A data mining approach for shelf-space allocation problem: considering customer moving paths and purchase behaviors

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ABSTRACT

A good shelf space allocation strategy can help customers easily find the desired product items and dramatically increase the cross-selling and store profit. Previous studies generally relied on the space elasticity formula to optimize space allocation models, but space elasticity requires estimates of many parameters, resulting in high costs and frequent errors in the mathematical models. This research proposes a three-stage data mining method for solving the shelf space allocation problem with consideration of both customer purchase and moving behaviors. In the first stage, the customer's purchasing behavior is derived from records of previous transactions, while moving behavior is collected through RFID systems. In the second stage, the Apriori algorithm is applied to obtain frequent product association rules from purchase transactions. In addition, the UMSPL algorithm is adopted to derive high-utility mobile sequential patterns from customer mobile transaction sequences. In the third stage, all product items are classified as either major, minor, or trivial according to a set of criteria. Only minor items are relocated to ensure customers can follow their preferred shopping paths. A Location Preference Evaluation (LPE) procedure is then developed to calculate location preference if a minor item is placed at a given section of the store. Based on the location preference matrix, minor items are reassigned to optimal shelves. The experimental results show the proposed method can reassign items to suitable shelves and dramatically increase cross-selling opportunities for major and minor items. In addition, more factors should be considered when conducting shelf space allocation to deal with real situation. For example, high sales profit product mix, the physical distance between the two shelves and two-dimensional space, and product storage conditions. Therefore, this research further proposes a modified evaluation approach including joint sales profit, geographic distance and product category when solving the product-to-shelf problem.

Keyword: Shelf Space Allocation、Association Rules、High Utility Mobile Sequential Patterns、Customer Travelling Behavior、Product Category