Construction of evaluation system for college students' career guidance service based on multi attribute group decision making

Yu Yu[1], Rui Tang[2], Yunfeng Li[1], Zhihua Zhang[1], Jie Li[3]

Abstract. In order to improve reasonability of service evaluation system construction for employment guidance of graduates, a service evaluation system construction for employment guidance of graduates based on decision tree classifier was proposed. Firstly, analytic statistics model for employment guidance of graduates was built with content-based method, and experimental analysis on clustering coefficient value of employment guidance service evaluation and analysis for undergraduates was implemented, optimal selection value of clustering coefficient was obtained; then, employment guidance evaluation model of undergraduates based on service evaluation system with decision classifier was built to realize the highest similar model classification for employment guidance of undergraduates, and content method model was used for correction; finally, effectiveness of proposed method was verified in simulation test of empirical data set.

Key words. Decision tree, Classifier, Employment of graduates, Evaluation system.

1. Introduction

Traditional university is represented by medieval European universities, imperial college and supreme college in ancient China, and takes discipline structure as center; the curriculum and teaching follow knowledge logic; the main teaching method is infusion and main learning method is memorization; economic foundation of build-

[1]School of Mechatronic Engineering, Southwest Petroleum University, Chengdu, China, 610500
[2]Sichuan Conservatory of Music, Party Committee Organization Department, Chengdu, China, 610021
[3]College of innovation and entrepreneurship, Southwest Petroleum University, Chengdu, China, 610500

ing universities is traditional economy or agricultural economy; student quantity in the college is small, it mainly cultivate ruling talents or professional research talents under the precondition of elite education. However, modern university is represented by universities arisen after British Industrial Revolution, especially local universities and vocational colleges; it takes improving better employment of students as center, the curriculum and teaching mainly follow practical logic; main teaching method is training and main learning method is practice; economic foundation of building universities is modern market economy; student quantity in the college is large, and it mainly cultivate modern citizens with better ability of making a living under the precondition of mass education or universal education. Modern universities especially local colleges take employment of graduates as center, and take better employment of graduates as logical starting point of all work in the college. Discipline construction and professional setting are constructed on such a starting point. So employment status of all disciplines in the university is an important standard to measure teaching quality of the university, is also an important reference factor of universities to adjust enrollment plan and reform professional setting. Just as comrade Lv Fuyuan, the original vice minister of education indicates: "Principals in relatively internationally known universities often put undergraduates in an important position; employment of graduates is a leading problem in fact, it can reflect many problems, so we shall grasp the link of employment of graduates severely and highlight its position, drive settlement of a series of deep problems by it, including enrollment, cultivation and discipline adjustment.

Local undergraduate universities studied in the Thesis refer to undergraduate universities in cities and states and newly established undergraduate universities. Newly established undergraduate universities refer to a great number of undergraduate universities newly established by all levels of government by merger, reconstruction and so on in the process that Chinese higher education transforms towards popular stage from elite stage. Employment quality of undergraduates is a concept with abundant contents. So-called employment quality of undergraduates is a comprehensive concept to measure employment status of students in universities in the whole process of employment using research result and practical experience of relevance theory as reference. Employment quality of undergraduates includes two parts: "Quality" mainly includes starting salary of undergraduates, employment structure and distribution, job matching, individual satisfaction, social recognition and other contents; "quantity" mainly refers to availability of employment opportunity for undergraduates, namely employment rate of undergraduates from the view of quantity.

2. Employment work survey of local universities and evaluation index system construction

2.1. Employment work survey of local universities

According to years of experiences for being occupied in employment of undergraduates, the Author thinks attention shall be paid to three aspects in terms of

employment of undergraduates. Firstly, employment results, namely employment rate. At present, employment rate has higher recognition degree in the society and is also the only index for some people to judge universities. Therefore, talking about employment separating from employment rate is impractical at present, and employment rate is still "lifeline" of local universities in certain period. Job result shall be considered in evaluation system; secondly, implement employment team construction. Only through constructing a powerful employment team, can correct implementation of policies and effective measures be guaranteed, and can employment be innovated and developed continuously; thirdly, employment environment construction. Employment rate of a university is inseparable with employment environment. Because good environment can improve work efficiency and improve backwardness. The Author designs *Questionnaire for Employment of Undergraduates in Local Universities* (filled by teachers) as shown in Appendix 1 and *Questionnaire for Employment of Undergraduates in Local Universities* (filled by students) as shown in Appendix 2 from these three aspects. 200 copies of *Questionnaire for Employment of Undergraduates in Local Universities* (filled by teachers) are specially issued based on the research, and 198 copies of effective questionnaires are returned. 1000 copies of *Questionnaire for Employment of Undergraduates in Local Universities* (filled by students) are issued, and 853 copies of effective questionnaires are returned. Main survey results:

(1) From statistical results of questionnaire in Appendix 1: Firstly, the condition that teachers participate in employment of undergraduates is unsatisfactory, because "not clear" is selected in the 11th, 12th, 13th, 16th, 17th and 18th question in 41.496% of questionnaires. Secondly, teachers pay more attention to employment rate of undergraduates, because there are relatively accurate answers in the 6th, 7th, 8th, 9th and 10th question in 89.9% of questionnaires. Thirdly, teachers hope the university to increase employment work engagement. 53.5% of teachers wish the university to increase capital input of employment to improve employment environment.

(2) From statistical results of questionnaire in Appendix 2: Firstly, students fully affirm employment in the university, because "Yes" is selected in the S, 7th, 9th, 11th, 13th, 16th, 19th and other questions in 8996 questionnaires. Secondly, students long for great social demand, because 91.8% of students wish the university to hold more recruitment fairs.

2.2. Employment work evaluation dimension and corresponding second class index confirmation

According to questionnaire results, through analysis and conclusion of questionnaire, and combined with practical conditions of employment work, employment is concluded into three aspects, namely attention on employment of the university, work performance and employment work environment construction. These three aspects of work are reflected by 10 second class indexes, and the other 10 second class indexes are specifically reflected by 27 third class indexes. Employment index system of undergraduates in local universities is constructed hereby, see Table 1.

Table 1. Structural frame table for employment index system of undergraduates in local universities

	First class index	Second class index	Third class index
Total employment situations of undergraduates in local universities (O)	Attention on employment work of the university (A_1)	Leaders participate in employment work (B_1)	The university sets up leading group of employment work taking the top leader as group leader (C_1)
			Conditions that employment leading group holds special session of employment work regularly (C_2)
			Use condition of employment fund in the university (C_3)
		Teachers participate in employment work (B_2)	Conditions that the university holds employment work meeting that teachers participate in (C_4)
			Conditions that teachers in the organization participate in employment work (C_5)
	Employment work performance (A_2)	Implementation of work (B_3)	Demanded information utilization (C_6)
			Default rate (C_7)
		Annual work performance (B_4)	Annual signature rate (C_8)
			Annual employment rate (C_9)
		Initial work performance (B_5)	Initial signature rate (C_{10})
			Initial employment rate (C_{11})
	Employment work environment construction (A_2)	Ideological education (B_6)	Conditions of implementing ideological education for undergraduates (C_{12})
			Implement education on leaving school morally (C_{13})
		Employment guidance (B_7)	Master employment and signature conditions and job tendency of undergraduates constantly (C_{14})
			Provide personality characteristics analysis and employment consult for undergraduates (C_{15})
			Organize special lecture and report of employment guidance (C_{16})
		Employment information (B_8)	Distribute employment information promptly by multiple forms (C_{17})
			Employment information number of recruiting graduates in the university (C_{18})
			Establish information base of employing organization (C_{19})
			Employment market development conditions of undergraduates (C_{20})

	Follow-up survey conditions of graduates once every two years (C_{21})
Employment work research (B_9)	Summary and analysis report of annual employment (C_{22})
	Writing employment work thesis of graduates (C_{23})
Standardized management (B_{10})	The university sets up professional team to take charge of employment work of graduates (C_{24})
	Submit data on schedule and data shall conform to requirements (C_{25})
	Implement national and school's employment guidelines, policies and regulations correctly (C_{26})
	Make employment work plan of graduates (C_{27})

3. Combination prediction for employment guidance of undergraduates based on decision tree classifier

3.1. Value decision and analysis for employment guidance service model of undergraduates

As for given employment guidance data set of undergraduates D, attribute space of the information is R^n, and n is quantity of information attribute. Decision classifier DT can decompose R^n into Q different areas. Class label of different area r_m is $r_m.cl$. Decision classifier DT is equal to subsection mapping of constant value $f_{DT} : x \to r_m \cdot cl$. It can realize construction of mapping relation between employment guidance sample of undergraduates $x \in D$ and corresponding area r_m, and obtain label value $r_m \cdot cl$ under such a condition.

There are two expressions of components and path structure for corresponding prediction area r of decision classifier, where path structure $r.p$ of prediction area r can be described as follows:

$$r.p = \{\cap d(a_v), v = 1, 2, \cdots, K_r\} \tag{1}$$

In the equation (1), $d(a_v)$ is taking value internal of employment guidance attribute of undergraduates a_v in prediction area r, K_r is quantity of involved node for prediction path between area r and root node, and operator $\cap$ is cross correlation conditions of different attribute quality inspection. Path structure $r.p$ can be associated with decision classifier DT and prediction area r and describe rule attribute between area r and root node.

In order to realize description of included contents in employment guidance set

D covered in area r, component structure form of r is given here:

$$r.c = \{num(k_1), num(k_2), \cdots, num(k_J)\}. \tag{2}$$

In the equation (2), J is category and quantity of employment guidance set of graduates, $num(k_1), num(k_2), \cdots, num(k_J)$ are sample quantities in area r and belong to $k_1, k_2, \cdots, k_J$ and other different category. $r.c$ component structure reflects component connection between employment guidance set D of undergraduates and prediction area r.

As for decision classifier DT_1 and DT_2 with different structure but correlation, similarity description can be implemented based on affinity prediction probability existing in employment guidance of undergraduates. As for prediction probability $P(r)$ for employment guidance of undergraduates, it can be divided into prediction component probability $P(r.c)$ and prediction path probability $P(r.p)$ according to access conditions. Component of prediction probability can be expressed as:

$$P(r_m.p) = V(r_m.p) \Big/ \sum_{l=1}^{Q} V(r_l.p). \tag{3}$$

$$V(r_m.p) = \prod_{v=1}^{K_{r_m}} (|d(a_v)|/|dom(a_v)|). \tag{4}$$

$$P(r_m.c) = |r_m.c| \Big/ \sum_{l=1}^{Q} |r_l.c|. \tag{5}$$

In the above equations, equation (4) is obtained hyper-volume after normalization operation of prediction area r_m in attribute space R^n. $|dom(a_v)| = \max(a_v) - \min(a_v)$ indicates taking value interval of attribute a_v, $|d(a_v)| = \max(a_v) - \min(a_v)$ indicates taking value interval of employment guidance attribute of undergraduates a_v in area r_m. In the equation (5), $|r_m.c| = \sum_{\rho=1}^{J} num(k_\rho)$ indicates summation for employment guidance sample of all undergraduates in area r_m.

Prediction value $P(r.p)$ of path probability obtained by equation (3) conforms to distribution consistency of attribute. For this, probability prediction value $P(r)$ needs to be solved according to equation (5) under accessible condition of training set D. At the same time, equation (3) and equation (5) only list component of prediction probability, and calculation form of total probability prediction is $P(r) = \{P(r_m)|m = 1, 2, \cdots, Q\}$.

After probability prediction value $P(r)$ is obtained, expression form of similarity for all kinds of decision classifier can be obtained based on the following equation:

$$\begin{aligned} S(DT_1, DT_2) &= s(P_{DT1}(r), P_{DT2}(r)) \\ &= \sum_{m=1}^{Q} [P_{DT1}(r_m) \cdot P_{DT2}(r_m)] \end{aligned} \tag{6}$$

In equation (6), $s(\cdot, \cdot)$ is probability affinity expression, can characterize similarity among different distribution of probability and satisfy $0 < s(\cdot, \cdot) < 1$. Then it is available that taking value interval of $S(DT_1, DT_2)$ is also $(0, 1]$. The higher similarity of prediction probability of DT_1 and DT_2 is, the closer $S(DT_1, DT_2)$ value is to upper limit 1. Otherwise, $S(DT_1, DT_2)$ value is closer to lower limit 0, and if $P_{DT1}(r) = P_{DT2}(r)$ exists, then $S(DT_1, DT_2) = 1$ can be obtained.

Calculation process of value decision and analysis for employment guidance service model of undergraduates is as follows:

Step 1: (Priori knowledge) use data set S_i in original data field of employment guidance of undergraduates to train decision classifier DT_i, and use employment guidance set T of undergraduates in target area to train targeted decision classifier DT_T.

Step 2: Make successive decision on similarity between decision classifier DT_T and targeted information for employment guidance service model of all undergraduates DT_i, and obtain $S(DT_T, DT_i)$. If data set S_i in original data area for employment guidance of undergraduates can be accessible, component structure $r.c$ in employment guidance area r can be predicted based on equation (10), and probability value $P(r.c)$ of prediction component can be obtained combined with equation (13). Otherwise, path structure $r.p$ can be obtained according to equation (13), and probability value $P(r.p)$ of prediction component can be obtained combined with equation (15).

Step 3: Implement normalization operation on similarity $S_i(DT_T, DT_i)$ of employment guidance service model target of different undergraduates. Weight value ω_i can be obtained and distribution of decision classifier is implemented.

Step 4: Decision classifier for employment guidance service model value of undergraduates $DT_T = \sum_{i=1}^{N} \omega_i DT_i$ can be obtained based on linear combination, and decision value for employment guidance service model value is output.

3.2. Correction for employment guidance service model value of undergraduates based on contents

All employment guidance of undergraduates in training set can extract an employment guidance service model list of undergraduates, and these employment guidance service models of undergraduates can indicate a model. As employment guidance service model quantity of undergraduates in all employment guidance of undergraduates is different, interpolation function can be adopted for all models to scale greatest possible attribute for employment guidance of undergraduates in training set. Then, construct a vector space representative, where each dimension represents one of matching models. Use decision tree classifier shown in section 3.1 in method model score prediction for employment guidance service model of undergraduates to implement score prediction training for employment guidance of undergraduates.

<instagram, -0.20>, <photos, 0.05>, <just, -0.77>, <so, -0.60>, <funny, -0.19>, <# sarcasm, -2.35>

Example 5: Given employment guidance of undergraduate t_k:" Some instagram photos are just so funny #sarcasm". In the example, we extract employment guidance service model list of undergraduates and their own scores: <some, -0.20>,

<instagram, -0.20>, <photos, 0.05>, <just, -0.77>, <so, -0.60>, <funny, -0.19> and <# sarcasm, -2.35>.

Methods based on contents and combined employment guidance evaluation methods of undergraduates for modules based on employment guidance service model modes of undergraduates are as follows:

$$S = \alpha \times SC + \beta \times SE\,. \tag{7}$$

Where S is the final score of employment guidance of undergraduates; SC is employment guidance score of undergraduates calculated by method module based on contents; SE is employment guidance score of undergraduates calculated by method module based on employment guidance service model of undergraduates; α and β are weight coefficient determined by training error score according to classification model of all methods, where $\alpha + \beta = 1$.

4. Empirical analysis

4.1. Evaluation result of evaluation system

Introduce employment work of part second class schools in Shenyang Institute of Aeronautical Engineering in 2009 into evaluation system (Table 1) established above, and employ 5 specialists to mark employment work of six second class schools in Shenyang Institute of Aeronautical Engineering in 2009 according to evaluation standards established in the above. Part indexes in the evaluation index are qualitative indexes, and marks of specialists will have differences, so weighted average method is adopted to reduce error here. Specific scoring conditions are as follows:

It can be obtained through the above experimental data that employment evaluation system in the research can reflect actual conditions of evaluated person comprehensively, and conform to objective reality of evaluated person. It can help the evaluated person to find and solve problems. Through empirical analysis, the evaluation system is applicable to employment work of local universities at present. Through the above analysis, it can be obtained that adopting employment evaluation index system can reflect employment work state of undergraduates in universities comprehensively, accurately and scientifically.

Table 2. Evaluation marking table for employment work in school of computing in shenyang institute of aeronautical engineering

Observation points	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Average score	Weight	Score
1	100	100	100	100	100	100	0.011	1.1
2	100	100	100	100	100	100	0.024	2.4
3	100	100	100	100	100	100	0.028	2.8
4	100	100	100	100	100	100	0.011	1.1
5	100	100	100	100	100	100	0.032	3.2
6	40	40	40	40	40	40	0.045	1.8
7	70	70	70	70	70	70	0.023	1.61
8	0	0	0	0	0	0	0.11	0
9	40	40	40	40	40	40	0.055	2.2
10	40	40	40	40	40	40	0.231	9.24
11	40	40	40	40	40	40	0.174	6.96
12	100	100	100	70	70	88	0.01	0.88
13	100	70	70	70	70	76	0.016	1.216
14	100	100	100	100	100	100	0.009	0.9
15	70	70	40	70	40	58	0.011	0.638
16	100	100	100	100	100	100	0.014	1.4
17	100	100	100	100	100	100	0.025	2.5
18	70	70	70	70	70	70	0.025	1.75
19	100	100	100	100	100	100	0.025	2.5
20	100	70	70	70	70	76	0.025	1.9
21	100	100	100	70	100	94	0.019	1.786
22	100	100	100	100	100	100	0.012	1.2
23	100	100	100	100	100	100	0.015	1.5
24	100	100	100	100	100	100	0.016	1.6
25	100	100	100	100	100	100	0.016	1.6
26	100	100	100	100	100	100	0.009	0.9
27	100	100	100	100	100	100	0.009	0.9
Total	2270	2210	2180	2150	2160	2192	1	55.58

4.2. Score comparison

Comparison conditions between score result for employment guidance service model of undergraduates and actual score result in data set 1 and data set 2 are shown in Fig. 1-2. Comparing algorithm is selected form algorithms in Literature [4].

It can be known from Fig. 5 and Fig. 6 that score result for employment guidance service model of undergraduates in the algorithm of the Thesis is closer to real score result of employment guidance service model of undergraduates than algorithm of Literature [4] in score comparison result of employment guidance service model of undergraduates, which reflects advantages of proposed algorithm in score result for employment guidance service model of undergraduates.
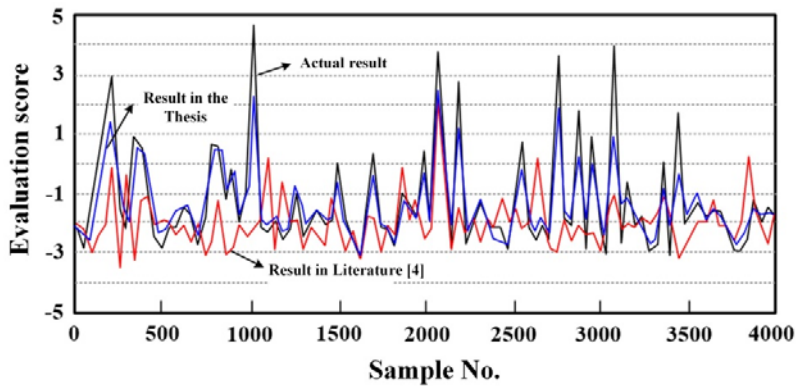
Fig. 1. Score comparison for employment guidance service model of
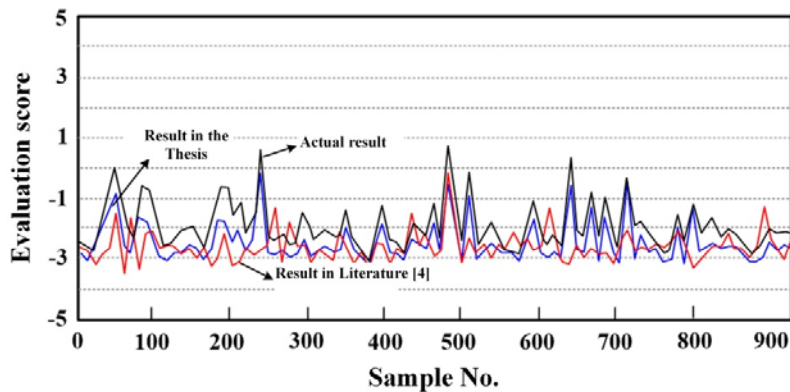undergraduates in data set 1

Fig. 2. Score comparison for employment guidance service model of
undergraduates in data set 2

5. Conclusion

In order to improve reasonability of evaluation system construction for employment guidance service of undergraduates, an evaluation system construction for employment guidance service of undergraduates is proposed based on decision tree classifier, and effectiveness of proposed methods is verified through simulation test in empirical data set. Based on the above analysis results, the following strategies and suggestions are proposed: (1) Improve talent cultivation quality and consolidate implementation foundation of employment guidance effectiveness taking employment and social demand as guide. Universities shall adjust talent cultivation mode, deepen education and teaching reform contents, optimize discipline distribution of universities and curriculum setting according to development trend of the society and demands of economic structure, industrial structure and employment markets on graduates in universities, combined with own actual conditions and taking em-

ployment as guide. (2) Employment market in campus should be actively cultivated in order to provide base of employment guidance for college students. Aiming at reality that employment situation is gradually worsen for current graduate students and non-standard external employment market, all universities should practically attach more importance to cultivating employment market in campus, should further normalize campus recruitments, and should actively establish stable employment site and safety job selection environment for graduates by taking schools as main bodies. (3) Propaganda should be enhanced in order to win over policy and financial supports to provide environment guarantee for employment guidance. Starting from improving talent cultivation quality and drive sustainable development of universities, universities should pay high attention to implementation of employment guidance work in order to provide excellent environment guarantee for smooth and deep implementation of employment guidance. (4) Combining with reality, in order to establish full-process and special employment guidance curriculum system, on the basis of social demands and changes facing by universities at the time of talent cultivation, universities should adjust employment guidance content, optimize curriculum setup, establish employment guidance system which conforms to school-running reality, faces all students in universities, and can promote individual to realize employment. (5) Training for teaching staff should be enhanced in order to provide talent guarantee for exerting the effect of employment guidance. Strengthening guidance team construction is the key to completeemployment guidance work; having high-quality employment guidance team is talent guarantee for implementing high level employment guidance work and exerting employment guidance effect. (6) Employment guidance methods should be enriched; and employment guidance ways should be innovated, in order to fully exert the effect of employment guidance. Universities should constantly explore new employment guidance methods and ways in order to further deepen theoretic classes for adapting to different module plan ways with different features for different students. Employment guidance and career plan course should be incorporated into the whole teaching system.

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