Chapter V

Semi-Adaptive Testing Strategies in a Web-based Generic Tutoring System

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Abstract

Adaptive testing is an important component of most tutoring systems. This component normally interacts with the student model to determine students’ abilities and students’ knowledge. For this, fully adaptive testing strategies are used. However, this kind of strategy needs training for estimating specific values before they can be applied. Furthermore, the human tutor does not have any influence on the testing process. In this chapter, semi-adaptive testing strategies are introduced to deal with these problems. It is shown how a generic tutoring system can be designed to apply semi-adaptive testing strategies. The meta-language XML is used as approach for implementing these results in a Web-based application.
Introduction

One of the most important features of paper-and-pencil tests is the relatively unobtrusive role of the examiner. The widespread availability of computers allows one to carry this feature to its logical extreme and eliminate the examiner altogether by putting tests on the computer. Computerized testing presents a number of potential advantages. First, it is possible to use computers to collect some of the data that are typically lost when one changes from individual oral tests to written group testing. In particular, it is possible to record the amount of time needed (or used) to respond to each item as well as to associate response latencies with both characteristics of the item (e.g., difficulty) and characteristics of the response (e.g., correct or incorrect). Most importantly, computers can allow for truly interactive, adaptive tests, whereby the responses affect the subsequent choice of test items, scoring rules, or response formats.

An important issue in automated testing is whether the computer format itself affects responses to the test. To put in a question, do people receive similar scores on a paper-and-pencil version as they do on a computer-presented version of the same test? Results of some experiments indicate that computer presented tests can be used with minimal loss in the accuracy or acceptability of the test (Elwood, 1969; Johnson & Mihal, 1973; Katz & Dalby, 1981).

The most sophisticated strategy for computerized adaptive testing involves applying latent trait theory or item response theory to intelligence testing (Urry, 1977; Urry & Dorans, 1981). These theories provide methods for estimating the difficulty of each item, the discriminating power of the item, and the probability of guessing the correct answer to that item independently of the sample being tested. Because the computer continually reevaluates the estimation of the subject’s ability and selects optimal test items, it is possible to achieve considerable accuracy in estimating a student’s ability using an extremely small set of questions. However, these kinds of fully adaptive testing strategies suffer from some disadvantages. For example, they require some training time for estimating the student’s ability and each item’s difficulty. Additionally, the tutor who designs the course has the domain expertise to determine how and if two varying questions stand in contextual correlation. Methods could be offered to the tutor enabling him or her to use this meta-knowledge to adapt the test without deep programming knowledge. Therefore, the main motivation towards the investigation of semi-adaptive testing strategies is to find a promising approach to tackle these problems.