ISSN 2706-6827 Vol. 3, Issue 13: 89-94, DOI: 10.25236/IJFS.2021.031314

Analysis and Application of University Human Resource Management Dependent on Ontology-based Decision Tree Algorithm

Xuejia Zeng

Office of the Party Committee, President's Office Southwest Petroleum University, Chengdu, Sichuan, 610500, China

Abstract: *In the analysis of teaching arrangements and flow of teachers, traditional manual analysis has problems such as insufficient data and low efficiency. In this paper, the ontology-based decision tree algorithm is used to establish an ontological attribute table, perform categorical data analysis, and use it in the university human resource management (UHRM). The experimental results have suggested the effectiveness of the ontology-based decision tree algorithm in the analysis of UHRM.*

Keywords: *Ontology-based Decision Tree Algorithm, University Human Resources, Management Analysis*

1. Introduction

With the continuous development of social economy in China, the development positioning of universities is also different [1-2]. The national policy support for universities in the west aims to narrow the gap in educational resources between the east and the west. However, the flow of teachers between universities still exists. : In the analysis of teaching arrangements and flow of teachers, traditional manual analysis has problems such as insufficient data and low efficiency [3-4]. Hence, the use of data mining technology to efficiently dig out this confidential information is an effective means to improve the current level of UHRM, enhancing the competitiveness of schools [5].

Classification is one of the crucial directions in data mining. The current mainstream methods mainly include decision tree classification, and neural network classification, etc. However, current classification methods are mainly suitible for the business field, and they are rare in the human resource management of colleges and universities [6]. In this paper, the ontology-based decision tree algorithm is used to establish an ontological attribute table, analyzes categorical data, and uses it in UHRM to improve the management level.

2. Ontology Description Language

2.1. Development of Ontology Description Language

Originated from the research of knowledge representation in the field of artificial intelligence (AI) in history, ontology description language is mainly represented by the following languages or environments: KIF and Ontolingua, OKB (open knowledge base connectivity), OCML (operational conceptual modeling language), Frame Logic, LOOM, etc.

In recent years, Web technology has offered a convenient means for global information sharing, and the combination of ontology characterized by sharing and Web technology is an inevitable trend. In this context, the ontology description language based on Web standards (hereinafter referred to as “Web Ontology Language” for short) has become a hotspot in the research and application of ontology.

In standards, RDF (resource description framework) and RDF Schema developed by W3C are based on XML grammar, based on semantic networks (semantic networks), and are language specifications for semantic description of information resources. RDF adopts “resources” (resources), “properties” (properties) and “statements” (statements), and other triples to describe things.

RDF Schema is further extended by adding primitives such as rdfs: Class, rdfss: ub Class Of,

ISSN 2706-6827 Vol. 3, Issue 13: 89-94, DOI: 10.25236/IJFS.2021.031314

rdfs:sub Property Of, rdfs: domain, rdfs: arnge, etc. based on the similar framework for classes, parent-child classes, parent-child properties, and properties to define and express the domain and value domain. In this way, RDF(S) has become a standard language for describing the ontology preliminarily. However, for ontology description language to become universal, some important issues need to be solved, such as effective support for reasoning (including computational complexity and decidability, etc.), formal and adequate semantic representation mechanisms, and standardization issues, depending on the development of an ontology language based on description logic.

2.2. Ontology Creation

Currently, there are dozens of tools supporting the development of Ontology, with different functions. The support capacities, expression capacities, logical support capacities, scalability, flexibility, and ease of use of the Ontology language are very different, among which Protege-2000, OntoEdit, OilEd, and Ontolingua, etc. is famous.

OWL is an ontology language for processing web information. Web information has a precise meaning. Web information can be understood and processed by computers, which can integrate data from the Web.

Protege is ontology editing and knowledge acquisition software developed by the Stanford University. The development language is Java, which is open-source software. Due to its excellent design and numerous plug-ins, Protege has become one of the most widely used ontology editors for establishing OWL.

Protege adopts the forms as the interface for entering slot values. Protege's knowledge model is compatible with OK.BC, including support for multiple inheritances classes and class hierarchies, templates and private slots, arbitrary faces of slots, and clear instructions before definition. The hierarchy is clarified, including values, cardinality constraints, default values, reversal slots, metaclasses, and metaclasses.

Beside the user-friendly interface, Protege has two essential features that make it stand out from most ontology editing environments, that is, scalability, and extensibility. Developers can use Protege to establish and use ontology, including 150,000 frameworks. The support for the knowledge base included in the previous frame contains two components, one is the back-end database to store and query data, and the other is the buffer mechanism, which has addressed the problem of failure when the number of frames exceeds the limit of memory.

The main advantage of Protege architecture is its open and modular style. The component-based architecture enables system developers to add new functions by generating appropriate plug-ins. Plug-ins can be divided into three categories. One category is the back-end plug-in, which allows users to store and input the knowledge base in multiple formats. The second category is the slot widgets plug-in, which can merge slots or display for specific domains or specific tasks. The third category is tab plug-in, usually together with the Protege knowledge base, to provide knowledge-based applications. The back-end plug-in supports storing and importing ontology in RDF Schema, XML files with DTD, and XML Schema files. Slot widgets plug-ins includes user interface components that display GIF pictures and audio videos. Tab plug-ins are highly popular, which can provide advanced visualization and ontology Merging, version management, reasoning, and other functions. For example, OntoViz and Jambalaya in the tab plug-in provide different views of the knowledge base. The Jambalaya tab allows interactive navigation, zooming of specific elements in the structure, and different levels of nodes in the image to highlight the connections between data clusters. In general, there are two strategies for domain knowledge acquisition: manual + auxiliary tools (graphic user interface); automatic/semi-automatic + manual proofreading. The former is relatively simple. Manual work is still the main body. However, it provides some graphical auxiliary tools for transplanters to facilitate and accelerate domain knowledge acquisition. The latter adopts guided, unguided, or indirectly guided machine learning technology to automatically or semi-automatically obtain domain knowledge from text data, with little manual intervention.

2.3. Knowledge Model of University Academic Affairs

The educational administration knowledge model in colleges and universitiesconsists of two sub-models: educational administration and scientific research. Among them, educational administration includes educational administration objects, educational administration resources, and

ISSN 2706-6827 Vol. 3, Issue 13: 89-94, DOI: 10.25236/IJFS.2021.031314

educational administration processes; scientific research includes subject direction, academic treatises, scientific research scholars, academic institutions, scientific research projects and information sources. The basic model is shown in Figure 1.

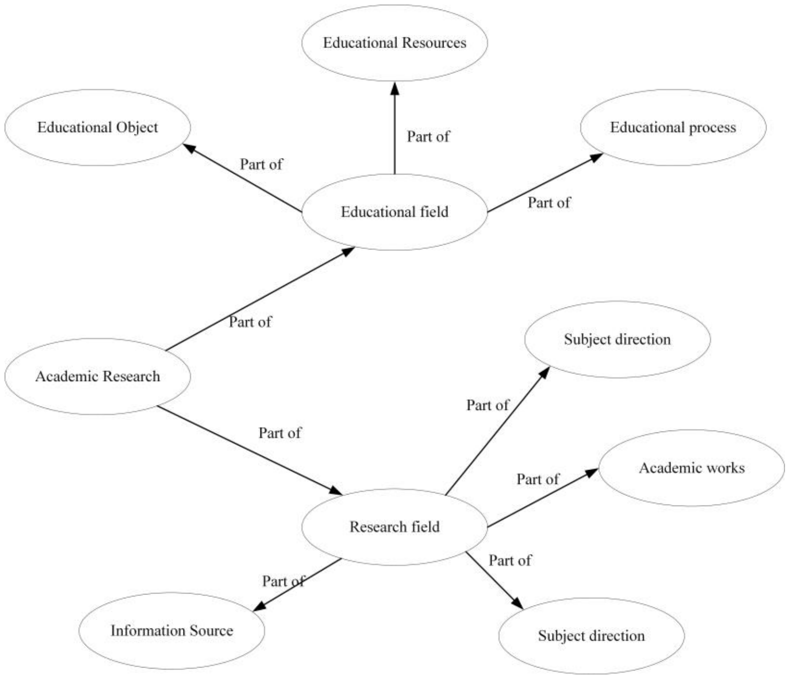

Figure 1: Educational and scientific research information school type

In the section below, only the field of educational administration management is analyzed. Hence, only the domain ontology model related to the field of educational administration management is established. The domain ontology is based on the data dictionary of the educational administration system. Based on actual needs, the ontology description requires multiple classification levels. Most of the ontology is converted from glossaries and academic industry-standard codes. The steps for establishing ontology in the field of educational administration management are as follows:

(1) Identify the description of terms and meanings in the academic field;

(2) Analyze the metadata of educational affairs;

(3) Analyze the role of participating in activities in the academic field;

(4) Analyze the E-R relationship of the OLTP system as the source of database data;

(5) Establish the analysis ontology of educational administration based on E-R relationship, domain terminology and business metadata.

The following figure shows the global ontology in the educational administration, where:

Part-of indicates the relationship between part and whole between concepts.

Is-a indicates the inheritance relationship between concepts, which is similar to the relationship between the parent and the child in object-oriented.

Attribute-of indicates the relationship between entities and attributes.

3. Application of Ontology-Based Decision Tree Algorithm in University Teacher Management

3.1. Store OWL Object Method

OWL indicates a domain of knowledge requires storing massive data. Although these data can be stored in XML files, relational database systems provide a better way for data storage and retrieval. Naturally, a relational database is used to store OWL data. The following describes the methods for storing OWL objects in the database.

(1) Level table method

ISSN 2706-6827 Vol. 3, Issue 13: 89-94, DOI: 10.25236/IJFS.2021.031314

The most promising method is to store all the entities of the OWL object in a table in the database. The summary of the table reflects the hierarchy of the entire class in the OWL object. The ID of the entity, class name, and all attributes of the Owl object are the fields of the database table. For entities, the attribute values are stored in the corresponding columns. This method is simple and easy to implement.

(2) Vertical table

One table is used to store all data. It has only three fields: the subject field stores the entity name, the predicate field stores the attribute name, and the object field stores the attribute value. It is a general method for storing data in relational databases.

(3) Horizontal method

In this method, each class is mapped to a separate table in the database. For each attribute of the class, a corresponding field is provided in the table. Entities that fall into the same class are stored in the same table. This method pair corresponds to the entity-relationship model in database theory.

(4) Create a table for attributes

Another method is to create a separate table in the database system for each attribute of OWL objects. The method has been successfully used in some knowledge base systems, where the table corresponding to attributes stores the subjects and objects.

3.2. Design of Ontological Attribute Table

In the method for storing data in the relational database proposed in this paper, a separate table is createdin the database system for each attribute of the OWL object. Subsequently, a separate table is created for each attribute in the associated field of achievement. Its advantage is that it responds quickly to data queries.

Based on the characteristics of university courses, the university is a credit system. The college will formulate some compulsory courses related to the major, and some courses are required if students choose the major. Meanwhile, to enable students to have a certain understanding of other colleges, And some credits have been added. These credits must be selected across colleges and cannot be selected in this college. For the courses of these credits, students choose autonomously. If students lose their interest in a certain college course through the class, or fail the final exam, they are not required retake this course and can choose another option.

The name of all compulsory courses is represented by the required field, all required courses are represented by the optional required field, and all cross-college elective courses are represented by the optional field. The design of the course attribute form is shown isn Table 1.

Table 1: Courses and concepts of a college of science

Field	Description	Types
ID	Logo	char
LesssonCode	Course code	char
LessonName	Course name	ntext
LessonGrade	Course category	ntext

The objects of lectures are teachers, and the main attribute of the concept is the curriculum, which is determined by the college based on the importance of the curriculum, such as whether it is an optional or compulsory course. Teacher level naturally becomes the basis for classification, such as excellent teachers, first-level teachers, and second-level teachers. Subsequently, first-level teachers are represented by first-level fields, excellent teachers are represented by excellent fields, and second-level teachers are represented by second-level fields. Achievement is a measurement attribute based on the curriculum concept. The level of achievement directly affects the course arrangement by the administrator, including the exchange of teachers, changing the place of class, and the ratio of male to female when enrolling students. It is the most direct decision-making basis for educational administrators. In the relational database, the discrete value of the specific score value is too large. Based on the ontological application in the score-related field in Chapter 3, it can be converted into the following mapping table, Y is the score between 60-100, and N is the score is 0 Score between -59; Y indicates the field that failed the average score, and N indicates the field that failed the average score.

The table is queried in a relational database by using SQL statements, the final decision data that

ISSN 2706-6827 Vol. 3, Issue 13: 89-94, DOI: 10.25236/IJFS.2021.031314

needs to be obtained is course category, teacher level, student gender, class location, grade level (Y or N). Table 2 shows the final exam results of students after class.

Table 2: Low-degree attribute table of a college of science with the concept of curriculum

Field	Description	Types
ID	Logo	char
LesssonCode	Course code	char
StudentNo.	Student ID	char
Mark	Fraction	char
MarkGrade	Score grade	char

Faculty resources in colleges and universities are scattered in various departments. Before the algorithm is applied, the data are integrated, sorted, purged (to remove noise), and transformed into a unified format suitable for data mining, that is, data transformation. For continuous value attributes, this step very useful. For example, the numeric value of the attribute "age" can be generalized into discrete intervals, such as old, middle-aged, and young.

The decision tree generated based on the improved decision tree algorithm is shown in Figure 2. School administrators can refer to the obtained decision tree to formulate measures to retain talent better.

The experiment data confirms that the results are essentially the same. However, the path of certain judgments in the decision tree is longer. For example, most people who leave their jobs because of the "poor urban environment" are elderly people. However, in the decision tree, the values of multiple attributes shall be judged. From this point of view, it is still necessary to perform pruning operations on the decision tree, or when converted to "IF...THEN..." rules, the "if" conditions can be integrated so that the judgment operations can be reduced.

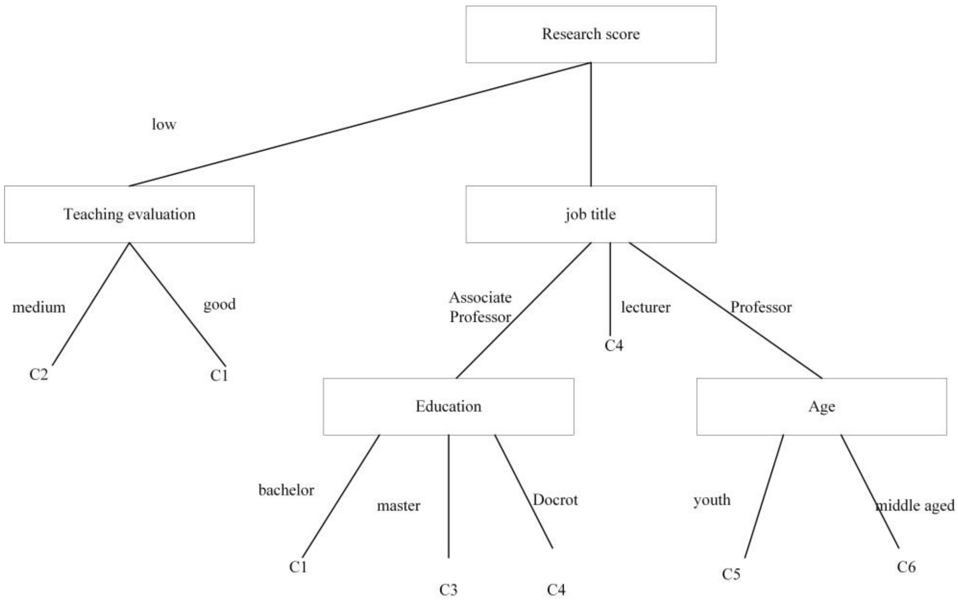

Figure 2: Decision tree for the analysis of the causes of teacher lossConclusions

In this paper, the ontology-based decision tree algorithm is used to establish an ontological attribute table, perform categorical data analysis, and use it in the UHRM to improve the management level. School administrators can refer to the decision tree obtained to retain talents with better measures and arrange the teaching work rationally.

References

[1] Soheilirad S, Govindan K, Mardani A, et al. Application of data envelopment analysis models in supply chain management: a systematic review and meta-analysis [J]. Annals of Operations Research, 2018, 4(2):915-969.

[2] Singh V K, Sharma J, Rai P K. Application of WDXRF and FT-IR for Human Tooth Analysis [J]. Spectroscopy, 2019, 34(12):23-31.

ISSN 2706-6827 Vol. 3, Issue 13: 89-94, DOI: 10.25236/IJFS.2021.031314

[3] Wu Z, Fan Y, Zhang Q, et al. Comparison and analysis of permanent magnet vernier motors for low-noise in-wheel motor application [J]. IET Electric Power Applications, 2019, 14(2):1-10.

[4] Jaung W, Carrasco L R. Travel cost analysis of an urban protected area and parks in Singapore: a mobile phone data application [J]. Journal of Environmental Management, 2020, 261(3):110-117.

[5] Park P, Kurihara T, Nita M, et al. Application of energy-filtering electron microscopy (EFEM) for analysis of hydrogen peroxide and lignin in epidermal walls of cucumber leaves triggered by acibenzolar-S-methyl treatment prior to inoculation with Colletotrichum orbiculare[J]. Plant Pathology, 2019, 68(9):86-92.

[6] Saei J N, Mokhtari A, Karimian H. Stopped-flow chemiluminescence determination of the anticancer drug capecitabine: Application in pharmaceutical analysis and drug-delivery systems [J]. Luminescence, 2020, 35(5):54-63.