A hybrid system by evolving case-based reasoning with genetic algorithm in wholesaler's returning book forecasting

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Abstract

A hybrid system by evolving a Case-Based Reasoning (CBR) system with a Genetic Algorithm (GA) is developed for wholesaler's returning book forecasting. For a new book, key factors, such as the grade of the author, the grade of publisher, hot or slow season of publication date, sale volumes for the first 3 months and the returning rate, have been identified and applied as the key features to calculate the similarity coefficient of a new release book and to retrieve similar book from the reference cases to justify if the new book is a slow-selling or selling book. The case base of this research is acquired from a book wholesaler in Taiwan, and it is applied by the hybrid system to forecast returning books. The results of the prediction of the hybrid system were compared with the results of a back propagation neural network (BPNN), a conventional CBR, and a multiple-regression analysis method. The experimental results show that the GA/CBR is more accurate and efficient when being applied to the forecast of the returning books than other methods.
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Keywords: Case-based reasoning; Genetic algorithms; Back propagation neural network; Multiple regression analysis

1. Introduction

Book Wholesales in Taiwan are under an extremely competitive business environment, in order to face the complicated market competition; they are trying their best to make the ultimate policy. The completeness of the information available to the decision-maker is the key factor influencing the quality of the decisions. A book wholesaler could have better controls if sales forecast is conducted for a new book, and simultaneously another forecast for book returning is conducted after its release. In business forecasting, managers often apply the outcomes of past similar cases to predict the result of the current one. The methods to be used for sales forecasting are nothing more than naive prediction, statistical methods, or artificial intelligent methods. Among these methods, artificial intelligent (AI) methods are mostly used in academic studies because of the ability to provide rapid solutions with high accuracy and to deal with diversified cases.

For the book industry in Taiwan, it is very difficult to predict sales and returned volumes because the products have various classifications and different lengths of life cycles, and the environment in this industry is very unique. Average, there are about 3412.6 new books being published every month in Taiwan, and the speed for new released books is really high. The returning rate of books is more than 30% in this industry according to

the actual data collected from the wholesaler and from the past studies [7]. The main reason of high book returning rate is caused by the insufficient information of book sales status in the book supply chain which brings up bullwhip effect and forms up the unbalanced situation between supply and demand. Blind returning activities happen so often because retailing bookstores are often space limited, without efficient computerized managing system, and moreover they do not have to bear any forward and reverse logistics cost. High book returning rate is a very heavy burden for all companies in this industry. Hence, a returning forecasting system for slow-selling books is developed in this research to advise the retailers on returning book decision making and to avoid blind returning movements. The system is a hybrid method by integrating a conventional CBR with adjusted factor weights by Genetic Algorithms (GAs) to conduct a high accurate and efficient book-returning forecast to reduce high book returning rate and to increase profits.

The remainder of this paper is organized as follows: Section 2 describes relevant literature review. Section 3 presents the hybrid method that integrates CBR with GAs. Section 4 describes problems. Section 5 depicts experimental design and results. In the final section, the conclusion is presented.

2. Literature review

In this section, current forecasting approaches and integrated GAs and CBR are briefly reviewed.

2.1. Current forecasting approaches

Forecasting always plays an important role in a decision support system. The first step for business planning is sales forecasting, and enterprises have to understand the changing demands of the products for future markets in order to reserve appropriate resources for future production. Effective forecasting obtained in advance can help the decision maker in planning the production quantity and cutting down the material costs, even determining the selling price. It can result in a lower inventory level and achieve the objective of just in time manufacturing [19]. The barrier of communication for forecast occurred because managers usually ignore the application, test, and control of key information and execute the results of forecast of the model [12].

In the book industry, returning books forecast is equally important to sales forecast. Under the environment of limited space, low computerized level, frequent release of new books and no forward/reverse logistics
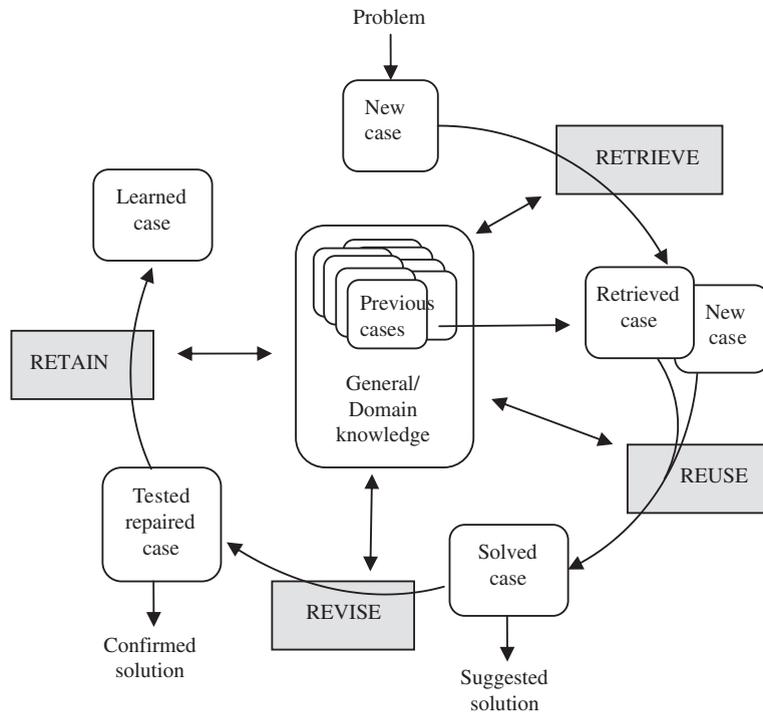

Fig. 1. A CBR cycle. (Adopted from Aamodt and Plaza [1]).