Study on Data Fields Grading Category Labeling for ERP Practical Skills Intelligent Assessment System

Lu-lu CUI and Ji-mei LI

School of Information Science, Beijing Language and Culture University, Beijing, China

*Corresponding author

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Abstract. The paper mainly discusses about the labeling method for data fields grading category, which aims at "setting scoring standard" part in ERP practical skills intelligent assessment system. According to the different importance of data fields when scoring, the paper divided them into different categories and determined classification rules based on field attributes. Using the computer programming language, the paper realizes automatic labeling the grading category of data fields.

Introduction

Since the "Internet +" era, the wave of informatization has flourished. Under the "national 13th Five-Year Plan", the "National Informatization Development Strategy Outline" and other related policies, informatization application has gradually deepened and the scale of the informatization market has continually expanded in China. With the emergence of enterprise informatization requirements such as enterprise mobile interconnection and supply chain coordination, large and medium-sized enterprises have gradually increased their investments in information construction, and enterprise information system has gradually become an important part of enterprise informatization. Yonyou, as a digital business application infrastructure, has provided enterprise cloud services to more than 4.09 million corporate and public organization customers, covering large and medium-sized enterprises as well as small and micro enterprises [1].

Under such background, the continuous improvement of enterprises' understanding and demand for information technology has also promoted the growth and optimization of professional personnel. The demand for EIS personnel in society and enterprises continues to increase, which leads to multiple training and competitions related to EIS skills certification. The National Vocational Student Skills Competition Accounting Skills Competition [2], the "Seentao Cup" National College Student Sand Table Simulation Operation Competition [3], and the "Seentao Cup" National University Student Accounting Information Technology Competition [4] have provided professional and diverse assessment platforms for relevant personnel. National certification of informatization engineer management information talent assessment certificate [5], while improving the overall quality of personnel, also provides talent protection for enterprise ERP application and promotes the process of informatization in China.

However, while ERP is gradually becoming the mainstream of enterprise management informatization, the lack of personnel restricts the process of enterprise ERP application to some extent. As important stages for cultivating and selecting personnel, in order to transport a batch of high-quality, high-level practical and comprehensive talents to the society, many colleges and universities across the country have been set up and carried out a number of EIS practical skills-related courses. Teaching models such as ERP simulation lab, enterprise operation process simulation and ERP sand table simulation are gradually popularized. Unfortunately, due to some real factors, most of personnel selection work in colleges and universities currently can only be done through manual assessment: teachers set specific scenarios or students design their own companies, students simulate business processes and operate ERP software to complete a series of business. After finishing all operations, students take screenshots of important documents, summarize important
data, and upload system A/C sets; teachers manually evaluate the student's operation results and assess the skills level of them. This kind of assessment method not only increases the teacher's work pressure and burden, but also increases the possibility of error.

Nowadays, the ERP curriculum system is becoming intensive and perfect gradually. The traditional manual assessment method cannot meet the fast-paced and high-efficiency personnel training pace. How to intelligently and automatically assess the personnel quality has become a common concern. The ever-increasing demand for talent has led to a change.

ERP practical skills intelligent assessment system emerged, which can improve the accuracy of assessment results to a certain extent while reducing the workload of teachers and improving the assessment efficiency. As a product in enterprise informatization era, ERP practical skills intelligent assessment system has broad development prospects and research space.

Related Technology

ERP Practical Skills Intelligent Assessment System

ERP practical skills intelligent assessment system, a kind of IT skill assessment system, is based on the actual ERP software environment. The general method of IT skill assessment is: after defining the assessment target and assessment rules, the system collects the facts which can reflect the skills level of personnel, compares the results with the assessment target to determine the difference, and finally evaluates the skills level of personnel according to the assessment rules [6, 7, 8]. Based on such technology, ERP practical skills intelligent assessment system puts the actual business process of the enterprise and the requirements of the enterprise informatization personnel into consideration. The system assessment process goes as follows [9, 10, 11, 12]:

a. Experts organize professional knowledge.
b. Teachers set questions according to the knowledge, determine the operation data, and set the scoring standard.
c. Teachers composite and publish the test papers, students are assigned to answer questions.
d. Students submit the database after completing all answers.
e. The assessment system automatically detects and extracts relevant data, compares them with the correct answers, and evaluates the student's score according to the scoring standard.
f. The system feedbacks the assessment results to students and teachers.

ERP Data Storage and Processing Mode

ERP practical skills intelligent assessment system is based on the ERP system data. The ERP data storage and processing mode is divided into two types: local storage and cloud storage according to the ERP software itself and the location of operation data storage [13]:

**Local Storage.** The operator operates the ERP system on the local computer and data is stored in local database. The database in this mode only stores the operation data from the local user, usually, the amount of data is small and the data structure is simple. In such mode, since the database is directly stored in the local computer, the user can directly extract the assessment data. For example, Yonyou ERP.

**Cloud Storage.** The operator operates the ERP system on the local computer and the data is stored centrally in the cloud database. The database in this mode can store the operation data from multiple users and multiple computers, and the amount of data is huge. In theory, multiple users can perform the cloud database at the same time. The data structure is complex. In such mode, users cannot directly access the data in the cloud database. Due to the huge amount and complexity of data, it is difficult for users to extract assessment data. For example, SAP software.

Data Field Grading Category Study
Significance

This study focuses on the classification of data fields in the ERP practical skills assessment process, that is, the "teachers set scoring standard" section in the ERP intelligent assessment system. When setting the scoring standard, teachers give different scoring weights to different data fields due to their different importance. For example, the operator name is used to identify cheating or not, so the scoring weight is higher; the remark and summary part of the document cannot be used to assess the skills level of personnel, so the scoring weight is lower. This study aims to distinguish the importance of different data fields, determine the grading category of the data fields, and provide classification rules for automatically labeling category.

Data Field Studied

ERP-U8 Database. Take the Yonyou ERP-U8 V10.1 system as an example. The ERP software data is stored locally, in SQL Server. Users can access U8 database with name and password, and get information such as data structure and data storage location [14, 15].

In ERP-U8 database, there are two important databases: the UFdata database and the UFmeta database. (Shown as the Table 1)

<table>
<thead>
<tr>
<th>UFmeta database</th>
<th>Storing U8 metadata, that is, Yonyou ERP-U8 software's own information, including table relationship information and UAP module view. In one version of system, even if the set of books is different, most data of this part is the same. For example, &quot;product code&quot; and &quot;product name&quot; in the &quot;finished goods receipt&quot;.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFdata database</td>
<td>Storing operation data after operating the ERP-U8 software. For example, the &quot;period&quot; input value and the &quot;quantity&quot; input value in a new &quot;purchase receipt&quot;.</td>
</tr>
</tbody>
</table>

Object Studied. In order to determine the object studies, that is, to obtain the assessment data, the UFmeta database is studied and analyzed, and two tables are obtained: Table and BD_PhysicsTables. Table contains the table name, table Chinese definition and other information. BD_PhysicsTables contains the field name, field Chinese definition and other attributes in 712 tables totally. After sorting and managing these two tables, 28853 fields are obtained, including the table name, table Chinese definition, field name, field Chinese definition, field data type, primary key and other attributes.

However, these attributes of the data in the BD_PhysicsTables table can only reflect the property of data itself, such as data type and primary key identifier, which cannot be associated with the ERP software interface. That is to say, the attributes of data in this table cannot be associated with the actual operation steps of ERP. In order to explore more about the related properties of data, the U8 database needs to be tracked by using the SQL Server Profiler tool. In theory, after operating the ERP software, SQL Server Profiler technology can track certain database that has changed [16, 17, 18, 19, 20], as well as the data, which have changed in the database, and its attributes. That is to say, during the user changes the ERP software document interface template, the SQL Server Profiler tool can capture the data and related attributes displayed in the ERP software interface, for example, whether the data is fixed length or not, whether the data can be zero. In this way, the VoucherItems_base and VoucherItems_lang data tables are finally obtained. Both tables belong to the UFdata database. VoucherItems_base is the basic table of document display template details; VoucherItems_lang is the document display template detail language table, including field name and field type description. User can view the details of these two tables by creating a query in SQL Server.

After the two data tables are merged and the redundant data is removed, 25996 data fields can be obtained, including the table name, field name, field Chinese name, whether the field can be null, whether the field can be deleted, whether the field can be split, whether the field can be zero, whether the field is a computer calculated data, etc. These properties can reflect the ERP software interface and the user's operating procedures.
Overall, more than 50,000 fields in these tables obtained through these two methods constitute the study object of this project. These data are useful for upgrading and perfecting the ERP data dictionary.

**Data Fields Grading Category**

The grading category of data fields is determined by the importance of the data, while the importance of the data is determined by the business process, the actual operation steps of the user and the ERP software platform.

**Automatically Growing Primary Identity Field.** The documents such as the stock in and the stock out are automatically numbered, and the fields such as the stock in number and the stock out number are automatically generated by the system. This category of field is self-incrementing and is the identifier (primary key) of the table. The naming convention for this category of field is AutoID or ID.

**Non-automatically Growing Primary Identity Field.** The area code in the region classification file and the time field in the product checkout status table can be classified in this category. This category of field does not grow automatically, but is also the identifier (primary key) of the table.

**Base Field.** The fields such as purchase quantity, retail unit price, tax rate, invoice number, item code, checkout mark, etc., which require operator to input or set are basic fields. This category is an important part during assessment.

**Key Field.** The fields such as the receivable and payable mark, the prepaid and prepay mark, the billing date are more important in respective documents, and are manually input or set by the operator. This category is also an important part during assessment.

**Comprehensive Field.** The beginning signs, currency, and exchange rate are the fields that are fully set by the system at first. The definitions of such field include "-first-, -First, KL, KL2".

**Operator Name Field.** Such field is an important category to identify whether the operator has plagiarized from or donated to others. Their Chinese definition has the characters "person" or "member".

**Calculate Field or Bring Out Value Field.** The fields such as original currency, total currency, invoice quantity, and loss amount are automatically calculated by computer from the data input by operator before. Fields such as project name code and inventory free item are also automatically recognized by computer from previously input data. The sources of these two types of data are the same. Such field’s naming rules include but are not limited to: "cfree, iOri-, iSum, iMoney, cItem_class".

**Reference Field.** The purchase order number in the sell stock out is automatically generated by the data in the purchase order. This category of field is automatically generated and entered from previous document, without the operation to input it again. Reference field includes some code or id number.

**Extension Field.** Extension field is used to assist accounting or add attributes, which won't decide assessment score. This category of field is named as "cDefine".

**Other Field.** Fields such as remark, abstract, self-test, and quality inspection are meaningless to assess personnel's skills level. The name of such field includes "memo, cdigest, check, gsp".

**Write Back Data.** The write-back data such as the system version number, time stamp, and accounting period has nothing to do with assessment.

In summary, based on the data source and data usage, the importance of data fields during assessment can be determined, and the data fields can be distinguished to different category. Specific classification rules can be determined from data attribute (primary key) and field name.

**Category Labeling Application**

After obtaining 11 classification rules, the computer programming language can be used to implement the automatic labeling function of the field’s category, as well as develop a automatically labeling
model for ERP practical skills intelligent assessment system. The following description can be used to model in a computer programming language:

```plaintext
<rule level>
<rule number>
 If (<condition> { <field name><property> })
 then
   <field category>
 else
   <field category>
```

In the final category labeling result, the labeling rate of nearly 30,000 data fields is 55%. Compared with the results from manually labeling process by experts, the correct rate of the automatic labeling result is 89.5%.

This shows that the existing category labeling method fail to cover most of the fields, and the classification rules still need to be researched and explored. At the same time, the correct rate of labeling results is very impressive. It can be considered that the idea of existing category labeling rules is correct.

**Category Rule Supplement**

In the ERP software, the input fields can be understood as assessment fields. Therefore, in the VoucherItems_base table, the "IsNull" attribute can be considered as a classification rule. That is to say, a non-nullable field is an assessment field. In addition, the "CalcField" attribute can be used to label the 7th (Calculate field or bring out value field) category.

**Summary**

To satisfy the requirements, nowadays, ERP practical skills intelligent assessment technology is booming. This study aims to support the "setting assessment standard" process, which based on the classification of the importance and source of data.

From this study, the assessment data fields have been divided into 11 grading categories, and the category labeling rules have been determined from data attribute (primary key) and field name. In summary, our team has obtained more than 50,000 fields as studied object, also useful for supplementing the ERP data dictionary; according to data source and field name, our team has divided these fields into 11 grading categories, defined a series of classification rules, and designed programming statements that automatically label the grading category of more than 50,000 fields.

However, the existing rules cannot cover all assessment data fields, and the information, including fields and their attributes, which is discovered from ERP template database, can be discussed as a new study idea. Overall, the study direction still has huge exploration space and research value.

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