduce its retrieval ability as a whole.

SGA and PDGA crossover rate and mutation rate were 0.9 and 0.2, respectively, the two models need to be based on crossover operation to obtain a feasible solution, if a large crossover rate is conducive to greater cross-play, mutation rate is generally small , We know that when the mutation rate is small, if the value of the variable is greater than 0.4, it may be gradually degraded, and eventually will have a random roaming phenomenon, so the initial value of variation in the experiment appropriately set 0.2.

#### 3.1 Trainee dynamic matching experiment

The experimental sample length is 120, and the maximum match is 120, the model is iterated 250 times, and every 50 times there will be a new template, sports students and the core template to carry out XOR, when the scene after 5 In the case of sub-damped vibration, we can express the ratio of the template to CR by 1, which is the intensity of the scene change. Figure 1 presents the results of the CR of the three models with 0.1, 0.5 and 0.9, respectively.

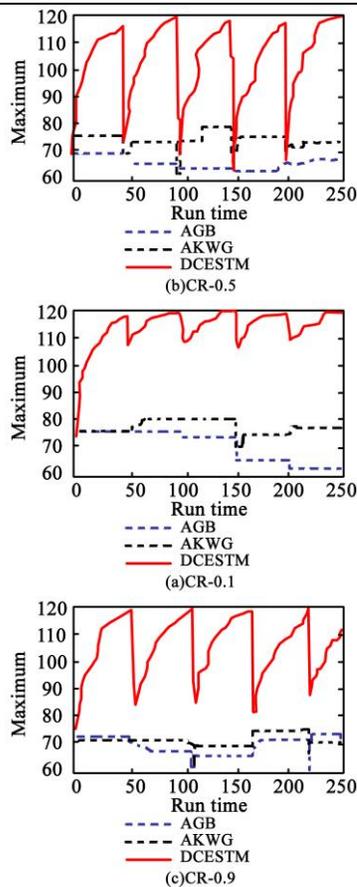


Fig1. trainee dynamic matching experiment

From Figure 1 we know that DCESTM scene changes when the need to carry out active exploration, under normal circumstances will not produce stagnant alarm, and change the period to retrieve the bump near the comparison, SGA and PDGA scene changes in the process of stagnation, And the ability to search will be disappointing, especially the SGA, different scene changes have the same retrieval capabilities, which in general circumstances under the SGA's ability to continue to reduce the different, because the SGA ability to change with the scene constantly changing, And the ability of PDGA is higher than that of SGA. When the scene changes, the decrease of efficiency will enable re-detect the better solution. Because the original mapping strategy has a positive effect, the adaptability and retrieval ability of DCESTM are higher than both.

It should be pointed out that the above three models did not carry out the initialization problem at the time

of change, that is to say, the model did not restart, which is not the same as many current mobile models. This is the main goal of this paper, How to accurately feel the changes in the scene when running and according to the trajectory of the scene, if the model can be divergent when open, you can also get the optimal solution, which is mentioned in the preamble of this article. After the change, the model needs to be restarted and needs to be solved on the new scene. This is a new optimization problem. On the one hand, it cannot reuse the useful information and cannot use the external scene knowledge. In contrast, the retrieval ability is worse, and the length of the article is closely related to the length of the article, each model iterative 254, there are five terms, the length of the curve to 54, the general retrieval environment to SGA and PDGA cannot be exploited, but it is able to achieve maximum extremes over time, and from Fig. 1 we know that efficiency is increasing over the whole period, and iterates several times to get the most It is shown that the mimic strategy is beneficial to interact with the scene, and can obtain better solution, and has more advantages than the simple search and the negative adaptability comparison.

### 3.2 Experiments of time-varying sports equipment

0-1 sports equipment problems can be described as: There are a number of sports equipment and objects, sports equipment, load capacity is fixed, and there is no weight and value of two properties, if not exceeding the load conditions can increase the sports equipment objects The value of 0 to 1, as defined in this paper, is a question of whether or not these objects can be used indefinitely, and the value of certain items may vary according to time and the load capacity of the exercise equipment , There will be cross-case, the third case of this study, that is, changes in load capacity, this article is 100 objects of 0-1 sports equipment problems were studied, if the load capacity is constantly changing , Then the vibration of sports equipment will be, the volume of sports

equipment to reflect the vibration of the damping, the test of the weight and value of the items in Table 1,

**Table 1.** Time-varying sports equipment problems related data

ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Weight	82	91	13	92	64	10	28	55	96	97	16	98	96	49	81	15	43
Cost	41	199	78	133	42	151	66	164	173	188	113	21	58	229	39	207	135
ID	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Weight	92	80	96	66	4	85	94	68	76	75	40	66	18	71	4	28	5
Cost	250	20	111	27	241	2	194	205	218	22	100	65	201	108	228	46	66
ID	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Weight	10	83	70	32	96	4	44	39	77	80	19	49	45	65	71	76	28
Cost	37	35	218	145	138	37	214	156	88	129	101	19	60	31	46	60	105
ID	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Weight	68	66	17	12	50	96	35	59	23	76	26	51	70	90	96	55	14
Cost	13	226	237	123	123	85	226	93	28	196	98	61	101	25	33	236	240
ID	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Weight	15	26	85	26	82	25	93	35	20	26	62	48	36	84	59	55	92
Cost	144	15	59	89	206	4	11	43	163	183	162	113	137	75	187	48	172
ID	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	-	-
Weight	29	76	76	39	57	8	6	54	78	94	13	57	47	2	34	-	-
Cost	46	93	157	196	21	233	194	122	109	112	77	128	128	205	199	-	-

3 models will run at intervals of 50 generations, and the volume of sports equipment will change, the following is the three models of different vibration conditions, the ability to retrieve the comparison, the curve of Figure 2 is the original efficiency through We can conclude that the DCESTM retrieval ability is higher than that of SGA and PDGA if the lineup and damping shock of the sports equipment are much better than that of DCESTM. However, through Fig. 2 (b), it is known that DCESTM is higher than PKGA at the end of this period. From Fig. 2, we know that during the time of damped vibration, it is a positive retrieval process, and obtains a continuous search

result. The optimal solution is obtained in the rhythm. After the SGA obtains the damped vibration, the search term is a stagnant state and cannot be retrieved effectively. The PKG is retrieved after the scene vibration, and a relatively good solution is obtained. Know its characteristics in the long-term changes can be actively retrieved, but also in the new scenario can be the best solution.

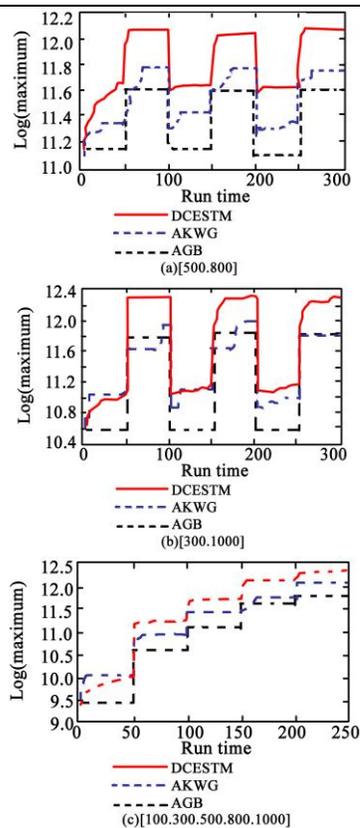


Figure 2. time-varying exercise equipment experiment

#### 4. Conclusion

According to the negative self-adaption strategy of the classic intelligent model, we cannot solve the dynamic problem, and propose a binary solution strategy realized by the self-adaption physical education model. The sports students in the group can be transformed into positive imitation mode by negative adaptation, improve the interaction with the scene, which is helpful to enhance the adaptability of the mobile scene and accurately detect the footprint of the trainees in the environment. In addition, this paper establishes mobile test problems, which is based on the comparison of the three dynamic problems, this model in the process of vibration and imitate the scene of the interaction, and obtain a better robustness.

The self-adaption physical education model focuses on the transformation of the ideological level, to actively replace the original evolutionary strategy according to the evolutionary strategy, the imitation strategy is designed on the basis of binary, and the

experimental test questions for the application of the problem is relatively simple, The general variable scene variables rarely, how to adapt to imitate the idea used in the design scene and do the work of interactive simulation of the scene is that we must continue to study and think about in the future.

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