Forecasting of ERP Implementation Using Case-Based Reasonings

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Summary
Case-based reasoning (CBR) is widely used in the business and industrial forecasting. CBR is powerful tool in forecasting. It is suitable to complex and unstructured problem. Recently, CBR is applied many variety of business decision making, such as Enterprise Resource Planning (ERP) pre-planning control, bankrupt, Information System (IS) development control, prediction of customer churning. This study applies the novel model to forecast a successful implementation of ERP systems. Experimental results show that the CBR approach is a promising method for forecasting of successful ERP implementation..

Key words:
Enterprise Resource Planning (ERP), Case-Based Reasoning (CBR), Forecasting, multivariable discriminant analysis (MDA)

Introduction

Case-based Reasoning (CBR) is an excellent method to use in business forecasting, because CBR is suitable to unstructured business problem. Recently, in order to forecast problems more accurately in cooperation management, CBR is applied many variety of business decision making. For example, CBR is widely used in the company on forecasting of bankrupt [13], ERP pre-planning [15], customer service [7], IS development control [14], stock price forecasting [12] etc.

In this study, CBR is applied to solve problems in forecasting a successful implementation of Enterprise Resource Planning (ERP) systems. This research has developed the template for measurement an ERP systems implementation based on prior research of related ERP systems [2], [3], [4], [5], [6], [9], [16]. The template is composed of four component that is project planning, AS-IS process design and analysis, TO-BE process design and analysis, ERP systems development and operation.

In developing the most well predictable model for an ERP systems implementation success, this study applied the CBR model. And proposed CBR model and multivariable discriminant analysis (MDA) model of forecasting performances have been compared.

The result of this research has shown, first, to present more accurate forecasting model to the ERP systems operation company. Secondly, the guide line of successful ERP system operation will be given to CEOs and ERP project managers.

This paper consists of five sections. Section 2 introduced the basic concept and business application of the CBR. Section 3 proposed CBR approach for forecasting of successful implementation of ERP system and 4 described research design and experiments. Section 4 summarized and discussed experimental result. In the final section, conclusions and limitations of this research are presented

2. Research Background

2.1 CBR and Their Applications

Machine learning separate eager learning and lazy learning algorithms. CBR is representative to lazy learning algorithms. CBR is an excellent algorithms and method to use in business forecasting. Hence, CBR is very popular approach for business forecasting. CBR strengths are following. Firstly, CBR is suitable to unstructured business problem. Secondly, CBR use numeric data and categorical data. Thirdly, CBR is provided clearly solution and description using small data set.

Table 1. CBR process

Component	Description
Retrieve	The most similar case or cases
Reuse	The information and knowledge in that case to solve the problem
Revise	The proposed solution
Retain	The parts of this experience likely to be useful for future problem solving

CBR is composed of four steps: case retrieve, case reuse, case revise, and case retain as in <Table 1>. CBR is retrieved for case-base using similarity. In CBR, the popular similarity computation is used to the nearest neighbor technique. It is an excellent case retrieval technique. Generally, the technique of the nearest neighbor uses Euclidean distance

Many researchers proved CBR effectiveness and efficiency. For example, Grupe [7] proposed exactly application exploration method using CBR. Kadoda [14] verified software project effort prediction using CBR. Kim, Han [12] proved powerful forecasting method for stock

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price index using CBR and GA. Cardie [1] suggested an instance selection method based on decision tree approach to improved case-based learning. Kwon, Shin [15] make a prototype system, PPSS (Project Planning Support System) that help project manager to make a pre-project plan of ERP implementations.

3. Paragraphs and Itemizations

3.1 Research Data

In this research, we analyzed ERP system articles, and then found research variable [2], [3], [4], [5], [6], [8], [15]. The 13 independent variable is established as ERP systems implementation process using Critical Success Factors (CSF) method through 15 ERP specialists in depth interview. ERP systems implementation process is component of following components.

For the first component, project planning is composed of project purpose and scope, project period and budget planning, project team and properly allocated role, project output reporting and control.

For the second component, AS IS process design and analysis is composed of AS IS process analysis, AS-IS system analysis, AS IS organization analysis.

For the third component, TO BE process design and analysis is composed of TO BE process analysis, TO BE systems analysis, TO BE organization analysis.

For the fourth component, ERP systems development and operation is composed of ERP systems design and programming, ERP systems testing, ERP systems operation and maintaining.

Survey questionnaires to measure the independent and dependent variable has been employed appropriately to fit in Small and Medium Enterprises (SMEs) using ERP systems. Each independent question is given values of 5 points of Likert type scales. For an operating purpose, the dependent variable is measured '1' in the success of ERP implementation and '0' in the fail of ERP implementation.

This survey is done from August through September in year 2002 to ERP systems managers of SMEs. The surveys are collected out website surveys supported by Small Business Corporation. The108 data of 174 surveys data are used for analysis after discarding insufficient answered surveys. The forecasting model used 13 meaningful variables. The descriptive statistics are followings <Table 2>.

Table 2. Descriptive Statistics

Feature Name	Min	Max	Mean	SD
project purpose and scope	1.00	5.00	3.4259	.90898
project period and budget planning	1.00	5.00	3.3148	.97298
project team and allocated role	1.00	5.00	3.4167	.98707
project output reporting and control	1.00	5.00	3.3333	.93729
AS IS process analysis	1.00	5.00	3.3611	.93187
AS IS system analysis	1.00	5.00	3.3704	.91297
AS IS organization analysis	1.00	5.00	3.4074	.92763
TO BE process analysis	1.00	5.00	3.3981	.95643
TO BE systems analysis	1.00	5.00	3.5000	.94226
TO BE organization analysis	1.00	5.00	3.2407	.91580
ERP systems design and programming	1.00	5.00	3.3519	.98886
ERP systems testing	1.00	5.00	3.3426	1.04266
ERP systems Operation, maintain.	1.00	5.00	3.3056	.99022

3.2 Research method

This research has compared the performance of forecasting a successful implementation of ERP systems through CBR, MDA model as mentioned earlier. The ratio for test data set and holdout data set is 80:20 for the test. The holdout data set is used to test result with the data that is not utilized to develop the model. Results are consists of 86 of test data set and 22 of holdout data set. This research is ignored linear scaling because research data already is nomalized by Likert type scale. And, CBR use 1-NN algorithm for total holdout data set.

1.1 3.3 CBR

CBR have some characteristics that distinguish them from the other Artificial Intelligence (AI) technique. CBR is able to modify, or adapt, a retrieved solution when applied in a different problem solving context. CBR uses k-Nearest Neighbor (k-NN) method for find similarity case. The popular method of k-NN is Euclidean distance. Euclidean distance method is following.

$$d(X, Y) = \sqrt{\sum_{j=1}^{p} w_j (x_j - y_j)^2}$$

Where d (X, Y) is a distance x and y, , I and j are the value for attribute x and y in the input and retrieved cases, p is the number of attributes, w_i is the importance weighting of the attribute X, Y. In this study, CBR use 1-NN algorithm for total holdout data set.

1.2 3.4 MDA

In this study, MDA model are used as a benchmark. In building MDA model for the purpose of predicting successful ERP systems implementations, we need to forecast a precise cut-off value showing a clear distinction between samples. A MDA is a useful technique for forecasting of ERP systems implementations. A MDA function is represented as follows.

$$Z = W_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_i X_i$$

Where Z-scores refers a discriminant score, W represents a cut-off values. Z and Xs indicate dependent and independent variables respectively. Statistical analyses were done using SPSS 11.0.

4 Results

The prediction performance of CBR and MDA model is compared in this section. Table 3 describes MDA model and the 1-NN prediction accuracy of CBR model. As a shown in table 3, CBR achieves higher prediction accuracy than MDA by 4.57% for the holdout data. According to experimental result, forecasting performances of CBR model is outperforms MDA model.

Table 3. Forecasting Performance of CBR and MDA

Model	CBR	MDA
Training Data	-	88.40%
Holdout Data	77.27%	72.70%

5 Conclusion

This research suggested a CBR model to forecast a successful implementation of ERP systems We proposed model, CBR model, outperforms MDA model. The result is very significant that CEO and ERP project manager can more control ERP system project.

However, this research has some limitations. First, experimental data is too is small. Therefore it is necessary to collect more samples of company using ERP system. Second, the variables for measuring the implementation of ERP systems were used with restricted ERP project variables. Therefore, research variable is extended through addition research for obtaining more meaningful contribution.

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