

Chapter 11

An Intelligent Framework for Automatic Question Set Generation

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ABSTRACT

Automated question selection is an emerging problem in the industry of Online Test Management. The Test Management Suites, offer administration of question sets, either precompiled by experts, or randomized over the database of questions. Presently available literature in this domain is sparse and primarily focuses on automated question classification problem. This paper proposes a novel technique for administering question sets in an intelligent and automated approach. Artificial Intelligence, in the form of Self Organizing Feature Maps is utilized for question selection process. Finally, results from experiments are compiled for an illustration of the whole technique. Optimal design parameters for further research are also proposed alongside plausible future direction in pervasive computing.

INTRODUCTION

Need for conducting examinations/tests for the purpose of academic performance evaluation is manifold. Several reputed institutes offer admissions to candidates after assessing their performance in

a self conducted examination. CAT, BITSAT, IIT-JEE, AIEEE, PET, PMT are examples of a few examinations held at National level. Troubled by the heavy cost requirements pertaining to management of such examinations, concerned authorities are looking ahead into the option of conducting examinations in an online manner as mentioned

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by Mukherji (2008). CAT, BITSAT, GMAT are examples of such online tests.

One of the important issues faced by most authorities while conducting online examinations is the formulation of question set creation policy. Most online test management suits offer random automated question set creation, or self administered question sets. Literature on automated test management is sparse and techniques for intelligent and automated question set creation are few.

This paper proposes a novel technique for administering question sets in an intelligent and automated fashion. The authors use the clustering capabilities of Self Organizing Maps explained by Haykin (1999) for achieving this purpose. But before any technique can be applied, it is necessary to generate meta-data on questions to make sure the machine understands the question's context. Modeling the context of questions in the form of a Feature Map also explained by Haykin (1999) and Kohonen (1982) is also proposed alongside.

Related Work

The academic research attention to automated intelligent question set creation is sparse. There is positive research focus on automated classification of questions in the work of Li (2002) and Hacioglu (2003). Feature based classification, that forms the basis of the Feature Map Model presented in next section, has been proposed and explored by Huang (2007). Applications of Self Organizing Feature Maps (or simply Self Organizing Maps) for feature based clustering are mentioned by Zhang (1993) and Vars (1992). A technique for generation of playlists from a music collection using SOMs has been explored by Pohle (2007), Rauber (2002) and Stavness (2005), which serves as a major guideline for the work in this paper. In several ways, the authors perceive the problem of question set generation solvable in a similar fashion to automated music playlist generation. The authors envision software solutions that bring

together automated feature extraction performed by Hacioglu (2003) from questions and question set creation techniques to produce a fully automated Online Test Management Suite.

Dynamic programming and stochastic algorithms for constraint satisfaction can be applied for solving the problem of question selection to a large extent. The novelty of the approach set forth for question selection, lies in the fact that the authors harness the abilities of Artificial Intelligence in imitating human procedure of question selection and offer greater prospects for adaptability.

A FEATURE MAP MODEL FOR QUESTIONS

This section proposes a novel mathematical model for abstraction of questions. Such abstraction provides the mathematical language for defining a question in terms of: the subject of the question, the intent of the question and the ease of evaluation of the question. The objective of such abstraction is to unify the validation process for the questions. Preparation of questions for the purpose of survey has been studied by McColl (2001) and Martin (2006). Huang (2007) explains the application of a similar model, but is done so in the context of automated question classification.

Domain of Evaluation (DoE)

Let there be a set,

$$D = \{t_1, t_2, \dots, t_n\} \dots \quad (1)$$

Each 't' is representative of a feature of the question. A feature is either one of the subject, the intent or the ease of evaluation. A set of these features forms the domain of evaluation for the questions¹.

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