An Effective Model for Case-Based Maintenance in Cased-Based Reasoning Systems

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***Abstract*—Case-based reasoning systems have been applied for machine learning, artificial intelligence, knowledge-based systems and other related fields in order to provide the right solution to the right problem regarding the four processes, which are the process to retrieve, reuse, revise, and retain cases. This paper focuses on the last process because it produces two main problems, which are the size of a case base increase and the ability of preserving the competency decreases. These critical issues are occurring when repeating the cycles of case-based reasoning. Consequently, the case-based maintenance methods are developed to handle the situations. Accordingly, this paper proposes an effective model for case-based maintenance in case-based reasoning systems to give the best results compared with random, utility, footprint, footprint and utility deletion including case addition algorithm. By running the seven comparative studies on ten datasets retrieved from the machine learning repository, especially to study the efficiency of each algorithm in terms of reducing the size of the case base by selecting the small number of case solutions and preserving the competency after the maintenance systems are applied. According to experimental results, the effectiveness of the proposed model for storing the number of case solution gives the lower size of a case base, when compared with the existing techniques about 34.34%-114.84%. Besides, the percentage of adapting solutions for the traditional methods are lower than the proposed model as about 1.12-6.64 times, including the percent solving problem is lower than the effective model approximately 4.73%-33.55%.**

Keywords—case-based reasoning; case-based maintenance; artificial intelligence; deletion; addition

I. INTRODUCTION

As we know that, cased-based reasoning (CBR) is one of the alternative systems for artificial intelligence, machine learning and knowledge-based systems. It has been developed for solving new problems by revising previously effective solutions to the related problems [1]. Up to now, the knowledge of CBR can be applied for practicing big data [2]. The traditional view of reasoning in artificial intelligence has been that the reasoning is given a problem, and by comprising the abstract operators, he is able to fix it [3]. Concisely, it is reasoned by recalling using previously solved problems or cases to prepare solutions for novel to fix the similar problems [4]. In the meantime, it has also been able to apply the explicit knowledge of earlier experienced, real problem situations [5]. A case usually means a problem situation. A previously experienced situation, which has been taken and learned in many ways that it could be reused for solving the future problems, which is mentioned to as an old case, new case, used case, or maintained case [6]. Congruently, unsolved case is the explanation of a new problem that needs to be fixed [7].

Aamodt and Plaza [8] developed a scheme of the CBR working process comprising the four REs: 1. RETRIEVE previously experienced case(s) by using the process named remembering, which combines the recall previous case and select the best subset; 2. REUSE the case(s) for solving the current problem, this step usually includes choosing the solution to the old problem; 3. REVISE the offered solution if required, sometimes called adaptation, the previous solution can be adapted to fit the new situation.; 4. RETAIN the new answer as a part of a new case by combining it into the existing knowledge-base or case base.

As for the field of using Artificial Intelligence typically, there are no complete systems appropriate for every domain of use [9]. The challenge is to develop the methods that are matched for learning and problem solving in particular subject domains and for specific environments [10]. Examples of the core problems addressed: knowledge representation and issue of retrieval, reuse, revise, and retain methods [11].

This paper improves the ability of the process of maintaining the cases. The reason for considering this point is because the size of the case base influences the performance of the four processes of using CBR. Accordingly, this can damage the entire performance of the system by increasing the processing time, including retrieving, reusing, revising and retaining cases. Besides, it complicates the development during the process of finding problems and solutions.

The expect outcomes of this paper is to develop the effective proposed model for retaining cases, including giving better results compared with the traditional well-known CBM methods, which are random deletion, utility deletion, footprint deletion, footprint utility deletion, and yang's model. Contributions to the work, first, this study will contribute to the development of the theoretical model that explains the case-based maintenance. Second, the findings will contribute to understanding the performance of CBM during the competency is preserved.

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