[1]Jian Liu

Teaching Quality Analysis of Health Management Professionals in Colleges and Universities Based on Big Data Decision Tree Algorithm

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Abstract: - In this study, we investigate whether the big data decision tree approach can be utilised to evaluate the effectiveness of teaching in higher education by health management professors. In light of the expanding need for high-quality healthcare education by the professionals, it is absolutely necessary to evaluate and enhance the teaching efficacy of healthcare management specialists. The application of big data analytics towards the creation of a method for the evaluation of instructors that is both objective and precise is the focus of this study. Every educational system may be broken down into its two primary components: teachers and pupils. The students are not only passive recipients of the instruction that their teachers provide. All of the desired instructional achievements must be driven by the effort of the students in order to fall within the category of "subjective initiative." Therefore, the first step in any educational activity should be encouraging pupils to build their own sense of initiative and intrinsic motivation to learn. This should be the case in any educational endeavour. If teachers have access to and make use of reliable employment data for statistical analysis, they will be able to have a more significant impact on the kids they teach. Based on a preliminary set of actual university employment data from 2012, this study compares the results of employing the C4.5 approach with a decision tree generating technique for the assessment of the teaching quality by the professionals. Both approaches were used to analyse the data. The findings demonstrate that a straightforward decision tree structure may be obtained using the decision tree approach that makes use of the multiscale rough set model. In addition, our approaches don't need to use overlapping data sets, and they're quite efficient from a computing standpoint. The relevance of this study lies in the fact that it sheds light on how the expertise and motives of teachers who are healthcare professionals to be precise, reflect on the learning of their students and their relevant field skills.

Keywords: Educational Impacts; Data Analysis; Health Management Learning; Decision Tree; Teaching Quality

1. Introduction

One of the new challenges in the quest to increase access to higher education is making sure that the teaching quality of the professors and their filed skills are properly assessed, (Zhu et al., 2023). The overarching idea of higher education is that it should be "service oriented and perfectly qualified," with the ultimate goal of creating skilled and reliable professionals in the fields of production, management, and service. In other words, everything of higher education is now "competency based" (H. Zhao, 2022). This style of education necessitates what is described as "double teacher quality" (Chen et al., 2020): educators who are well versed in both the theory and practise of vocational technology. For decades, research and experience in the classroom have demonstrated the advantages of "dual-teacher" instructors in the university setting (Li & Mao, 2022). Using structural equation modelling, this paper aimed to explain how "dual-teacher" professors can improve the overall aspects of learning for the students. To better support talent nurturing capacities and judgements on faculty development in higher education institutions, this was done (Cui, 2022). Teachers with "dual-teacher" characteristics may be better able to educate efficiently and realistically in accordance with the abilities required by actual occupations, as well as organise educational contents scientifically from the standpoint of practical application. Students are better able to learn the marketable skills businesses need when they are exposed to the needs of "appropriate quantity and sufficient use" in this way. When students understand professional information that is in line with real-world needs in the workplace and use what they have learned in a fair way to meet challenges in the real world, they considerably improve their capacity to apply professional knowledge (Z. Zhang et al., 2020). A positive feedback loop is created in the classroom when students have higher expectations for the quality of the lectures they attend. If lectures are presented in a way that is close to the students' actual work, students will be more engaged, understand the relevance of what they have absorbed, and rate the standard of the lectures higher.

[1]school of law, Dongguan City College, Dongguan , Guangdong 523419, China
E-mail: liujian@dgcu.edu.cn

Our research leads us to believe that teachers' professional competence includes a wealth of content knowledge (PCK), constructivist views, an innate passion for teaching, and the ability to self-regulate. Students seem to benefit from these instructor factors, and empirical research shows that they predict higher instructional scenario mastery. Nevertheless, our research questions in this study are guided by extra theoretical assumptions made by the competency method, which have not been tested experimentally yet. (J. Zhao & Li, 2022). In recent years, data mining has been recommended by academics as a way to address this problem. Particularly, they pushed for the use of decision trees, a common data mining classification method, to real-world decision problems (Hou, 2021). This approach is an enhancement of H1, the most widely used method for creating ID3 decision trees. H1 was invented by Quinlan. However, this strategy fails because of the ambiguity and unpredictability in labour market statistics. In (Matas-Terrón et al., 2020), a variant of the traditional decision tree called a fuzzy decision tree is used. By allowing decision tree learning to deal with ambiguity, this method expands the method's applicability. The difficulty of making sense of conflicting information in employment data is addressed in the article. (Wang et al., 2022) Historical employment data from schools tend to be noisier datasets than those utilised in the aforementioned methods due to the diversity and complexity of real-world job settings. In addition, the aforementioned approaches struggle to find satisfactory answers when confronted with the varying demands for decision precision across organisations at varying hierarchical levels. The idea of multiscale is included into the theory of rough sets through the multiscale rough set model (Rizvi et al., 2019), which serves as the basis for this technique. This method is quite effective in fixing the problem at hand.

This article proposes using the multiscale rough set model, the foundation of the decision tree approach, to analyse college graduates' chances of finding gainful work. The study relies on actual data from the labour market. The study compared its findings to those obtained using the C4.5 method and a rudimentary set-based approach to creating decision trees. We think teachers should apply the independent study method with their students, with considerable leeway to adapt the method to the needs of individual students and classroom circumstances. Moreover, this approach shouldn't be standard, but rather take into account the following three criteria: (3) to lead and support students in progressively developing the abilities necessary for learning by creating conditions in teaching, and stimulating the internal drive of active learning in students.

2. Literature Review

Formal education, according to the majority of contemporary educational theorists, should assist students develop an interest in gaining new knowledge, encourage the development of the ability to think critically, and get them ready for "lifelong learning" for the students and the professionals as well, (Nie et al., 2020; Palacios et al., 2021). Effective collaboration between health and social care providers is essential in the complicated field of patient care. But the data shows that these experts are not good at working together. One strategy to enhance teamwork and care for patients is interprofessional education (IPE). (Qian et al., 2022) Given the growing complexity of healthcare organization and delivery, it is not unexpected that IPE continues to attract attention. Population aging and the shift from acute to chronic disease care are two of the many reasons that need the involvement of many healthcare and social care providers in the provision of care. Thus, professionals from different fields must work together effectively to coordinate patient care. Regardless of the need, studies show that this kind of interaction may be difficult. When professionals from different fields work together, it may be difficult for them to grasp each other's responsibilities, which can lead to misunderstandings, poor communication, and a lack of coordination. Compared to a setup of multi-professional education, where professionals share knowledge but do not engage with each other (like in a joint lecture), or unprofessional education, where professionals learn independently, IPE has a greater potential to improve collaboration in practice and the health care of patients and clients by encouraging various professionals to come together and participate in learning.

Some researchers have used more inclusive methodological and outcome criteria to show the broader impacts of this kind of education since previous research did not find any IPE studies using randomized control trials before and following studies, or interrupted time series studies. Research from these reviews has shed light on how various IPE studies have affected various outcomes, such as how learners view each other's professions, how much they know about interprofessional collaboration, how they behave when working together, and how much better patient care is delivered. The majority of the research that was included in these evaluations did not deal with the issue of how IPE was defined, even if they did show that IPE had beneficial effects. It is also difficult to attribute observed improvements to IPE since most studies did not employ robust study methods and objective or well-validated measures of better professional practices or enhanced patient morbidity, survival, or satisfaction.

These below are two of the few studies that have explicitly linked instructor factors with student outcomes, particularly student success. We wanted to know how this connection works, therefore we looked at whether or whether variations in instructors' quality of teaching moderate the link between teachers' competency and students' growth. According to the researcher, three factors are essential for students to engage in mathematical lessons and continue to learn: the level of cognitive opposition and activation, the level of learning support through individual monitoring of the process of learning, and effective classroom management. To our surprise, we found that these three measures of classroom performance were each predicted by distinct areas of instructors' professional ability, (Alahmar & Benlamri, 2020). In addition, job positions and requirements have also been collected. In addition, unstructured data sources include clickstream data generated from page interactions. The gap in information that exists between applications and analytics can be bridged with the use of complete or incremental data collecting (Tyagi & G, 2019). There are many different resources available at educational institutions that gather and disseminate data regarding career opportunities. The bottom storage layer architecture of HDFS may accommodate unstructured, semi-structured, and structured data; however, structured data is often kept in Hive or Hbase and Solr before being moved to HDFS (Alsalman et al., 2019). HDFS components can be used to store all three types of data. It is imperative that the data that is saved for employee records be assured to maintain its integrity, timeliness, standardisation, correctness, and authenticity. These methods include data verification, extraction, cleaning, and conversion. The employment data warehouses at colleges keep a variety of sensitive information, including students' names, ID numbers, addresses, phone numbers, job preferences, salary ranges, and other information; a leak of any of this data would have major ramifications for both the students and the businesses. Desensitisation processes make use of data manipulation in accordance with a predetermined set of guidelines in order to consistently preserve the privacy of individual units and persons (Yahia et al., 2021; J. Zhang, 2021). The fact that some work documents are of a personal nature makes this step very necessary. It will then be possible to do data matching and integration when the employment data has been obtained, sanitised, and de-identified. This model would have a variety of views and levels of investigation. An employment data warehouse that does a multidimensional analysis of factors such as recruitment firms and so on can better serve the general public by providing a uniform data interface. This is one way to achieve this goal.

3. Methodology

Decision Tree Generation Algorithm According to MRSM for the Labor Assessment of the Healthcare Professionals

The variable precision rough set theory-based MRSM-based decision tree generation technique makes use of the property that variables give distinct decision rules at different scales by combining scale variables and scale functions. The characteristic to be used for categorising each node must be chosen before constructing a multiscale rough set decision tree. The decision rule of a node can be given optimal input if the sample data is classified using a classification attribute. It can then be used as the basis for classification. Since the deterministic data will encounter an approximation inclusion challenge because of the existence of the approximate boundary domain, uncertain data may also be helpful for decision making. The root node's extended attribute is most helpful for estimating classification accuracy. The following formula is used to get a general estimate of a classification's efficacy:

$$(1)\ \boldsymbol{d_{ci}(Di)} = \frac{\sum_{i=1}^{n}\}\boldsymbol{apr_{ci}^{f(s)}(Yt)_i}}{\sum_{i=1}^{n}\}\boldsymbol{apr_{ci}^{f(s)}(Y)_i}}$$

By applying suppression factors during decision tree generation, decision tree pruning helps to speed up the decision tree generation process and reduce the number of steps required for pruning after the decision trees have been generated. Moreover, the resulting decision tree is simpler and more intuitive, making it more suitable for use by human decision-makers.

4. Application in Data Analysis

The first stage in data mining and analysis in the context of the labour market is to decide what you'll be analysing the data on. Companies that are supported exclusively by outside investors are considered "foreign-funded," while businesses owned by the government, educational institutions, and other comparable organisations are called "institutions." A tiered system was developed because of the therapeutic benefits offered by various business

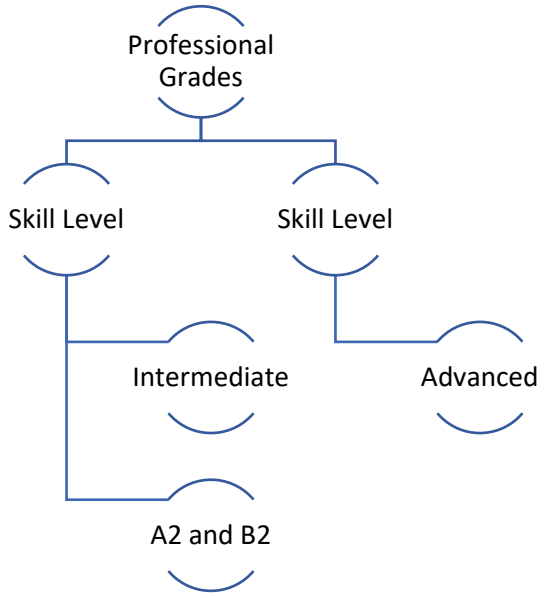
formats, geographic regions, and other factors. All across the world, various corporations, governments, and other organisations were given the qualitative and quantitative quality marks of "good" (C1) and "general" (C2), respectively. Table 1 displays the results of the numerical analysis.

Table Students Data through the Quality Assessment of Tutors 1 –

S. No	Professional Grade	Foreign language Grade	Computer Grade	Skill Level
1	Average	A	1	Intermediate
2	Great	A	2	Intermediate
3	Good	4	1	Advanced
4	Good	A	2	Intermediate
5	Good	A	2	Intermediate
6	Good	4	2	Advanced
7	Good	A	1	Intermediate
8	Good	A	1	Intermediate
9	Good	A	2	Intermediate
10	Average	A	2	Advanced
11	Great	4	1	Intermediate
12	Average	4	1	Advanced
13	Great	6	2	Intermediate
14	Great	A	2	Advanced
15	Average	A	1	Intermediate
16	Great	A	2	Advanced
17	Great	A	1	Intermediate
18	Good	A	2	Advanced
19	Good	A	1	Intermediate
20	Good	4	1	Intermediate

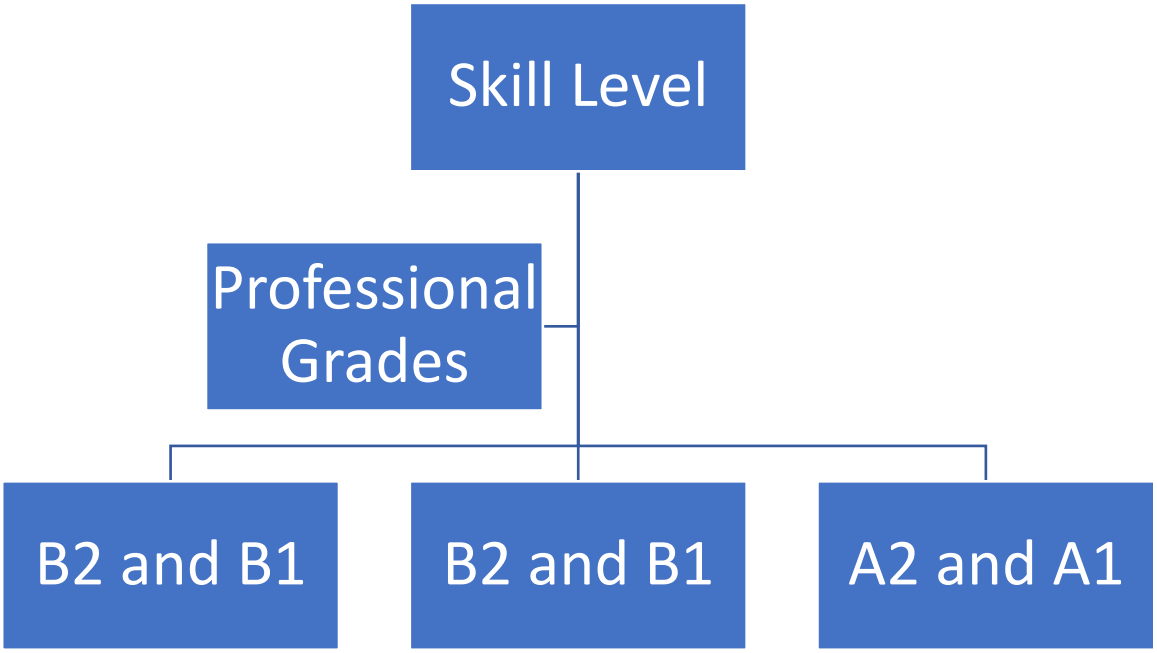
The scaling function are f(s) = 0.4 and the threshold f(s) = 0.6. The following procedures constitute the algorithm for constructing a decision tree: Each conditional attribute's approximation of its correctness with respect to the decision attribute, f(s), may be calculated using Equation (1), yielding values of 0.74, 0.15, 0.32, and 0.15 for dci(D), respectively. It is necessary to take the current subset and redo the computation from Step 2 when e2 = 2 and e3 = 3. The node whose attribute was chosen (here, skill level) is now known to be the tree. (5) Using Equation (1) again, we redo the approximation and get dci(D) = 1. Onward until you reach the 8-node, 3-level depth, 5-leaf decision tree seen in Figure 1.

Figure 1 - At f (s) = 0.4.



One of the various scale functions that can employed to build decision trees is f(s) = 0.6, which we again choose for this computational investigation. With those inputs, we may construct a decision tree (Figure 2).

Figure 2 – At f(s) = 0.6.



By analysing experimental results reported here, we found that as s was made larger, f(s) increased, the information display became more elaborated, and the quantity of decision rules increased over time. The complexity of the resulting decision tree, however, increased as a result. Concurrently, the scope of the governing principles expands. But keep in mind that with increased noise comes the possibility of unclear decision rules due to the improved coverage of the rules. Remember this, because it's important. Therefore, it is important to assess the accuracy requirements of different users and tailor the parameters of f(s), in choice analysis and the user's level of precision. Doing so will guarantee that the various users' needs for precise decisions are met.

By expanding its roots, a decision rule is generated using a decision tree generated using the Minimum Spanning Root Method (MSRM). The studied data set on employment training provided in this study, along with Figure 1, can be used to make decisions. First, those with "medium" ratings have a better shot at finding job in the private sector. If the grade is "good" and the skill level is "intermediate," as specified in Rule 2, then employment is typically based on private enterprise units. Those who meet the criteria of Rule 3 (a professional grade of "good" and an advanced skill level) can find work in institutional settings. Principle 4 states that one should not expect a job offer from a private sector employer if one has an "excellent" professional grade but only a "medium" competence level. It is crucial that the content of professional course syllabi be as relevant as feasible to the world of work within the context of the talent training plan. This will make it easier for recent grads to find work.

5. Result

To demonstrate the utility of the approach for labour market data mining, the following setting was used: These are the minimal minimums for applications and operating systems: MATLAB v6.5, and Windows XP Service Pack 3. Employment data from Table 1 was utilised as the experimental training set, and a preliminary set generated by the decision tree generation method was used to evaluate C4.5 (for the quality assessment) and formation. Table 2 provides a summary of the results. Task data was analysed using a multiscale rough set model and a decision tree generation technique. This study did not produce an unusually large or profound tree structure. This produced discrepancies all over the data collection and a limited range of rules. There was analysis of assessment quality by the two competing algorithms, but the decision trees were complex, the rules were extensive, and the dataset was unexpected.

Table 2 – Decision Tree Algorithm

Algorithm	Scale	Depth	No. of Rules	Non-separable Dataset
MRSM f(s) = 0.4	7	3	5	0
MRSM f(s) = 0.6	9	3	4	0
C4.5	19	5	7	0
RS	15	6	6	2

It is important to consider the decision tree's complexity and accuracy in classification when contrasting methods for creating decision trees. When the categorization discovery model talks about complexity, it is referring to the difficulty of a problem description in terms of its rules. A rule's clarity can be measured in a number of ways, including its decision tree complexity and computation time consumption index. Another indicator of difficulty is the amount of time needed to calculate the answer. High accuracy shows the prospect of getting more precise classification data while working with massive amounts of data. A good classification model will be able to accurately forecast new classes of data. Following its development on the training set, the aforementioned decision tree model was tested on a dataset consisting of one thousand employment records. There are two phases to the decision tree's implementation: training and validation. Experiments comparing the method to the C4.5 and RS algorithms, with scale functions of f(s) = 0.4 and f(s) = 0.6 as shown in Table 3. It can be seen that although having poorer classification accuracy for many values, it surpassed the RS algorithm. The experimental sample data set degraded the accuracy of the decision tree. Consequently, the decision analysis must place a high value on the parameters selected so that they are suitable for the dataset and the accuracy with which the user describes the research topic.

Table 3 – Comparison of the Performances

Algorithm	Classification Accuracy	Running time
MRSM f(s) = 0.4	75%	111.5
MRSM f(s) = 0.6	80%	104.3
C4.5	69%	99.1
RS	79%	100.4

The Deduced Results for the Quality Testing of Professional

Finally, we looked at the health management lecturers' pedagogical quality using a big data decision tree approach. Our findings support the practicality of decision trees as a tool for assessing educational programs. Using the decision tree approach, we were able to draw significant conclusions and identify interesting trends about the quality of the instructors. Those in charge of faculty development and assessment in higher education may use the study's findings to make their processes better. In addition, we may discover details and patterns that weren't there before by merging big data with the decision tree method. By adopting this approach, we can better assess educators by considering all factors that impact student achievement. College and university administrators in charge of academic affairs and human resources will find our study's findings useful. If universities incorporate the results into their faculty evaluation systems, they may better evaluate the quality of teaching and make adjustments that benefit all students. Finally, our study adds to the body of knowledge on health management education by providing a quantitative way to evaluate the effectiveness of professors in the subject. Health management programs at the university level may benefit greatly from the results of this research, which will provide the groundwork for future improvements.

6. Conclusion

Finally, we looked at the health management lecturers' pedagogical quality using a big data trees approach. Our findings support the practicality of decision trees as a tool for assessing educational programs. Using the decision tree approach, we were able to draw significant conclusions and identify interesting trends about the quality of the instructors. Those in charge of faculty development and assessment in higher education may use the study's findings to make their processes better. In addition, we may discover details and patterns that weren't there before

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