

Toward the use of Relative Benefit For Case Base Maintenance In Electronic shop

by

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Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Technology Assumption University

May, 2002

MSIT St. Gabriel's Library, Au

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Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Technology Assumption University

The Faculty of Science and Technology

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ACKNOWLEDGEMENTS

I sincerely thank my advisor, Dr. Jirapun Daengdej, for his valuable guidance, and advice throughout this study. I would also like to thank the other members of my committee, Asst. Prof. Dr. Thotsapon Sortrakul and Dr. Thiraphong Charoenkhunwiwat for their guidance and support. Thank to Khun Sorapong for his suggestion of mathematic. I also thank Khun Anan for providing useful resources especially on Microsoft SQL Server.

Finally, thank to my parents, the other members of the family, and my friends for supporting me all along the way.



ABSTRACT

In today's environment where the electronic commerce becomes more and more available and important, a case-based reasoning (CBR) is one of the widely used techniques in product searching and sales selection process. As it becomes more popular, the library scale of the CBR system is also growing. Theoretically, large scale of library will impact the overall efficiency of the system in term of searching, retrieving data as well as storing new cases.

As a result, a maintenance so called case-based maintenance is required in order to prevent any effect from having large database. However, the reducing amount of case library must be done carefully in order not to produce any damage to the system's objectives and overall accuracy. Some previous researches usually maintain the case library by focusing only either on the performance or the competency of the case-based system. But in electronic shop, removal of case library needs to concern more than just performance. The other factors, such as the frequency of sell, the availability of the product if that case represent product existing in the stock, should also be taken into account when maintaining the case library.

Deletion method should minimize the size of the case-based while maintaining the benefits (objectives) of the domain (electronic shop). This thesis aims to propose the deletion method, where the benefit of the domain will not be traded off. The proposed deletion method will be done by taking all necessary factors into consideration and modeling the relative benefit value, which is mainly guided in deleting the case library.

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Conclusion and future work

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CHAPTER1: INTRODUCTION

1.1 Background

Case-Based Reasoning (CBR) is widely used for the search and the selection process in the sales system. To date in electronic shop, the sales system allows customers enable interactive to the system to find appropriated products for meeting customer satisfaction [2,3]. The example of such system, i.e.WEBSELL [2], is designed by applying CBR technology for product selection and customization in electronic commerce environments. The growing access and the use of the system lead to the huge portions of Case-Based. An uncontrolled case-base growth can cause serious performance problems as the retrieval efficient degradation and incorrect or inconsistent cases which becomes increasingly difficult to detect [1]. At the same time, configurations of products are frequently changed (e.g., price, new hardware components, etc.) [2]. Therefore, the casebased system must be controlled and maintained to support the incremental up-date of changing.

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1.2 Problem statement

As Case-Based Reasoning is widely used in problem solving and various applications especially in Electronic Commerce, the growing use of CBR system leads to the large scale of case library. The large case base without monitor, control, or reducing amount of case is the cause of many problems in searching, retrieving, adaptation, or storing a new case in case library, especially, the incremental up-date of dynamic cases in electronic shop. The case base of base product needs to be monitored, controlled, and maintained to support the huge of business transaction. There are many researches that have been focused on the competence of CBR system but a few to describe its maintenance. Some research describes the competence-preserving case deletion policy. However, pure reduction case without analyzing the benefit for the commercial is very dangerous in the domain of Electronic Commerce. The loss of chance in business may occur during transactions causing a loss of some cases. The useful product (a case) might be deleted from the system without consideration of benefit viewpoint. These things lead to the loss of benefit for the electronic shop domain.

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This thesis will present the deletion method to maintain the growing of case library that used in electronic shop by defining the relative benefit value to measure the quality of a case, and then use its analysis for selection case in adding or deletion method. The model is designed to facilitate, monitor, and control the incremental up-date of dynamic case-based.

1.3 Objectives

As maintenance case base reasoning applied in electronic shop, this thesis would present the strategy to maintain the growing of case library as follows these objectives:

- 1. Propose an appropriate technique of maintenance for the large case library used in electronic shop.
- 2. Define the relative benefit value to guide the case and use it to maintain the case in case library.
- 3. Create an algorithm to find out the relative benefit value.
- 4. Design a deletion model and its process for case reduction.
- 5. Simulate a prototype of adding case to the system. Demonstrate deletion technique to compare and see the result of remained cases in case library with other technique.

1.4 Scope and limitation of study

Case based reasoning is applied in various areas such as information retrieval, technical support or help desk, finance, engineering, www application, etc. The growing access and the use of the system lead to the huge portions of case library. Maintenance is very important to control amount of case and performance of case based system. The selection of appropriate technique to maintenance is also important. Selecting inappropriate technique leads to damage function of work and also loss of opportunities in such area. Electronic commerce or the area that used the case to represent either product is the area that must be carefully considered. This thesis is narrowly scoped to find out the deletion method to use for maintaining case library used in sales support system for electronic commerce application. The working area is scoped as follows:

- Research and learning CBR and survey the application or working area where CBR was applied to use.
- Survey and literate the previous approach of case base maintenance and then analyze advantage and weak point that has an impact to electronic commerce area.
- Find out an appropriate technique of maintenance for the large case library used in electronic shop.
- Definite relative benefit for each case and use it for adding or deletion case
- Simulate prototype to support algorithm by assumption the existing case library.

- To experiment maintenance by deletion case from the system following the process and deletion policy
- See the result of remained case in the case library. Compare the expected result with other technique.



CHAPTER 2: LITERATURE REVIEW

2.1 Introduction of Case based reasoning and product customized in Electronic shop

Kolodner [4] described the meaning of Case-based reasoning that is a method for solving the problem by remembering previous similar situations and reusing information and knowledge about that situation. Riesbeck and Schank [5] gave a simple idea that a case-based reasoner solves new problems by adapting solutions that were used to solve old problems. The case structure is shown in Figure 2-1. The case (d) is the solution of the adapted case (b) and case (y) in order of CBR cycle.

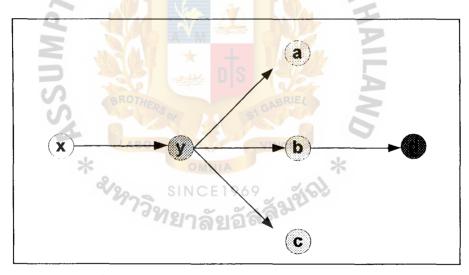


Figure 2-1: Case Base Structure Graph

Nowadays, case base reasoning is applied in various solutions to solve the problem. Electronic commerce is one domain where CBR is usually used. The first example is negotiation during intelligent sales support with case-base reasoning [6]. It presents architectures of sales agents, which are able to negotiate with a customer.

The other examples, Armin, Ralph, and Sascha suggest CBR technique for product selection and customization-structured product in Electronic shops [2,3]. Normally, most electronic catalogs and online shops do not explore the interactivity available on the Web, so they propose the interactive approach to customize products for many electronic commerce applications. They gave the configuration of PC domain as the example. Each case represents the description of the real product in the base. Very briefly, the configuration process can be subdivided into two major steps, called base product retrieval and adaptation cycle. The task of the first step is the similarity-based retrieval of the best available base product from the respective case-base. The second step is an iterative procedure that performs the necessary adaptation of the retrieved-base product if it does not fulfill all customer demands. The result of adaptation cycle is validated product. The complete configuration process is succeeded, and the final product can be presented to the customer as show in

Figure 2-2.

In electronic commerce, the case contained in case library represents the real product. Maintenance case is very important to control and improve the competence of case base system. This is strictly careful to add, update, or delete a case in case base system.

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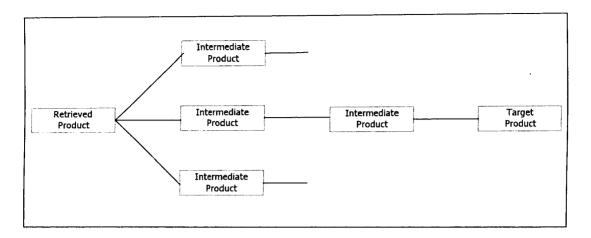


Figure 2-2: Customization of product by using CBR process

This paper is giving the exemplary domain of PC configuration, which can be easily understood. Imagine an only catalog of an electronic shop. Every single product, i.e., PC workstation or server in the present domain example, is represented by a case in case base system. As an example, such a case could have the following description:

| iguration PC |
|--------------------|
| /* brand */ |
| /* type *///Norr |
| /* CPU */ |
| /* memory */ |
| /* monitor */ |
| /* modem */ |
| /* hard disk */ |
| /* price */ |
| /* product code */ |
| /* End of date */ |
| |
| |

The example of case in catalog of travel agency

| Case2=("Caribbean", | /* region */ |
|---------------------|----------------------|
| "Winter", | /* season */ |
| "Airplane", | /* transportation */ |
| 10, | /* duration */ |
| 1999.99, | /* price */ |
| "Beach", | /* holiday type */ |

Figure 2-3: Example of case in real-world application

In electronic commerce, the cases are descriptions of products. The problem description is a specification of a single product and possible demands the product can satisfy. The solution to the problem is an unambiguous reference to the product [2]. For configuration products such as computers or travel packages, the solution is not only the part number, but also possibly the entire configuration as shown in Figure 2-4.

| | 7 C · Customize 9 | Part No: CPPC1 | <u> </u> | | | rieve buttons fr | | LUT Colo D | 1.49 | 000.00 | - 1 |
|---|-------------------------|----------------|------------|-----------|--------|------------------|--------------------------------|--------------|------|--------|---------------------------------------|
| | | Parino CPPC | K IYPS.PC | Orono . (| | | LCCA Plileta LCOM - Microso | | | 000.00 | نمني. |
| | | | Old Spec | | | | Brend | | | | |
| / | T ype Monitor | Compeg | 14" Inch | Desc | Select | PartNo ASCD1 | Asus | Model 52x | 52X | Desc | Price + 1,000.00 |
| , | Modem | 3Com | V 92 56 K | | 2 | ASDD2 | Asus | 16x | 16x | | + 2,000.00 |
| - | Bam | Compag | 128 MB | | 3 | CPCD1 | Compag | 40x | 40X | 2 | + 1,550.00 |
| , | Harddisk | Compag | 20 GB | | 4 | SACD1 | Sumsung | 52x | 52X | | + 1.000.00 |
| , | CPU | Compag | 1 13 GHz N | 4hz | | | cannoung | | | | 1,000.00 |
| ĩ | Mouse | | LA | | | | | | | | |
| , | Keyboard | | | | | | | | | | |
| 7 | Network card | 3Com | 10/100 LA | N PC Card | | | A | | , | * | againer and |
| - | SCSI card | | U Hase I | | 8 Done | | | | 7 | | al intranet. D |
| 2 | CD-Rom | Compag | 40x | 0 | SIL | O Sumsun | g 9052x | | 2X | 0 | 1,000.0 |
| - | 0VD-Rom | | | 120 | | | 0 | SQ. | 1 | | .0 |
| - | CD-RW | | | · · / | 121 | | เลอ | 61- | | | .0 |
| | | | | | | 1011 | | | | | mount \$ 1,000.0 1ount \$ 44,000.0 |
| | | | | | | | | | | Back | Confirm Order |

Figure 2-4: Product configuration in Electronic shop

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In configuration of PC/Server, there are two types of case found, base product and custom made. Base product is a case that represents the original product that can be retrieved while custom made or intermediated product is a case that is modified and configured in learning process.

2.2 Previous approach of Case Base Maintenance

The previous research in maintaining case-base systems has addressed many different aspects of the direct reduction cases as follows:

2.2.1 Utility metric for deletion policy

Minton's utility metric [1,7,9] is a simple random deletion policy. A random item is removed from the knowledge-based one to the knowledge-base size that exceeds some predefined limited.

Utility=(ApplicationFreq*AverageSavings)-MatchCost (2.1)

The *utility metric*, which takes into account the cost of maintaining, is defined the knowledge item (retrieval or match cost) and expected the problem solving saving offered by the item (*average savings multiplied by application frequency*) [1], [9].

This technique chooses a knowledge item for deletion based on an estimate of its performance benefits. This utility deletion policy removes knowledge items with negative utility. This technique can work very well and can often be as effective as more principled and expensive methods [7]

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Advantage

- 1) Work very well to reduce big amount of case from case library
- Easy to select the case considering only the negative utility for deletion

Drawback for electronic commerce

- 1) In electronic commerce, the retrieval time in www application should depend on the speed of internet linked and system performance of remote client in customer side while accessing the web. It's difficult to calculate the retrieval from customer side.
- 2) The case that has negative utility will be removed from the system without other considerations. The case that represented the product that usually sell out or retrieve for solving problems might be deleted.

2.2.2 Competent preservation

SUMP

Smyth and Keane [9] suggested a competence-preserving case deletion policy called the footprint deletion policy. This approach uses statistical techniques to calculate case competence. Each case should be classified according to its competence. The key concepts in categorizing cases are *coverage* and *reachability*. Coverage refers to the set

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of problems that each case can solve. Reachability is the set of case that can provide solutions for each current problem.

$$Coverage(c) = \{c' \in CB: Adaptable (c, c')\}$$
(2.2)

$$Reachable(c) = \{c' \in CB: Adaptable(c', c)\}$$
(2.3)

Using coverage and reachability, a case is *pivotal* if it is reachable by no other case but itself. *Auxiliary* case is the case that is completely subsumed by other cases in the case base. *Spanning cases* are the case that its coverage spaces link covered by other cases. *Support cases* exist in groups, each support providing similar coverage as others in a group. The deletion algorithm then deletes cases in the order of their classifications: auxiliary, support, spanning, and pivotal cases.

Advantage

 This technique can help to model the competence of case base system while the model can exploit to against
 the competent deletion for controlling case base size.

Drawback for electronic commerce

 It is typically difficult to calculate the actual coverage and reachability of a case because the possible set of problems is normally too extensive [6]. Thus it is assumed that the problem distribution in the case base is representative and a heuristic is used for further considerations. In electronic shop, the set of problem exactly come from several user requirements that are very extensive. It is quite difficult to assume and uniform the requirement or expectation of various customers from the side of system administrator.

 The competent case might not be the case that be of benefit for sales transaction in electronic commerce

2.2. 3 Identifying competence-critical instances

Brighton and Mellish introduce an algorithm, which they term the Iterative Filtering Algorithm (ICF) [14]. The ICF algorithm uses the instance-based learning parallels of case coverage and reachability. They applied a rule, which identifies cases that should be deleted. The reachable set is not fixed in size but rather bounded by nearest case of different class. They remove cases, which have a reachable set size greater than the coverage set size. A more intuitive reading of this rule is that a case "c" is removed when more cases can solve "c" than "c" can solve itself.

| ICF(T) | > Perform Wilson Editing for all $x \in T$ do |
|--------|---|
| 1 | > Perform Wilson Editing |
| 2 | for all $x \in T$ do |
| 3 | if x classified incorrectly by k nearest neighbors then |
| 4 | flag x for removal |
| 5 | for all $x \in T$ do |
| 6 | if x flagged for removal then $T = T - \{x\}$ |
| 7 | > Iterate until no cases flagged for removal |
| 8 | repeat |
| 9 | for all $x \in T$ do |
| 10 | compute reachable (x) |
| 11 | compute coverage (x) |
| 12 | progress = fals |
| 13 | for all $x \in T$ do |
| 14 | if $ reachable(x) > coverage(x) $ then |
| 15 | flag x for removal |

| 16 | progress = true |
|----|---|
| 17 | for all $x \in T$ do |
| 18 | if x flagged for removal then $T = T - \{x\}$ |
| 19 | until not progress |
| 20 | return T |

Figure 2-5: The Iterative Case Filtering Algorithm

This is the deletion criterion the algorithm uses; the algorithm proceeds by repeatedly computing these properties after filtering has occurred. Usually, additional cases will begin to fulfill the criteria as thinning proceeds and the bands surrounding the class boundaries narrow. After a few iterations of removing cases and re-computing the sets, the criterion no longer holds.

Advantage

Above point turns out to be a very good point to stop removing cases as removing more cases tends to breach their objective of intrusive storage reduction.

Drawback for electronic commerce

 Although this approach can preserve removing more case, the calculation of the actual coverage and reachability of a case were being a problem as the originality of Smyth and Keane's approach [9].

2) The case that represented the product that usually sold out or retrieved for solving the problem will be deleted without other consideration except when applying the rule for deletion policy in competent case.

2.2.4 Performance-based metric

Leake and Wilson describe a strategy for performance-based case selection [13]. They used the relative performance (RP) metric aimed at assessing the contribution of a case to the adaptation performance of the system. The metric can be used to guide either case addition-favoring cases with high RP values—or case deletion—favoring cases with low RP values. They let RS(c',c) stand for ReachabilitySet(c')-{c}, for a fixed case-base the define:

$$RP(c) = \sum_{\substack{i=1 \\ Max \ c^{*} \in RS_{(c',c)}}} \frac{AdaptCost(c,c')}{AdaptCost(c^{*},c^{*})}$$

$$c' \in CovergeSet(c)$$
(2.4)

Suppose that if case C_1 solves problem p_1 , the cost to adapt C_1 to solve new problem p_2 is $\alpha |p_1 - p_2|$, for some fixed $\alpha > 0$

Advantage

This technique aims to adapt performance to case base system.

Drawback for electronic commerce

- This technique intends to delete the case concerning relative performance of adaptation only.
- Although the remained case has a high performance of adaptation, it will not assure that the case usually retrieved and selected for sale in sales transaction may be removed.

2.3 Remained issue

The pure reduction case from the system is very dangerous for sales transaction. The above techniques work very well in competence preservation and performance based selection. However, in electronic shop, deletion each case effects to actual product in the shop. The error may occur in CBR cycle or sales transaction. There are many factors to peruse which case should be deleted from the base. Delete uncorrected case will cause a loss of benefit to domain (electronic shop).

2.4 Fuzzy logic for decision-making

Fuzzy systems can be used for estimating, decision-making, and mechanical control systems such as air conditioning, automobile controls, and even "smart" houses, as well as industrial process controllers and a host of other application.

Fuzzy decision-making is a specialized, language oriented fuzzy system used to make personal and business management decisions, such as purchasing cars and appliances [15].

2.4.1 Discovering fuzziness

Lotfi Zadeh introduced fuzzy logic in 1965. The basic idea was to extend the classical logic (the Boolean logic) in order to relax the harsh constraint that everything that can be said about anything is either absolutely true or absolutely false. Zadeh combines the concepts of crisp logic and the Lukasiewicz sets by defining graded membership. With fuzzy logic the answer is maybe, and its value ranges anywhere from

0 (No) to 1 (Yes). One of Zadeh's main insights was that mathematics can be used to link language and human intelligence.

2.4.2 Fuzzy set

Fuzzy set theory differs from classical set theory in on crucial aspect: An element can belong to the fuzzy set, be completely excluded from fuzzy set, or it can belong to the fuzzy set to any intermediate degree between these two extremes. The extend to which an element belongs to a given fuzzy set is called the grade of membership or degree of membership. The term of fuzzy was introduced by Zadeh to describe sets whose membership criteria are vague. Thus, small is only margininally a member of set of sales margin. Uncertainty about a statement such as the sales margin is small is not represented by the probability that the margin is small, but rather by Zadeh calls the possibility that the margin is small. The term small, medium, and high are imprecise terms. The inputs of a term are real-valued that people tend to respond that values by labeling them with a group name. For example, 10% of sales margin might be considered small margin of a sales. Real-valued attributes can present a problem for an expert system, because each value cannot be dealt with individually. Therefore, the values must be grouped together in some way. The possibility of a statement is represented by a number generated by a membership function. The membership function χ associated with a fuzzy set assigns degrees of membership to elements in the set. For example, we can assign the following values to the membership function associated with the margin of sales: the degree of membership of 10% margin in fuzzy set of small margins is 1 (χ [10] = 1), but the degree of membership of 18% margin is only 0.2 (χ [18] = 0.2).

A fuzzy set can also be represented by a quadratic equation (involving squares, n2, or numbers to the second power), which produces a continuous curve. Three shapes are possible, named for their appearance—the S function, the pi function, and the Z function [15],[16],[18]

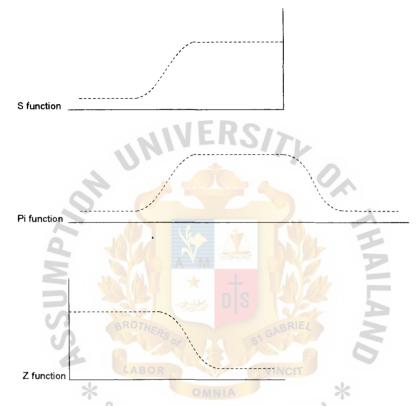


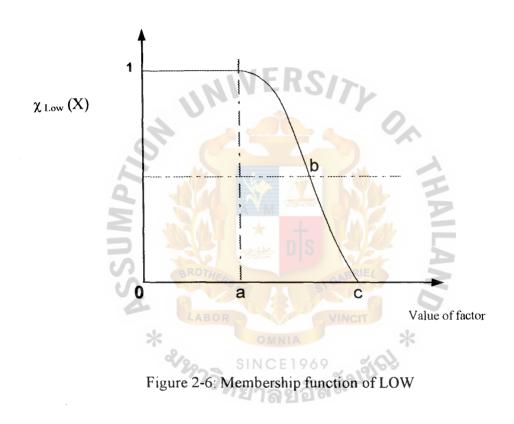
Figure 2-5: Graphs of the S function, the pi function, and the Z function

The degree of membership function of each sharp can be formulated from these following functions

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$$\chi_{A}(X) \quad 1-S(x;a,b,c) = \begin{cases} 1 & \text{for } x \le a \\ 1-2((x-a)/(c-a))^{2} & \text{for } a < x < b \\ 2((x-c)/(c-a))^{2} & \text{for } b < x < c \\ 0 & \text{for } x \ge c \end{cases}$$

where "a" and "c" are the function's end points, and b = (a+c)/2



A normal set, such as let A is the set of frequency of sell, is described by a characteristic function

$$\chi_{\Lambda} : \mathbf{X} \in \{1, 0\}$$
 (2.6)

In other word, if element x of X is included in A, it is expressed by $\chi_A(x) = 1$, and if not by $\chi_A(x) = 0$. The extension of the rang of this characteristic function, $\{0,1\}$, to the real number interval [0,1] gives the fuzzy set, and fuzzy set A of X is the set characterized by the membership function

$$\boldsymbol{\mu}_{A}: \mathbf{X} \rightarrow [0,1] \tag{2.7}$$

 $\mu_A(x) \in [0,1]$ expresses the degree of membership of element x of X in A. Since $\{0,1\}$ is included in rang [0,1] of μ_A , χ_A is a special case of μ_A , and it can be said that conventional sets are a special case of fuzzy sets. It is assumed that μ_A is determined based on human subjectivity.

Consider for example the fuzzy set LOW. The elements of the set are real values of each evaluation items whose membership grades depend on their results. For example, let the result of price performance be 10% might have a membership degree of 1, the result of price performance is 50% which might have a membership degree of 0, and price performance of intermediate LOW have intermediate grades of membership between 0 and 1. The fuzzy set LOW can be symbolized in the following way:

LOW: result value of each evaluation item
$$\rightarrow$$
 [0,1] (2.8)

Or degree of membership function of element x of X in Low can be expressed by

$$\mu_{\text{Low}}(\mathbf{x}) \in [0,1] \tag{2.9}$$

The set can be represented in graphical form as shown in Figure 3-6. Let "0" to "c" is the membership of set LOW. If "a" is the highest value of evaluation item that can be accounted for degree of membership of set LOW is 1, the value between a and c need to interpolate a value for the grade of membership by using a smoothing function, called the 1-S-function or the other name called Z-function, which is defined as shown in Figure 2-6. The membership functions of fuzzy set A in the universe labeled LOW can be defined in the term of 1-S function.

Let B represent fuzzy set labeled HIGH, x is the real value of the result that get from evaluation item, the membership function of fuzzy set B can define the term of Sfunction [16] as defined in formula (2.10)

$$\chi_{B}(X) \quad S(x;a,b,c) = \begin{cases} 0 & \text{for } x \le a \\ 2((x-a)/(c-a))^{2} & \text{for } a < x < b \\ 1-2((x-c)/(c-a))^{2} & \text{for } b < x < c \\ 1 & \text{for } x \ge c \end{cases}$$
(2.10)

For the fuzzy set of MEDIUM, the membership function has a "bell shape" and is referred to as the π -function[16]:

$$\pi (x;b,c) = \begin{cases} S(x; c-b,c-b/2, c) & \text{for } x \le c \\ 1-S(x; c, c+b/2, b+c & \text{for } x > c \end{cases}$$
(2.11)

where S(x; ..., ..., ...) is the S-function given in (2.10). In π -function, the parameter "c" is the point at which π is unity, and the parameter "b" represents the distance between the two crossover point of π (resulting from the two S-functions, and 1-S) and is referred to as the bandwidth of π -function.

CHAPTER 3: RELETIVE BENEFIT MODEL

3.1 Why Relative Benefit Model

Since, some cases contribute mainly to the competence of the system and others may predominantly contribute to its performance, the previous approaches have direct refection to real world application in Electronic commerce. They may not guarantee that the deleted case contributes mainly benefit or still is usually used or still be represents product being sold in the shop.

This section describes the new maintenance strategy, which is relative benefit model, to maintain case base system based on Relative Benefit value (RB) of each case. This model is designed to minimize the loss of necessary cases for the selling process.

The key concept is identifying relative benefit value and classification cases into low benefit group, medium benefit group, and high benefit group by taking necessary factors from case attribute and transaction of sales such as an average frequency of retrieval, frequency of sell, margin, and remaining day that case is available in the system to perform relative benefit value for measuring cases.

3.2 Introduction to Relative Benefit Structured

The relative benefit model consists of two major levels in structural. Identification of relative benefit value (RB) to each case is the first level. The second level is the selection of deletion policy.

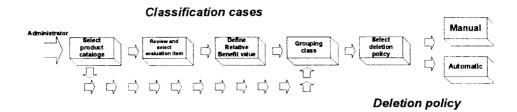


Figure 3-1: Structure of Relative Benefit Model

The cases are grouped into low benefit group, medium benefit group, and high benefit group depending on their relative benefit value that fit in each group. The cases grouped in the low benefit group will be deleted from the system before the cases grouped in the medium benefit group and the high benefit group in ordered. However, the cases with immediate end of life cycle will be the first priority to be selected for deletion without considering their relative benefit value.

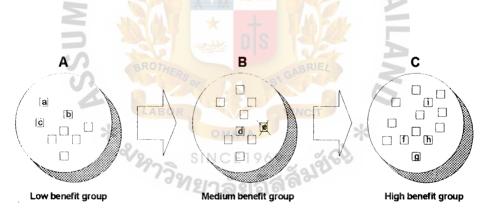


Figure 3-2: Case categories

Figure 3-2 illustrates the difference case categories in term of their benefit for case library and electronic shop. Each case is identified benefit value and modeled into

Low benefit group, Medium benefit group, and High benefit group in ordered with subjected by human depending on benefit value from less to much. Case "a", "b", "c" are classified into Low benefit cases which is the first group that will be selected to delete from the system before other while case "d" and "e" are grouped into medium benefit group. Case "f", "g", "h", and "i" are high beneficial cases, which are classified as high benefit group that are selected for deletion from the system in the last group. However, the case with immediate end of life cycle will be moved firstly from the system before other system before other will be moved from the system before other case because it is end of life case.

3.3 Two steps of maintenance process

This section illustrates the structure of Relative benefit model, which is separated into two steps to maintain case, classify case and deletion policy as illustrate in Figure 3.1

3.3.1 Classification case

In electronic shop, each case is important to sales application because it can represent product contained in actual inventory. Maintenance case base system is helps to increase the efficiency and effectiveness for sales processing especially in term of storage control, inventory control, and performance control that lead to increase customer satisfaction. To delete each case we must consider effectiveness of sales transaction and efficiency case base system. Each case should be classified in term of benefit to case base system and electronic commerce business. Some attributes and transactions of a case such as frequency of sell and frequency of retrieval, therefore, are selected to be evaluation item to model relative benefit value. There are four steps to classification case as follows

- 1. Select product type
- 2. Select factor and identify the group of quality to each factor for using in the calculation of relative benefit value
- 3. Define relative benefit value
- 4. Classification cases into several groups based on benefit level

3.3.1.1 Select product type

Sine, there should be many products sell in electronic shop, the case should be kept in case library indexed by product type. In business environment, each product may be measure either factor in different value such as high gross margin of sell for PC should not lower than 20% while high margin of printer should between 10-15%. Therefore, the maintenance case should be separately considered if possible.

3.3.1.2 Select factor to denote relative benefit value to measure the benefit of a case

The factors selected to be the criterion for measuring level of benefit to each case must contribute mainly to be benefit for the vender and the customer in term of sales processing. The criteria can be any attributes or transactions of a case depending on each business type. However, this thesis shows some example criteria to evaluate and identify the relative benefit of a case

- Case attribute such as pricing, date, time, stock, etc.
- Transaction such as frequency of retrieval, frequency of sell, etc.

| Criteria Fuzz term | Average frequency of retrieval | Average frequency of sell | Margin | Life Cycle |
|-----------------------|--------------------------------------|---------------------------------|--------|------------|
| l st Level | Low | Low | Low | Short |
| 2 nd Level | Normal | Normal | Normal | Normal |
| 3 rd Level | High | High | High | Long |

Table 3-1: The table of modeling quality to each factor

From the Table 3-1, each factor can be selected from attributes and transaction of a case occurred during sales processing. Average of frequency of retrieval, Average of frequency of sell, margin and remaining date of life cycle are selected to be the sets of fuzzy.

Factor 1: Average frequency of retrieval (AvgFR)

The average frequency of retrieval is a ratio of an average of frequency that the case is retrieved from the system in selling process and the period of that case available in the system.

AvgFR = total amount of retrieval/(Effective date-Expired date) (3.1)

Factor 2: Average Frequency of sell (AvgFS)

The average of frequency of sell is a ratio of an average frequency that the case is selected for buy from the buyer or customer and the period of that case available in the system

AvgFS = total amount of sell out times/(Effective date- Expired date) (3.2)

Factor 3: Margin

Margin is the percentage of margin that can earn from selling process

Margin = [(sale price - cost) x 100]/sale price

Factor 4: Life cycle (LC)

Life cycle is the remaining day that a case is available in the system till end of its life cycle.

Life cycle = (Expired date-current date)

(3.4)

(3.3)

After collect static of value of all factors, their value are denoted the term Low, Medium or High group of their quality level (see example in Table 3-1). The degree of membership function represents the grade of each term. Referring to the membership function represented in (2.5), (2.6) and (2.7), they are used to calculate and denote the term Low, Medium and High for each factor.

| Case no. | Code | Brand | Price | Solution | |
|----------|---------|-------|-------|----------|-----------|
| Case01 | IBMH001 | IBM | 4000 | 10GB | Hard Disk |
| Case02 | HPH001 | HP | 3500 | 10GB | Hard Disk |

Table 3-2: Case of personal computer

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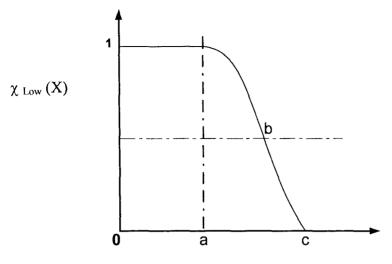
The element or value of each factor, the average of frequency of retrieval and frequency of sell, gross margin, and product life cycle, is collected for using in specification of quality level to such factors.

| Case no | AvgFR | AvgFS | Margin | LC |
|---------|--------|--------|--------|--------|
| Case01 | 0.875 | 0.0571 | 7.4074 | 0.4286 |
| Case02 | 1.8958 | 0.833 | 10 | -0.625 |
| | | | | |

Table 3-3: Factors and their elements

Referring the graph of fuzzy set Low in figure 2-6, the example of defining the

quality for each factor can be described in next page



AvgFR/AvgFS/Margin/LC

Figure 3-3: Graph of membership function for term Low of each factor

Let the range of term Low quality for each factor is set as follow:

| Define Value for Maintanace | | | | |
|------------------------------|-------------------|---------|----------|-----|
| Save Close | De Carlo | BRIEL | P | |
| F | Product Type : PC | | 6 | |
| LA | BOR | VINCITA | <u> </u> | 8 |
| Frequancy of Retrival : Rang | of low FR OMNIA | 0.3 | 0.6 | 0. |
| Frequancy of Sale : Rang | of low FSINCE 196 | 0.3 | 0.4 | 0. |
| Price Performance : Rang | of low Margin % | 2 2 | 3 | 2 |
| Life cycle of a case : Rang | of low LC Day | 0.25 | 0.3 | 0.2 |
| | | · | | |

Figure 3-4: Define rang of low quality to each factor

If value of Avg FR is 0.875, we can define the membership function of fuzzy set Low by using formula (2.5)

$$\chi_{A}(X) \quad 1-S(0.875;a,b,c) = \begin{cases} 1 & \text{for x a} \\ 1-2((0.875-a)/(c-a))^{2} & \text{for a} < x < b \\ 2((0.875-c)/(c-a))2 & \text{for b} < x < c \\ 0 & \text{for x c} \end{cases}$$

where "a" and "c" are the function's end points, and b = (a+c)/2

Let a = 0.3, c = 0.6, b = 0.45, the degree of membership function in set low of FR value 0.875 is 0.

If we denote fuzzy term Medium and high to element 0.875 by using formula (2.10) and (2.11) in order, we can get the degree membership function of term Medium is 0 and term High is 1. Therefore, the element 0.875 should be denoted to term High because the maximum of degree of membership function belongs to term High.

3.3.1.3 The calculation of Relative Benefit Value (RB)

After the quality of each factor is denoted such as Margin is high or Frequency of retrieval is high, these results can be used to define Relative Benefit Value of each case.

Let $I = \{A_1, A_2, A_3, ..., A_n\}; A_1, A_2, ..., A_n \text{ is set of transaction or case attribute} selected as factors to measure benefit of each case.$

Dgr = degree of membership of each evaluation item

W = weight of each classification quality;

where $W_{Low} < W_{Medium} < W_{High}$

N = amount of evaluation items

Relative benefit value (RB) =
$$\frac{\sum_{i=1}^{N} (W_i * Dgr_i)}{N}$$
 (3.5)

The format of distribution form can be shown as in this following formula

$$RB = [(W_{A_1} * Dgr_{A_2}) + (W_{A_2} * Dgr_{A_2}) + (W_{A_3} * Dgr_{A_3}) + \dots (W_{A_n} * Dgr_{A_n})]/N$$
(3.6)

Example of how to calculate relative benefit value

Let "case A" have 0.8 of a degree of membership function of LOW for frequency of retrieval, a degree of membership function of set HIGH for frequency of sell is 0.7, a degree of membership function of set HIGH for price performance is 0.9, a degree of membership function of set MEDIUM for life cycle is 0.7 for life cycle, the weight for LOW class is 1, the weight of MEDIUM class is 2 and the weight of HIGH class is 3. The relative benefit of case "A" can be defined as follow

If $I = \{ AvgFR, AvgFS, Margin, LC \}$ where AvgFR is average frequency of retrieval, AvgFS is average frequency of sell, *Magin* is margin of sales, and *LC* is remaining of Life cycle of a case

$$RB = (W_{AvgFR} * Dgr_{AvgFR}) + (W_{AvgFS} * Dgr_{AvgFS}) + (W_{margin} * Drg_{margin}) + (W_{LC} * Dgr_{LC})]N$$
$$= [(1x0.8) + (3x0.7) + (3x0.9) + (2x0.7)]/4$$
$$= 1.75$$

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3.3.1.4 How to classify case

Each case can be classified in to the groups depending on relative benefit value of either case. The groups that are denoted to the level of benefit are classified by using the three linguistic words, Low benefit, Medium benefit, and High benefit, according to the subjective judgment of the inspector.

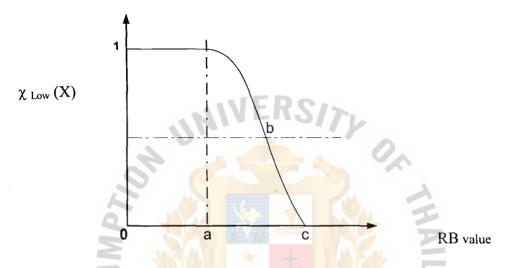


Figure 3-5: Graph of membership function of RB value in set LOW

Referring to the formula (3.10), let X be Relative benefit value. The low RB is used for guiding case deletion. The key concept is classified into the group LOW RB which containing the case with about low RB value. The degree of membership function of $\chi_{LOW}(X)$ is between 0 to 1. The fuzzy set LOW of X is the set characterized by the membership function

$$\mu$$
Low: X \rightarrow [0,1]

Here, the degree of membership is a measure of benefit level, and the best quality level is 0 and the worst 1[17]; it is a basic variable standardized on the interval [0,1]. An example of membership functions for the three linguistic variables mentioned above is shown in following:

Let x be degree of membership function of Relative benefit value that variable standardized on the interval [0,1], y is membership function of degree of membership function in low benefit level, medium benefit level and high benefit level.x1 and x2 is the minimum and maximum of x that classified into Low benefit group, x3 and x4 is the minimum and maximum of x that classified into Medium benefit group, x5 and x6 is the minimum and maximum The group of Low benefit, Medium benefit and High benefit can be denoted from the degree of membership function as shown in figure 3-6

| 5 | | | 19 | PIE | A | |
|-------------------|-----------------------|-------|--------|------|----------|---|
| 📲 Input Fuzzy set | names and description | | | | | × |
| New Delete Save | Close Close | | | NOIT | S | |
| : | Product Type : | | 1969 | | * | |
| | Low Benefit | ยาล์ร | าร์เลด | 0.4 | <u>_</u> | |
| | Medium Benefit | 0.25 | - - | 0.75 | <u>.</u> | |
| | High Benefit | 0.6 | | 1 | | ~ |
| | | | | | | |

Figure 3-6: The minimum and maximum of fuzzy term Low, medium,

and High benefit

Let x1 = 0, x2 = 0.4 x3 = 0.25, x4 = 0.75, x5 = 0.6, and x6 = 1. The shape of benefit level graph also can be subjects in Figure 3-6.

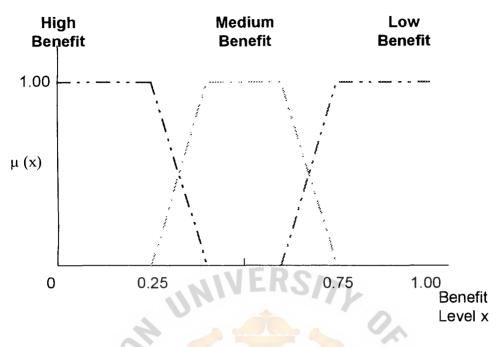


Figure 3-7: Graph of relative benefit level

Referring to fuzzy set theory [16] that operated the union of two fuzzy sets is the set of their elements that belong either to one of the constituent sets or to both. For any point in the domain of the two fuzzy sets, the membership grades of the elements of the union set must be equal to the greater of the two membership grades of the either one of the constituent sets. Thus,

The union of the fuzzy sets A and B, denoted by $A \cup B$ (or $A \ OR B$) is defined by:

$$A \cup B = \int_{U} [\chi_A(x) \# \chi_B(x)]/x, \qquad x \in U \qquad (3.7)$$

where the symbol # stands for max, Thus, for any $a \in A$ and $b \in B$,

$$max \left[\chi_A(a), \chi_B(b) \right] = \chi_A(a) \qquad \text{if } \chi_A(a) \ge \chi_B(b) \quad (3.8)$$

 $= \chi_B(b) \qquad \text{if } \chi_A(a) < \chi_B(b) \qquad (3.9)$

The max operation can exhibit the following property

Associativitity: $[\chi_{\chi}(x) \cup \chi_{\chi}(y)] \cup \chi_{z}(z) = \chi_{\chi}(x) \cup [\chi_{\chi}(y) \cup \chi_{z}(z)] \quad (3.10)$

where X, Y, and Z be fuzzy sets and let $x \in X$, $y \in Y$, and $z \in Z$

Let X, Y, and Z are fuzzy sets of Low benefit, Medium Benefit and High benefit in ordered. x, y, and z are relative benefit value of the cases where $x \in X$, $y \in Y$, and $z \in Z$. Thus, the cases are in

INFPC

| Low benefit group | if $\chi_{Low}(x) \geq \chi_{Medium}(y)$ and $\chi_{Low}(x) \geq \chi_{High}(z)$ | |
|----------------------|---|--------|
| Medium benefit group | if $\chi_{Medium}(y) \geq \chi_{Low}(x)$ and $\chi_{Medium}(y) \geq \chi_{High}(z)$ | |
| High benefit group | if $\chi_{High}(z) \geq \chi_{Low}(x)$ and $\chi_{High}(z) \geq \chi_{Medium}(y)$ | (3.11) |

3.3.2 Deletion policy

This section is detailed in the deletion policy based on cases categorized in previous section. Case deletion is favoring cases with low RB values.

Ideally, the case in Low benefit is considered for deletion before the case in medium benefit and high benefit group. However, the case with immediate end of life cycle will be the first priority to be selected for deletion. Within each group, the case that has lowest relative benefit value will be selected before higher value in order.

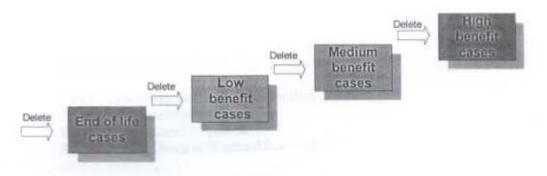


Figure 3-8: Deletion diagram

In the deletion process, the selection case or group will be moved to recycle bin area before removing from the system. The system administrator can review the cases that were deleted again. They can still use the case from recycle bin again.

Let case base represent base product (Single), package product, or custom made product customized by customer during searching in sale process, the policy to maintain either case based on relative benefit value is shown in the following procedure

Procedure DeleteCase IS

Begin

If there are EndOfLife Case Then Call DeleteSingleProduct(EndOfLifeSingleProduct) Call DeletePackageProduct(EndOfLifePackageProduct) Call DeleteCustomMadeProduct(EndOfCustomMadeProduct) Elseif there are Low Benefit Group Then

> Select LowestBenefit.SingleProduct From LowBenefitGroup Product Where ProductLevel = "Lowest" And ProductGroup is "SingleProduct "

Call SingleProduct(LowestBenefitProduct)

Select LowestBenefit.PackageProduct From LowBenefitGroup Product Where ProductLavel = "Lowest" And ProductGroup is "PackageProduct " Call PackageProduct(LowestBenefitProduct)

Select LowestBenefit.CustomMadeProduct From LowBenefitGroup Product Where ProductLavel = "Lowest" And ProductGroup is "CustomMadeProduct "

Call CustomMadeProduct(LowestBenefitProduct)

Elseif there are Medium Benefit Group Then

SelectLowestBenefit.SingleProductFromMediumBenefitGroup ProductWhereProductLavel = "Lowest"AndProductGroup is "SingleProduct

Call SingleProduct(LowestBenefitProduct)

| Select | LowestBenefit.PackageProduct |
|--------|-----------------------------------|
| From | MediumBenefitGroup Product |
| Where | ProductLavel = "Lowest" |
| And | ProductGroup is "PackageProduct " |

Call PackageProduct(LowestBenefitProduct)

| Select | LowestBenefit.CustomMadeProduct |
|--------|------------------------------------|
| From | MediumBenefitGroup Product |
| Where | ProductLavel = "Lowest" |
| And | ProductGroup is "CustomMadeProduct |

Call CustomMadeProduct(LowestBenefitProduct)

Elseif there are High Benefit Group Then

Select LowestBenefit.SingleProduct From MediumBenefitGroup Product Where ProductLavel = "Lowest" And ProductGroup is "SingleProduct "

Call SingleProduct(LowestBenefitProduct)

Select LowestBenefit.PackageProduct From MediumBenefitGroup Product Where ProductLavel = "Lowest" And ProductGroup is "PackageProduct "

Call PackageProduct(LowestBenefitProduct)

| Select | LowestBenefit.CustomMadeProduct |
|--------|-------------------------------------|
| From | MediumBenefitGroup Product |
| Where | ProductLavel = "Lowest" |
| And | ProductGroup is "CustomMadeProduct" |

Call CustomMadeProduct(LowestBenefitProduct)End if; End if; End if;

End; End DeleteCase

Procedure Deleted SingleProduct (P_ProductCode)IS

<Define Cursor><Base product Cur>
Select EndofLife.Product
From AllProduct
Where ProductGroup is "SingleProduct" AND ProductCode = "P_ProductCode"

<Open Cursor read data>< Single product Cur >

Execute Command Fetch data Fetch data from Single product Cur into variable as following declaration part Execute Command Delete Loop till either send status is success or Cursor % not found Execute command do commit data Terminate with Success. End Deleted SingleProduct

Procedure Deleted PackageProduct (P_ProductCode)IS

<Define Cursor><Package product Cur> Select EndofLife.Product From EndOfLifeProduct Where ProductGroup is "PackageProduct "

<Open Cursor read data><Package product Cur>

Execute Command Fetch data Fetch data from into variable as following declaration part Execute Command Insert into All Delete Code Insert into COLUMNS Product_code, Product_Description, Delete Date

Execute Command Delete

Loop till either send status is success or Cursor % not found Execute command do commit data Terminate with Success.

End Deleted PackageProduct

Procedure Deleted CustomMadeProduct (P_ProductCode)IS

<Define Cursor><CustomMade product Cur> Select EndofLife.Product From EndOfLifeProduct Where ProductGroup is "CustomMadeProduct "

<Open Cursor read data><Package product Cur>

Execute Command Fetch data

Fetch data from into variable as following declaration part Execute Command Insert into All Delete Code Insert into COLUMNS Product_code, Product_Description, Delete Date

Execute Command Delete

Loop till either send status is success or Cursor % not found Execute command do commit data Terminate with Success.

End Deleted CustomMadeProduct

Procedure Alert Deleted Product(P_ProductCode Parameter

In) IS

<Define Cursor><Alert product Cur> Select ProductCode From All Delete Product {Summary of all product} Where ProductCode = P_ProductCode

Popup Alert message ('Product was delete is' || Product Code || Product Description)

Exception When no data found Then Null;/* Product existing in system */

<Open Cursor read data><AlertProduct Cur>

Execute Command Fetch data Fetch data from into variable as following declaration part Execute Command Delete

Loop till either send status is success or Cursor % not found Execute command do commit data Terminate with Success.

End Alert Deleted Product

Figure 3-9: The algorithm of deletion each case

3.3.3 Relative benefit in adding case into new case library

This method is reverting of deletion case. The cases in an original case base are selected and added to an empty case base until the limited size is reached. Selection can be one case or whole group. The high benefit case will be the first group for selection, and then followed by medium benefit case and low benefit case in order. The detail is not described in this thesis.

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CHAPTER 4: EXPERIMENTAL AND EVALUATION

As the performance evaluation on this type of contribution is difficult because in domain of electronic shop the performance of retrieval case is involved with hardware specification of remote client. This chapter will focus on measuring the quality of remaining cases after deletion case from the system based on beneficial value used as a criterion. For evaluation, the relative benefit method is compared with the utility method on different sizes of case library.

4.1 Environment of Examination

Regarding the measurement of evaluation that focused on the quality of remaining case after deletion, the following issues are the consideration for evaluation

0.

- The expected results of cases after deleting target case from case library
- The deletion are examined with different amount of fixed sizes of cases library
 (swamping limit)
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The environment used to evaluate the measurement of the quality of remaining case and response time is examined under the following system environment:

Hardware specification

- Intel Pentium II 600
- Hard disk
 12 GB
- RAM 128 MB

Software specification

- Using Microsoft Visual Basic 6.0 develops the prototype.
- A tested database in on Microsoft SQL server
- Windows 2000 Professional

Tested case base system

The case library system is stimulated to initial case. A case is initialed from both original server and via web page. The database is developed based on specific and control domain of PC/Server configuration. Each case constrains necessary attributes of PC/Server specification. Case name, brand, type, product number, description, CPU, memory, monitor, modem, hard disk, price, effective date, expired date, etc, are all attributes within a case. An average of frequency of retrial and frequency of sell per day, the margin of sales, and remaining day that each case stay in the system were kept a static as a factor to measure a beneficial case for sales processing in electronic commerce.

O.

4.2 Experimental method

An initial case-base size of 25 cases was creased. The web accessing for searching and doing sales transaction is started. Additional cases are added to the system until the size of case base hits 50 cases, swamping limit. The example of description of a case is as follow :

| Case Name | Brand | Description | Monitor | Modem | Ram | Harddisk | CPU | CD- ROM | DYD- Rom | CD- R¥ | LAN | Price |
|--------------|--------|-------------------|-----------|-------------|------------|------------|---------|-------------------|-------------|-----------|-----------|-------|
| P0001 | Compaq | Pentium III no I | 15" Compa | 56 K Compi | 128 Comp | 20 Compa | 133 MHz | - | • | - | - | 31200 |
| P0002 | Compaq | Pentium III CD | 15" Compa | 56 K Compi | 129 Comp | 20 Compa | 133 MHz | 40x Comp | - | | - | 32200 |
| P0003 | Compaq | Pentium 4 1.6G | 15" Compa | 56 K Comp | 128 Comp | 20 Compa | 1.6GHz | | - | - | | 38000 |
| P00031 | Compaq | Pentium 4 1.6G | 15" Compa | 56 K Comp | 128 Comp | 20 Compa | 1.6GHz | $\mathbf{\Omega}$ | - | Yamaha | - | 42900 |
| P0007 | IBM | Pentium III 800 | 15" IBM | 56 K IBM | 64 IBM | 20 IBM | 800 MHz | | <u>.</u> | | - | 27500 |
| P00071 | IBM | Pentium III 800 | 15" IBM | 56 K IBM | 64 IBM | 20 IBM | 800 MHz | | 16x HP | - | • | 32300 |
| P0010 | HP | Pentium III 1.3 (| 15" HP | 56 K HP | 64 HP | 40 Seagate | 1.3 GHz | | | - | - | 29000 |
| P00101 | HP | Pentium III 1.3 (| 15" HP | 56 K HP | 64 HP | 40 Seagate | 1.3 GHz | <u></u> | 55 | - | LAN typ | 35000 |
| P00102 | НP | Pentium III 1.3 (| 15" HP | 56 K HP | 64 HP | 40 Seagate | 1.3 GHz | KP. | | - | 10/100 L/ | 36000 |
| P0039 | StarPC | Celeron 1.3Gha | | 56 K US Rol | 128 Hitach | 40 Seagate | 1.3 GHz | Ø. | - | - | - | 13000 |
| P00391 | StarPC | Celeron 1.3Gha | -140. | 56 K US Rol | 128 Hitac | 40 Seagate | 1.3 GHz | 16x Asus | | - | - | 15000 |
| P003910 | StarPC | Celeran 1.3Gha | | 56 K US Rol | 128 Hitach | 40 Seagate | 1.3 GHz | | | LG | | 16450 |
| P0049 | innoPC | ATHLON 1.4 G | • • | 56 K Rockw | 128 Hitacl | 20 Seagate | 1.4GHz | 52x Sony | - | - | - | 14000 |
| P0050 | InnoPC | ATHLON 950 | | 56 K Rockw | 128 Hitacl | 20 Seagate | 950 MHz | 52x Sony | \leq | . | - | 13000 |
| P00501 | InnaPC | ATHLON 950 | 2 - 0 | 56 K Rockw | 129 Hitacl | 20 Seagate | 950 MHz | 52x Sony | 16x HP | | | 17800 |

Table 4-1: Example of case description

The cases are classified into low benefit, medium benefit and high benefit group based on relative benefit value identified from necessary factors such as average frequency of retrieval, average frequency of sales, margin, and remaining day that case available in the system. The identification of values for low quality of each factor used to define relative benefit value is as follow :

| Define Value for Maintanace | a tong tong tong tong tong tong tong tong | | 35.7-: | | × |
|--|---|----------|--------|------------------|-------|
| Image: Weight of the second | | | | ······ | |
| | Product Type : PC | <u> </u> | | ₹ ⁿ i | 2 |
| Frequancy of Retrival: | Rang of low AvgFR | ſ | 0.3 | 0.6 | 0.45 |
| Frequancy of Sale : | Rang of low AvgFS | [| 0.1 | 0.15 | 0.125 |
| Price Performance | Rang of low Margin % | | 7 | 10 | 8.5 |
| Life cycle of a case | Rang of low LC Day | | 5 | 8 | 6.5 |
| | | | | | |

Figure 4-1: Define range of low quality to each factor

| Perine Rang | ge of Low | | | | Clerk. |
|-------------|-------------|--------------------------|------------------------------|---------------------------------|---|
| a Enjete | Save Close | | | | P |
| | | 1 | | | |
| Please (| define rang | ge <mark>of Low F</mark> | RB : | | A |
| | ERSOFA | | ST GABRIEL | t t | 3 |
| From : | | 1.5 To : | | 2 | 1.75 |
| | | | | * | |
| 2/29m | SIN | CE196 | 9 ~ ~ | 67 | |
| | Please of | Please define rang | Please define range of Low F | Please define range of Low RB : | Please define range of Low RB : A C I From : 1.5 To : 2 |

Figure 4-2: Define range of low relative benefit value

| S Input Fuzzy set names and description | | | × |
|---|------|------|---|
| Product Type : | PC | ▼. | |
| | Min | Max | |
| High Benefit | | 0.4 | |
| Medium Benefit | 0.25 | 0.75 | |
| Low Benefit | â.0 | | |
| | | | |

Figure 4-3: Define fuzzy set for classification of a case

The relative benefit method and the utility method are studied and experimented. The cases that remained in the system should be high benefit cases whereas deletion cases should minimize the loss of high beneficial cases. For this experiment, the cases that have top five levels of high score of relative benefit value are assumption as high benefit cases that are the criterion to measure the result of both deletion methods.

| | | LABOR | VINCIT | Grade or degree |
|------|-----------|--------------------------|------------------|-----------------|
| ltem | Case Name | Case description | Level of benefit | of each level |
| 1 | P0003 | PC Pentium 4 1.6Ghz | High benefit | 2.6787 |
| 2 | P0039 | PC Celeron 1.3Ghz SAVING | High benefit | 2.5 |
| 3 | P0022 | PC Duron 1.2 GHz | High benefit | 2.5 |
| - 4 | P0019 | PC Duron 950 MHz | High benefit | 2.5 |
| 5 | P0018 | PC Duron 900 Mhz | High benefit | 2.5 |
| 6 | P0015 | PC Pentium III 1.3 GHz | High benefit | 2.5 |
| 7 | P0008 | PC Pentium III 866MHz | High benefit | 2.5 |
| 8 | P00071 | PC Pentium III 800 MHz | High benefit | 2.5 |
| 9 | P00091 | PC Pentium III 933 MHz | High benefit | 2.4997 |
| 10 | P00093 | PC Pentium III 933 MHz | High benefit | 2.4955 |
| 11 | P0024 | PC ATHLON 1.4 GHz | High benefit | 2.4812 |
| | | | | |
| | | | | |

Table 4-2: Example of top five levels of high beneficial cases

The experiment starts with taking one necessary factor as a criterion to subject beneficial cases. An average frequency of retrieval (AvgFR) is the first factor selected to measure a benefit of a case. The case that has much average frequency of retrieval should be of more benefit than other cases. After deletion with relative benefit method and utility method, see and compare how many high benefit cases subjected as example in Table 4-2 are deleted or remained in the system.

| | matic Delet | | | | | | | | | 1. 1. 1. 1. S. 1. | 최 🛛 |
|------------|--------------|------------------------|-------------|--------|-------------------|---------------------------|------------|---------------|-----------------|-------------------|----------------|
| <u> </u> | elete | Close | | | 747 | | | | | | |
| | Dend. at The | | nping Limit | 50 | | | | | | | |
| | Product Ty | pe: PC 🔄 Swean | iping Limit | 50 | | | | | | | |
| | Delete Clo | ss: Low benefit 💌 Tar | et Delete | | | | | | | | |
| Remai | ned Case | | | | Export | Show R8 | | - | | | |
| No. | Case Name | Case Description | RB | Dgr A8 | Class | Frequency of Retineval | Usage Time | Utility Value | Qty of Sales | <u></u> | |
| 17 | P00081 | PC Pentium III 866MHz | 1.9960 | .0001 | High benefit | 37 | 0 | .0000 | 4 | | |
| 18 | P0008 | PC Pentium III 866MHz | 3.0000 | .0000 | High benefit | 112 | G | .0000 | 15 | 2.34 | |
| 19 | P00071 | PC Pentium III 800 MHz | 3.0000 | .0000 | High benefit | 57 | 0 | .0000 | 1 | | |
| 20 | p0007 | PC Pentium III 900 MHz | 3.0000 | .0000 | High benefit | 112 | 0 | .0000 | 16 | | |
| 21 | P0006 | PC Cereion 1.1Ghz | 3.0000 | .0000 | High benefit | 96 | 0 | .0000 | 9 | | |
| 22 | P0005 | PC Pentium 4 1.5Ghz | 2.9541 | 0000 | High benefit | 105 | 0 | .0000 | 1 | | |
| 23 | P0004 | PC Pentium 4 1.6Ghz | 2.6738 | .0000 | High benefit | 97 | 0 | .0000 | ż | | |
| 24 | P00031 | PC Penkium 4 1.6Ghz | 3,0000 | .0000 | High benefit | 62 | Ó | .0000 | 23 | 1000 | |
| 25 | P0003 | PC Pentium 4 1.65hz | 3,0000 | 0000 | High benefit | 106 | Ō | .0000 | 13 | Series | |
| 26 | p00011 | PC Pentium III no CD | 1.9729 | .0059 | High benefit | 37 | Ō | .0000 | 17 | | : 1 0 |
| 27 | P0001 | PC Pentium III no CD | 3 0000 | 0000 | High benefit | 103 | Ō | .0000 | 2 | | () 12 |
| 4 | | | | | | | | | | | |
| | d Case | BRUTHE | | | GA | Differ of | | | | استناسب | |
| No. | | Case Description | RB | | | Frequency of | Usage Time | Utility Value | | - | |
| _ | Case Name | | | Dgr RB | Class | Retrieval | Usage i me | | ratio or person | | _ 1 |
| 1 | FD802 | FC Pentium III CD | 3 0000 | 0(8)0 | End of file cycle | | 0 | 0000 | 1 | | |
| 2 | P00033 | PC Pentium 4 1.6Ghz | .9922 | 1.0000 | Low benefit | 29 | 0 | .0000 | 1 | | |
| 3 | P00034 | PC Pentium 4 1.6Ghz | .9922 | 1.0000 | Low benefit | 29 | 0 | .0000 | 1 | | |
| 4 | P00035 | PC Pentium 4 1.6Ghz | .9922 | 1.0000 | Low benefit | 29 | 0 | .0000 | 1 | | 1 |
| 5 | P00041 | PC Pentium 4 1.6Ghz | 1.0000 | 1.0000 | Low benefit | 28 | 0 | .0000 | 7 | | |
| 6 | P00051 | PC Pentium 4 1.5Ghz | 1.0000 | 1.0000 | Low benefit | 28 | 0 | .0000 | 2 | 5.C. | |
| 7 | P00052 | PC Pentium 4 1.5Ghz | 1.0000 | 1.0000 | Low benefit | 28 | 0 | .0000 | 2 | S | 5 |
| B | P00092 | PC Pentium III 933 MHz | S 1.0000 | 1,0000 | Low benefit | 18 | 0 | .0000 | 4 | | |
| 9 | P00093 | PC Pentium III 933 MHz | 1.0000 | 1,0000 | Low benefit | 19 | 1 | .0000 | 19 | | |
| 10 | P00101 | PC Pentium III 1.3 GHz | 1.0000 | 1,0000 | Low benefit | 30 | 0 | .0000 | 1 | | |
| 11 | P00102 | PC Pentium III 1.3 GHz | 1.0000 | 1.0000 | Low benefit | 29 | 0 | .0000 | 1 | - I | |
| ب ا | 000101 | DO DANK IN REPORTS | - 1 + nnnn | 6 1 mm | - 6 | | • | 0000 | • | 1 | - 29 |
| - | ····· | | | | | | | | | | <mark>2</mark> |
| | | | | | | | | | | | |
| | | | | Export | Start 8:14:17 PM | End 8:14:20 P | ī | | | | |

Figure 4-4: Deletion case by Relative benefit method

| Product Type: PC Swamping Link 50 Delete Class: Low benefit Toget Delete Remained Case Toget Delete No. Case Name Case Descrition RB Dy RB Case By d Sate 15 P00091 PC Perturn III 533 MHz 20000 0000 High benefit 8 15 P0009 PC Perturn III 563 MHz 20000 0000 High benefit 5 16 P0007 PC Perturn III 660 MHz 20000 0000 High benefit 9 19 p0007 PC Perturn III 660 MHz 130000 High benefit 9 17 P0005 PC Perturn III 600 MHz 13975 0010 High benefit 9 20 P00001 PC Perturn III 600hz 1975 10000 High benefit 13 21 P00003 PC Perturn III 150hz 13977 2000 0000 High benefit 17 24 P0003 PC Perturn III 150hz 129286 0000 High benefit 17 24 P0003 PC Perturn III 150hz 10000 Low benefit 1 10000 Low benefit 1 <th>Delete Class Low beneft Torget Delete termained Class Implement Torget Delete Show AI 15 P00031 PC Pertamill S201H1; 20000 0000 High beneft 6 15 P00032 PC Pertamill S201H1; 20000 0000 High beneft 6 15 P00033 PC Pertamill S201H1; 20000 0000 High beneft 6 15 P0003 PC Pertamill S00 H1; 20000 0000 High beneft 15 18 P00071 PC Pertamill S00 H1; 13055 0001 High beneft 15 19 p00071 PC Pertamill S00 H1; 13055 0010 High beneft 15 20 P0005 PC Pertamill S00 H1; 13055 0000 High beneft 13 21 P0005 PC Pertamill S00; 23586 0000 High beneft 13 22 P0001 PC Pertamill Ino CD 24664 0000 High beneft 13 25 p00011</th> <th>#</th> <th>Delete</th> <th>c Cose</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>¥</th> <th></th> | Delete Class Low beneft Torget Delete termained Class Implement Torget Delete Show AI 15 P00031 PC Pertamill S201H1; 20000 0000 High beneft 6 15 P00032 PC Pertamill S201H1; 20000 0000 High beneft 6 15 P00033 PC Pertamill S201H1; 20000 0000 High beneft 6 15 P0003 PC Pertamill S00 H1; 20000 0000 High beneft 15 18 P00071 PC Pertamill S00 H1; 13055 0001 High beneft 15 19 p00071 PC Pertamill S00 H1; 13055 0010 High beneft 15 20 P0005 PC Pertamill S00 H1; 13055 0000 High beneft 13 21 P0005 PC Pertamill S00; 23586 0000 High beneft 13 22 P0001 PC Pertamill Ino CD 24664 0000 High beneft 13 25 p00011 | # | Delete | c Cose | | | | | | ¥ | |
|--|--|------|------------|--|-------------|--------|--------------|--|--------------------------------|--|-----------|
| Agemeined Case Earch Show Al No. Case Name Case Discription R8 Dp R8 Cast Dty of Sele 15 P00039 PC Perturnill 933 MHz 20000 0000 High benefit 8 16 P00039 PC Perturnill 933 MHz 20000 0000 High benefit 8 17 P00039 PC Perturnill 800 MHz 20000 0000 High benefit 15 18 P00071 PC Perturnill 800 MHz 13095 0010 High benefit 15 19 P0007 PC Perturnill 800 MHz 13975 0313 High benefit 15 20 P0005 PC Ferturnill 800 HHz 13975 0313 High benefit 16 21 P00005 PC Ferturnill 150Hz 13977 0002 High benefit 17 22 P00005 PC Ferturnill 160D 2388 0000 High benefit 13 23 P00007 PC Perturnill 160D 24684 00000 High benefit 12 | Isrmäning Case Exot Shon Al Na Case Name Case Description R8 Dy R9 Cast By of Sater 15 P00051 PC Perturn III 330 MHz 20000 0000 Hxp boreft 6 15 P0005 PC Perturn III 300 MHz 20000 0000 Hxp boreft 6 17 P0005 PC Perturn III 500 MHz 20000 0000 Hxp boreft 15 18 P00071 PC Perturn III 500 MHz 20000 0000 Hxp boreft 15 19 p0007 PC Perturn III 500 MHz 19855 0010 Hxp boreft 15 20 P0005 PC Perturn III 500 MHz 19877 0002 Hxp boreft 15 21 P0005 PC Perturn II 1500 19771 0000 Mxp boreft 13 22 P0004 PC Perturn III 1500 24684 0000 Hxp boreft 13 23 P0001 PC Perturn III 100 D 24684 0000 Loro boreft 1 <t< th=""><th></th><th>Product Ty</th><th>pe: PC - Swar</th><th>nping Limit</th><th>50</th><th></th><th></th><th></th><th></th><th></th></t<> | | Product Ty | pe: PC - Swar | nping Limit | 50 | | | | | |
| No. Case Name Case Description R8 Ogr R9 Case Quy of Seler No. Case Name Case Description R8 Ogr R9 Case Quy of Seler 15 P00031 PC Perstam III S33 MHz 20000 0000 High benefit 6 16 P00071 PC Perstam III B60MHz 20000 0000 High benefit 15 18 P00071 PC Perstam III B60MHz 20000 0000 High benefit 15 19 p0007 PC Perstam III B60MHz 13975 0113 High benefit 15 20 P0006 PC Perstam III S00 HHz 13975 0113 High benefit 2 21 P00051 PC Perstam III S002 13977 0103 High benefit 2 22 P00051 PC Perstam III S002 23988 00000 High benefit 1 23 P00051 PC Perstam III S002 24684 0000 High benefit 1 24 P00053 PC Perstam III S004 | Number Conservation R8 Dy R8 Class Ry of Select Na Case Name Case Descration R8 Dy R8 Class Ry of Select 15 P0003 PC Perturn III 333 MHz 20000 0000 High benefit 8 15 P0007 PC Perturn III 850 MHz 20000 0000 High benefit 1 18 P00071 PC Perturn III 860 MHz 20000 0000 High benefit 1 19 p0007 PC Perturn III 800 MHz 15958 0010 High benefit 3 20 P0005 PC Perturn II 600 MHz 15858 20178 High benefit 3 21 P0004 PC Perturn II 6161x 16563 2788 0000 High benefit 2 22 P0001 PC Perturn III 70 2388 0000 High benefit 1 7 26 P0001 PC Perturn III 70 2388 0000 High benefit 1 7 26 P0001 PC Perturn III 13 G | | Delete Cla | ss: Low benefit 💌 Ta | get Delete | | | | | | |
| 15 P00091 PC Perturn III 933 MHz; 2,0000 0000 High benefit 8 15 P0009 PC Perturn III 930 MHz; 2,0000 0000 High benefit 5 18 P00071 PC Perturn III 800 MHz; 2,0000 0000 High benefit 15 18 P00071 PC Perturn III 800 MHz; 2,0000 0000 High benefit 15 19 p0007 PC Perturn III 800 MHz; 1,3959 0010 High benefit 15 20 P0006 PC Perturn III 500 HHz; 1,3959 0010 High benefit 1 21 P00001 PC Perturn III 500 HHz; 1,3958 0000 High benefit 1 22 P00001 PC Perturn III 500: 1,3971 0042 High benefit 1 23 P00001 PC Perturn III 60: 2,388 0000 High benefit 1 24 P0003 PC Perturn III 60: 2,388 0000 High benefit 1 25 P00011 PC Perturn III 16: 1 10000 Low benefit 1 24 | 15 P00091 PC Perturn III 933 MHr; 20000 0000 High beneft 8 15 P0009 PC Perturn III 933 MHr; 20000 0000 High beneft 5 18 P00071 PC Perturn III 800 MHr; 20000 0000 High beneft 15 18 P00071 PC Perturn III 800 MHr; 19898 00101 High beneft 15 20 P0006 PC Perturn III 800 MHr; 19898 00101 High beneft 9 21 P0006 PC Perturn II 15br; 19771 0042 High beneft 2 22 P0006 PC Perturn II 16br; 16563 278 High beneft 2 23 P00071 PC Perturn III no CD 2.4684 0000 High beneft 1 25 p00071 PC Perturn III no CD 2.0600 0000 High beneft 1 26 P00071 PC Perturn III 13 GHr; 10000 10000 Low beneft 1 13 P00103 PC Perturn III 13 GHr; 10000 10000 Low beneft 1 14 <td< th=""><th>Rema</th><th>ined Case</th><th></th><th></th><th>i[</th><th>Export</th><th>Show All</th><th></th><th>······</th><th></th></td<> | Rema | ined Case | | | i[| Export | Show All | | ······ | |
| 15 P0003 PC Perturnill SD3 HHz 20000 0000 Hxy beerik 1 18 P00071 PC Perturnill BS0Htz 20000 0000 Hxy beerik 15 18 P00071 PC Perturnill BS0Htz 20000 0000 Hxy beerik 15 19 p0007 PC Perturnill BS0Htz 13875 0001 Hxy beerik 15 20 P0005 PC Exeturnill BS0Htz 13875 0001 Hxy beerik 15 21 P0005 PC Ferturnill BS0 11385 2172 Hxy beerik 13 22 P0004 PC Perturnill TS0Lz 1385 2172 Hxy beerik 13 22 P0003 PC Perturnill TS0Lz 2388 0000 Hxy beerik 2 23 P0003 PC Perturnill TS0Lz 2388 0000 Hxy beerik 13 25 p0001 PC Perturnill TS0Lz 2388 0000 Hxy beerik 17 26 P0011 PC Perturnill TS0Lz 24684 0000 Hxy beerik 17 26 P0011 PC Perturnill TS0H | 15 PO009 PC Pertam III 300 MHz 20000 0000 High benefit 1 17 P0008 PC Pertam III S60 MHz 30000 0000 High benefit 1 18 P0007 PC Pertam III S60 MHz 20000 0000 High benefit 1 18 P0007 PC Pertam III S00 MHz 13885 0000 High benefit 1 19 p0007 PC Pertam II S00 MHz 13875 0100 High benefit 1 21 P0005 PC Pertam II SGNz 15371 0002 High benefit 2 22 P0004 PC Pertam II SGNz 1563 2178 High benefit 1 22 P0004 PC Pertam II SGNz 23986 0000 High benefit 1 23 P0001 PC Pertam III no CD 24684 0000 High benefit 1 25 P0001 PC Pertam III no CD 20000 0000 High benefit 1 26 P0013 PC Pertam III 1 3 GHz 10000 10000 Low benefit 1 14 P00134 PC Pertam III 1 3 GHz 10000 Low benefit 1 15 P00134 PC Pertam III 1 3 GHz <td< th=""><th>Na</th><th>Case Name</th><th>Case Description</th><th>R8</th><th>Dgi RB</th><th>Class</th><th>Qty of Sales</th><th></th><th>له .</th><th></th></td<> | Na | Case Name | Case Description | R8 | Dgi RB | Class | Qty of Sales | | ل ه . | |
| 17 P0003 PC Perkam III B65AH/r; 30000 0000 H.g.berefit 1 18 P0007 PC Perkam III B60 MH;; 20000 0000 H.g.berefit 1 13 p0007 PC Perkam III B00 HH;; 13895 0010 H.g.berefit 1 20 P0006 PC Cerkon II SDN 13975 0013 H.g.berefit 1 20 P0006 PC Cerkon II SDN 13975 0013 H.g.berefit 1 21 P0007 PC Perkan II SDN: 13971 0002 H.g.berefit 1 22 P0004 PC Perkan II SDN: 13971 10024 H.g.berefit 1 22 P0007 PC Perkan II SDN: 2398 0000 H.g.berefit 1 23 P0007 PC Perkan III SDN: 2398 0000 H.g.berefit 2 24 P0003 PC Perkan III SDN: 20000 0000 H.g.berefit 1 75 P0001 PC Perkan III SGH: 10000 Low berefit 1 13 P00160 PC Perkan III SGH: 100000 <td>17 P0005 PC Previan III 650Ht; 20000 0000 High benefit 1 18 P0007 PC Previan III 600 Ht; 20000 0000 High benefit 1 19 p0007 PC Previan III 600 Ht; 15985 0010 High benefit 1 20 P0005 PC Centon 115hz 15977 0013 High benefit 1 21 P0005 PC Perturn H 155hz 1577 0013 High benefit 2 22 P0004 PC Perturn H 155hz 15653 2728 High benefit 2 23 P0005 PC Perturn H 156hz 15658 2728 High benefit 1 24 P0003 PC Perturn H 156hz 2388 0000 High benefit 1 75 p0001 PC Perturn HI 100 CD 24684 0000 High benefit 1 76 P0004 PC Perturn HI 100 CD 24684 0000 High benefit 1 76 P00014 PC Perturn HI 136Hz 10000 10000 Low benefit 1 13 P00104 PC Pe</td> <td>15</td> <td>P00091</td> <td>PC Pentium III 933 MHz</td> <td>2.0000</td> <td>0000</td> <td>High benefit</td> <td>B</td> <td></td> <td>and the second second</td> <td></td> | 17 P0005 PC Previan III 650Ht; 20000 0000 High benefit 1 18 P0007 PC Previan III 600 Ht; 20000 0000 High benefit 1 19 p0007 PC Previan III 600 Ht; 15985 0010 High benefit 1 20 P0005 PC Centon 115hz 15977 0013 High benefit 1 21 P0005 PC Perturn H 155hz 1577 0013 High benefit 2 22 P0004 PC Perturn H 155hz 15653 2728 High benefit 2 23 P0005 PC Perturn H 156hz 15658 2728 High benefit 1 24 P0003 PC Perturn H 156hz 2388 0000 High benefit 1 75 p0001 PC Perturn HI 100 CD 24684 0000 High benefit 1 76 P0004 PC Perturn HI 100 CD 24684 0000 High benefit 1 76 P00014 PC Perturn HI 136Hz 10000 10000 Low benefit 1 13 P00104 PC Pe | 15 | P00091 | PC Pentium III 933 MHz | 2.0000 | 0000 | High benefit | B | | and the second second | |
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| Export Start (8:32:15 Pr End (8:32:19 Pr | | 1 | | | - 217 | | | en al an | | | |

Figure 4-5: Deletion case by Utility method

Re-run the experimental again but increase the factors to be two, three, and four factors by using an average frequency of sale (AvgFS), margin, and remaining day that case available in the system (LC) to be additional factors in order.

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| Select Evaluati | Close กลัยอัลลิม | | × |
|-----------------|--|--------|---|
| Select facto | r to identify relative benefit value : Factor | Select | |
| AvgFR | Average Frequency of Retrieval | ন | |
| AvgFS | Average Frequency of Sell | ম | |
| Margin | Margin | 되 | |
| LC | Remaining day of life cycle | ন | |

Figure 4-6: The factors selected as criteria to subject the beneficial case

| | | | | Actual re | sult | after deleti | on | | | |
|--------------|--------------------|--------|-------|--------------------|---------------------------------|--------------|-------|-------------|-----|------|
| | High beneficial | | | ng high I cases | Loss of high beneficial case | | | | | |
| measuring | | | thod | Relative be | nefit | Utility me | thod | Relative be | ene | ≥fit |
| benefit | (amount) | Amount | % | Amount | % | Amount | % | Amount | | % |
| One factor | 25 | 15 | 60 | 25 | 100 | 10 | 40 | | 0 | 0 |
| Two factor | 22 | 12 | 54.55 | 22 | 100 | 10 | 45.45 | | 0 | 0 |
| Three factor | 12 | 2 | 33.34 | 12 | 100 | 8 | 66.66 | | 0 | 0 |
| Four factor | 11 | 3 | 36.37 | 11 | 100 | 7 | 63.63 | | 0 | 0 |



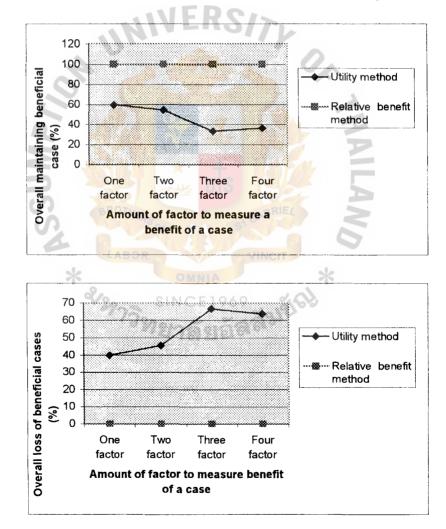


Figure 4-7: The comparison of using different amount of factors

as a criterion to subject beneficial case

Experimental 2:

The previous experimental is re-studied again but both deletion methods are compared in the environment of different case base sizes, 25, 50, 75, and 100. The procedure of step for testing is as follows:

Step of Experimental

Get parameter; /*from user input from terminal : Start with AvgFR till CL factor*/

Procedure ExperimentalStep (AvgFR, AvgFS, Margin, LC In, CompareResult Out) As

Begin

/* NumberOfCase start with 25 and increase by 25 till 100 */ NumberOfCase := 25; For NumberOfCase.value = 25 to 100 Loop NumberOfCase;

> Insert case data Into case table as equal to NumberOfCase value;

/* Factor values start with 1 and increase by 1 till 4 * Factor.values := 1; For Factor values = 1 to 4 Loop Factor If Factor values Then FactorParameter := 'AvgFR'; Elsif Factor values = Then 2 FactorParameter := 'AvgFR' and 'AvgFS'; Elsif Factor values = Then 3 FactorParameter := 'AvgFR' and 'AvgFS' and 'Margin'; Elsif Factor values =4 Then FactorParameter := 'AvgFR' and 'AvgFS' and 'Margin' and 'LC'; End if;

/* this area will be combine all parameter that choose by user together */

/* Compute classification will used the FactorParameter for calculate

EndofLife,low,medium,high values) */

Call Compute classification case(EndofLife,Low,Medium,High); /* Call Delete case by Relative Benefit Method */ Call MaintainanceRB(AvgFR,AvgFS,Margin,LC); /* Call Delete case by utility Method;*/ Call MaintainanceUB Method; CompareResult; Return CompareResult; Increase Factor.value by 1; Do Factor.values till Factor.values is False ; Exit Factor Process; End Loop Factor;

Increase NumberOfCase.values by 25; Do NumberOfCase.values till NumberOfCase.values is False; Exit NumberOfCase Process; End Loop NumberOfCase; End ExperimentalStep Procedure;



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| | | | <u> </u> | <u>.</u> | Actual r | esul | t after deleti | on | | | |
|----------|-------------------------------|----------|-----------|----------|---------------------|-------|---------------------------|-------|--------------|------|--|
| | High Factor for beneficial | | Maint | | igh benefici ses | ial | Loss of high benefit case | | | | |
| | 1 | case | Utility n | nethod | Relative ber | nefit | Utility me | thod | Relative ben | efit | |
| | benefit | (amount) | Amount | % | Amount | % | Amount | % | Amount | % | |
| | One factor | 13 | 11 | 84.62 | 13 | 100 | 2 | 15.38 | 0 | 0 | |
| Size 25 | Two factor | 6 | 5 | 83.34 | 6 | 100 | 1 | 16.66 | 0 | 0 | |
| | Three factor | 8 | 6 | 75 | 8 | 100 | 2 | 25 | 0 | 0 | |
| | Four factor | 8 | 6 | 75 | 8 | 100 | 2 | 25 | 0 | 0 | |
| | One factor | 25 | 15 | 60 | 25 | 100 | 10 | 40 | 0 | 0 | |
| Size 50 | Two factor | 22 | 12 | 54.55 | 22 | 100 | 10 | 45.45 | C | 0 | |
| | Three factor | 12 | 2 | 33.34 | 12 | 100 | 8 | 66.66 | C | 0 | |
| | Four factor | 11 | 3 | 36.37 | 11 | 100 | 7 | 63.63 | C | 0 | |
| | One factor | 32 | 13 | 40.63 | 13 | 100 | 19 | 59.37 | C | 0 | |
| Size 75 | Two factor | 30 | 10 | 33.34 | 10 | 100 | 20 | 66.66 | c c | 0 | |
| | Three factor | 18 | 6 | 27.78 | 5 | 100 | 13 | 72.22 | C | 0 | |
| | Four factor | 17 | 6 | 35.3 | 6 | 100 | 11 | 64.7 | C | 0 | |
| | One factor | 35 | 14 | 40 | 35 | 100 | 21 | 60 | C | 0 | |
| Size 100 | Two factor | 32 | 12 | 37.5 | 32 | 100 | 20 | 62.5 | c c | 0 | |
| | Three factor | 23 | 8 | 34.79 | <mark>– 2</mark> 3 | 100 | 15 | 65.21 | c | 0 | |
| | Four factor | 22 | 7 | 31.82 | 22 | 100 |) 15 | 68.18 | (| 0 0 | |

Table 4-4: The result of deletion with Relative benefit method VS Utility method

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in different case base sized

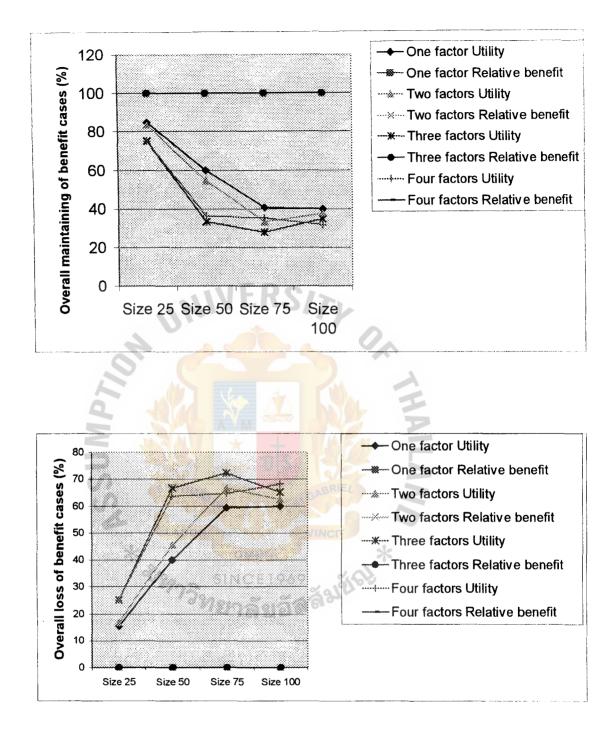


Figure 4-9: The comparison between Relative benefit method and Utility method in different sizes of case base

4.3 Result Analysis

From the previous experimental, the result can be discussed as below:

Clearly, the relative benefit based method is maintaining the cases that have high benefit in a viewpoint of sales for the domain of electronic shop whereas utility method maintain the beneficial cases less than relative benefit method because it has no understanding of the benefit in a viewpoint of sales, therefore, the high beneficial cases may be deleted from the case base system.

Figure 4-7 illustrates the graphs of comparison between deletion by relative benefit method and utility method in different amount of factors used as criterion to subject beneficial cases. The relative benefit method still can maintain the high beneficial cases. In contrast, some high beneficial cases can be deleted from the system by the utility method.

Figure 4-9 shows that the relative benefit still works very well in the incremental of case bases size. The cases deleted by this method are firstly selected and measured that they are low beneficial cases concerning with various factors. The high beneficial case must not be deleted from the system whereas the high beneficial cases may or may not be deleted from the system by utility method.

CHAPTER 5: CONCLUSION AND FUTURE WORK

In case base maintenance, there are many current researches focusing on the competence of case base system and its performance. This thesis started with an argument that the competence and performance of a case is not mainly contribution in every domain especially in sales processing within electronic shop environment. In fact, the performance of retrieval is deepened on the speed of Internet linked and system performance of customer side. This paper shows that case attributes and transactions of a case can be a practical use to identify relative benefit value for guidance either case in deletion policy. This thesis also described how fuzzy theory is valued to subject and classify the benefit level to each case in incremental updated of case base.

The relative benefit based method focuses on taking necessary factors involved in sales processing in electronic shop such as average frequency of retrieval, average frequency of sell, margin, and stilling sold to be a criterion for using to identify the relative benefit value used to measure and subject beneficial case.

The high beneficial cases must be maintained in the system whereas deletion should minimize the loss of high beneficial cases. The case that has low relative benefit value or low benefit group is selected for deletion. However, the study of stopping the intrusive reduction is important advances for case base maintenance in the future study.

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