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Cloud-service decision tree classification for education platform

Wang Chao, Wang Junzheng *

Jilin Agricultural University, Changchun City, Jilin Province 130118, China

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Abstract

Aiming at the NP hard problem existed in the university students' ideological education, this paper puts forward an optimization algorithm for the university students' ideological education based on the cloud-service decision tree classification algorithm. Firstly, it researches the ideological education model of university students, puts forward the optimized objective function and constraint of the university students' ideological education and establishes the optimized mathematical model, besides, it provides the multi-objective weight self-adaptation form; Secondly, it introduces the cloud-service decision tree classification algorithm, aiming at the problem that the fixed domain hunting scope of traditional cloud-service decision tree classification algorithm is not beneficial to enhance the algorithm hunting efficiency, to enhance the evolution efficiency of algorithm; finally, based on comparison experiment, it verifies the effectiveness of the algorithm, meanwhile, conducts systematic design on the algorithm in optimizing the university students' ideological education.

Keywords: Cloud-service decision tree classification; Local space; University students' ideological education; Algorithm evolution

1. Introduction

The university students' ideological education involves in many uncertain factors such as a large number of courses, students and classrooms, which causes it to become an extremely heavy work (Liu, Peng, & Yang, 2013; Xue, 2013). Especially universities have increased enrollment in recent years and paid attention to teaching quality, how to realize course configuration more reasonably and effectively is the important content emphasized by universities. Especially the raising of course resource sharing idea in many universities has made the university students' ideological education more important (You and Xie, 2016).

The ideological education problem of university students is a NP hard combination and optimization problem featured with multi-objective and multi-constraint (Latif, Abbas, & Latif, 2015). There have been many mature algorithms for such kind of problems, such as branch and bound (Yuan et al., 2015), grouping optimization algorithm (Yuan et al., 2015), association rule algorithm (Chen, 2017), which obtain certain effect in solving the NP hard combination and optimization problem but exist with the following problems: (1) The algorithms only aim at one certain problem in the solution process and form no universal ideological education solutions of university students; (2) The algorithms provide few judgement criteria in course arrangement but pays much attention to optimization in one orientation to be incapable in realizing the overall optimization; (3) The association rule algorithm exists with the problem of difficult acquisition in association rule in the solving process to cause non-universality and ideal solution (Guo et al., 2012; Cui, 2015; Rome, 2003).

* Corresponding author.
E-mail address: wangmingji90@163.com (W. Junzheng).

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Therefore, this paper adopts a kind of stable cloud-service decision tree algorithm and realizes the self-adaptation updating of hunting area of cloud-service decision tree classification thus to effectively reduce the calculation complexity and enhance the convergence speed based on guaranteeing the optimal point to be in the hunting area in order to enhance the ideological education effect of university students effectively (Meng and Arunkumar, , Arunkumar, 2018; Chen2017; Hamza and Muhammad, 2017; Fernandes et al., 2017; Arunkumar et al., 2017; Arunkumar and Ramkumar, 2017).

2. Ideological education problem model of university students

2.1. Introduction to the ideological education problem model of university students

Provided that the universities implementing the ideological education for universities students have *G*substitute teachers, *C*available university students' ideological education classes, *L*courses, *T*time periods of university students' ideological education, *R*classrooms. And the mathematical model can be described as:

The set form of available university students' ideological education classes: $C = \{c_1, \cdots, c_C\}$, the class size set: $K = \{k_1, \cdots, k_C\}$. The set of substitute teachers: $G = \{g_1, \cdots g_G\}$, the course number of teachers: $Y = \{y_1, \cdots y_G\}$. The course set: $L = \{l_1, \cdots l_L\}$, the class number for each course: $Z = \{z_1, \cdots z_L\}$. The classroom set: $R = \{r_1, \cdots, r_R\}$, the number of students for each teacher: $X = \{x_1, \cdots, x_R\}$. The time period set: $T = \{t_1, \cdots, t_T\}$.

Based on the calculation time and Cartesian product of classroom, the ideological education problem of universities students is transformed to be the model pair of course and proper classroom, the form is:

$$M = T \cdot R = \{(t_1, r_1), \cdots, (t_T, r_R)\} \tag{1}$$

2.2. Model constraint

Constraint 1: in the same time, one course and above can not exist in the same class at the same time, namely the constraint form is:

$$\sum_{g=1}^{G} \sum_{l=1}^{L} \sum_{r=1}^{R} c_c g_g l_l r_r t_t \leqslant 1 \tag{2}$$

In the formula, $c = 1, 2, \cdots, C, t = 1, 2, \cdots, T$. If the class $c_c$is in the classroom r_r, in the time period t_t, the substitute teacher $g_g$takes charge to teach the course l_l, and its expression form will be $c_c g_g l_l r_r t_t = 1$, otherwise, it is equal to 0.

Constraint 2: in the same time, the same teacher can not teach one course and above at the same time, namely the constraint form is:

$$\sum_{c=1}^{C} \sum_{l=1}^{L} \sum_{r=1}^{R} c_c g_g l_l r_r t_t \leqslant 1 \tag{3}$$

In the formula, $g = 1, 2, \cdots, G, t = 1, 2, \cdots, T$. If the teacher $g_g$is in the classroom r_r, in the time period t_t, the teacher $g_g$takes charge to teach the class $c_c$with the course l_l, and its expression form will be $c_c g_g l_l r_r t_t = 1$, otherwise, it is equal to 0.

Constraint 3: in the same time, the same classroom can not establish one course and above, namely the constraint form is:

$$\sum_{c=1}^{C} \sum_{g=1}^{G} \sum_{l=1}^{L} c_c g_g l_l r_r t_t \leqslant 1 \tag{4}$$

In the formula, $r = 1, 2, \cdots, R, t = 1, 2, \cdots, T$. If only the teacher $g_g$is in the classroom r_r, in the time period t_t, the teacher $g_g$takes charge to teach the class $c_c$with the course l_l, and its expression form will be $c_c g_g l_l r_r t_t = 1$, otherwise, it is equal to 0.

2.3. Optimization objective

The ideological education problem of universities students is a multi-objective optimization problem in essence, and its optimization objectives are as follows:

Objective 1: arrange important courses in the time period with good teaching effect. If $a_i (i = 1, 2, 3, 4, 5)$represents 5 classes each day, based on the practical teaching experience, wherein, the 1st, 3rd and 5th classes have best teaching effects, make $a_i = 1 (i = 1, 3, 5)$, the 2nd and 4th classes have poor teaching effects, make $a_i = 0 (i = 2, 4)$. Use the parameter $\beta_j = 1 (j = 1, 2, 3, 4)$to represent the importance of course, for example, the weight values of elective course, basic course, professional course and degree-based course are different, and the optimization objective is:

$$\max(f_1) = \sum (a_i \beta_j) \tag{5}$$

Objective 2: considering the class time and place raised by teachers, set the title coefficient to be $\chi_i (i = 1, 2, 3, 4)$, corresponding to assistant, lecturer, associate professor and professor respectively. When the teacher sets the class time, his will can be represented as $\delta_i = 0, 1, 2$, respectively corresponding to no, yes and willingness. Its optimization objective from is:

$$\max(f_2) = \sum (\chi_i \delta_j) \tag{6}$$

Objective 3: for the course with more class hours every week (such as $n \geqslant 4$), arrange it every other day to guarantee the teaching effect. The definition of $\beta_j = 1 (j = 1, 2, 3, 4)$is same to objective 1, the definition of $\varepsilon_i (i = 1, 2, 3, 4)$represents the teaching effect of the course arranged every *i*day, the optimization objective form is:

$$\max(f_3) = \sum (\beta_i \varepsilon_j) \tag{7}$$

Objective 4: resource utilization objective, the larger the student number $k_c$in classroom accounting for the class-