CASE-BASED RETRIEVAL
ON QUESTION ITEMS GENERATION

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DEDICATION

This thesis is dedicated to my beloved family and UNISSULA

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ABSTRACT

In the education, the purpose of the conducting test is to determine whether the instructional objectives have been achieved or not. It is a challenge to build a learning system that meet pedagogical aspect of learning. Test items should match to the learning outcomes and the conditions determine by the instructional objectives. Taxonomy Bloom's known is as the standard of the instructional objective level on the cognitive domain. This work is to study how effective the Case-based Reasoning (CBR) method is to solve the generation of question items problem. CBR is the artificial intelligent method that is suitable to solve the problem by finding similar cases from the past. Based on the similar case, the solution is to reuse the similar case and to revise its similar case solution. It is the fact that some question items or some test may be reused or revised for future situation. This work has been successfully implementing the CBR method on question items generation. Some retrieval techniques (Rule Base Reasoning and CBR) and similarity measure (Nearest neighborhood and Euclidean distance) has been experimented. From these experiments is that, CBR retrieval technique using Euclidean distance similarity and inductive indexing approach is the best performance. The experiment has given the similarity tolerance 0.7 is acceptable because it categorizes to high similarity and the recall is enough to give suggestion solution (in this experiment about 3 or 4 similar cases). Finally the overall results show that the complete task of CBR method has successfully solved the problem of matching the learning outcomes with the instructional objectives.

Keyword: Case-based Reasoning, Case Retrieval, question item generation, similarity measure

ABSTRAK

Dalam pendidikan, tujuan melaksanakan ujian adalah untuk menentukan sama ada objektif pengajaran telah dicapai atau tidak. Adalah suatu cabaran untuk membangunkan suatu sistem pembelajaran yang memenuhi aspek pedagogi dalam pendidikan. Item-item ujian yang disediakan sepatutnya berpadanan dengan hasil pembelajaran dan syarat-syarat yang ditentukan oleh objektif pengajaran. Taksonomi Bloom telah dikenali sebagai suatu piawaian dalam membahagikan aras objektif pengajaran bagi domain kognitif. Tujuan pendidikan ini ialah untuk mengkaji keberkesanan kaedah Case Based Reasoning (CBR) untuk menyelesaikan masalah penjanaan item-iten soalan. CBR ialah suatu kaedah kepintaran buatan yang sesuai untuk menyelesaikan masalah dengan cara mencari kes-kes yang serupa daripada pengalaman lepas. Berdasarkan kes yang serupa, penyelesaiannya adalah dengan cara guna semula kes tersebut, dan dengan cara menilai semula penyelesaiannya daripada kes yang serupa. Didapati ada antara item-item soalan atau ujian boleh diguna semula dan boleh dinilai semula untuk penyelesaian pada situasi akan datang. Penyelidikan ini telah berjaya melaksanakan kaedah CBR untuk menjana item-item soalan. Beberapa teknik capaian seperti Rule Based Reasoning (RBR) dan CBR dan pengukuran keserupaan telah diujikaji. Hasil daripada ujikaji ini, didapati teknik capaian CBR menggunakan Euclidien distance similarity dan pendekatan memberikan hasil yang terbaik. Ujikaji ini memberikan nilai toleransi keserupaan 0.7 ialah boleh diterima kerana boleh dikategorikan keserupaan tinggi dan memberikan cadangan jawapan yang cukup (3 atau 4 kes). Semua fasa pengekalan, didapati rumus purata telah berjaya mengemaskini pengetahuan. Akhirnya , keputusan keseluruhannya menunjukkan pelaksanaan semua tugas-tugas dalam kaedah CBR telah berjaya menyelesaikan masalah memadanmkan hasil pembelajaran dengan objektif pengajaran.

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CHAPTER 1

PROJECT OVERVIEW

1.1 Introduction

E-learning is recently growth to optimizing education process. An important part in the modern e-learning is intelligent system inside the e-learning system. Every class in education process has some certain cognitive aspect of instructional objectives and those ones must be measurable. Assessment system in the e-learning should support cognitive measurement by the test. This work related to education application to generate question items, which have related with the certain instructional objectives. The taxonomy of educational objectives for cognitive domain helps categorize objectives at different levels of cognitive complexity.

Conventional method to generate questions from questions banks is random generator method. However, random method is not appropriate to generate question items from question bank, because each question has various objectives, and random method cannot analyze some items which are related to certain objective.

Case-Based Reasoning (CBR) is a method in artificial intelligent (AI) that suitable to cognitive problems. This work related to the CBR method to generate items question.

1.2 Background of problem

In education, the purpose of test is to collect objective information that may be used in conjunction with subjective information to make better educational decision. Test is one of ways to determine that the objective has been achieved (Kubiszyn, Borich, 1995).

It has been realized that the process of constructing and designing questions for the various purpose of test is always time consuming, redundant and not an easy task. Although there are e-learning systems that contain test bank, the method usually used is the random generation approach (Tecuci and Keeling 1998). The drawback of this approach is that, it does not have the capability of selecting questions that meet the user's specific need, especially for evaluating the student's specific understanding or skills. Therefore, there's a need to find other approaches to generate question items that meet the user's need. The generator must have intelligent which it gotten from the knowledge and experiences.

The most popular knowledge base that usually used is rule base system or called by rule-based reasoning, and another one is case-based reasoning. They have different method to solve the problem. First one use inference to find the solution and the second one is by finding the similar problem from the past experiences and reuse or revise the solution of that problem.

1.3 Statement of the problem

It is a challenge to build learning system that meet pedagogical aspect of learning. Test items should match the learning outcomes and conditions determined by the instructional objectives. Therefore there is a need to study on CBR methodology to find out it can effectively solve the problem.

1.4 Research objective

a. To analyze the performance of the case retrieval of CBR method based on instructional objectives, question type and difficulty level on question items generation
b. To study the feasibility of Case-Based Reasoning (CBR) method on question item generation based on Bloom's Taxonomy.

1.5 Scope

1. Case-Based Reasoning (CBR) is applied Artificial Intelligent (AI) to generate the question items.
2. This project focus on the case retrieval as the basic to study the feasibility of CBR method on question items generation.
3. Case similarity measure to analyze the characteristic of question items generation based on Bloom's taxonomy.

4. This work focus on the Bloom's level. Taxonomy Bloom is being considered as the pedagogical aspect of learning that classifies the levels of cognitive domain in learning.
5. Multiple choice type of question is chosen as the sample for experiment.
6. Instructional objectives, question type, and difficulty level are the features chosen for case representation of this experiment.

1.6 Importance of Research Study

This study gives the result of the intelligent system for question items generator, in this case using CBR method. This is usefully for e-learning development to achieve the educational cognitive objectives in education process. Future work from this study is how to measure each question or test for quality and estimation completion time of them based on the student answer.

1.7 Organization Report

Chapter 2 discusses the literature review. Chapter 3 discusses on the methodology used to build up thus project. Chapter 4 discusses result. Chapter 5 presents the conclusion of this study.