Chapter 65

Using a Knapsack Model to Optimize Continuous Building of a Hybrid Intelligent Tutoring System:
Application to Information Technology Professionals

Maha Khemaja
University of Sousse, Tunisia

ABSTRACT

Intelligent Tutoring Systems (ITS) provide an alternative to the traditional "one size fits all" approach. Their main aim is to adapt learning content, activities and paths to support learners. Meanwhile, during the last decades, advances in lightweight, portable devices and wireless technologies had drastically impacted Mobile and Ubiquitous environments' development which has driven opportunities towards more personalized, context-aware and dynamic learning processes. Moreover, mobile and hand held devices could be advantageous to incremental learning, based on very short and fine grained activities and resources delivery. However, measuring efficiency and providing the most relevant combination/ orchestration of learning activities, resources and paths remains and open and challenging problem especially for enterprises where choices and decisions face several constraints as time, budget, targeted core competencies, etc. This paper, attempts to provide a knapsack based model and solution in order to implement ITS's intelligent decision making about best combination and delivery of e-training activities and resources especially in the context of fast changing Information and Communication Technology (ICT) domain and its required skills. An android and OSGi based prototype is implemented to validate the proposal through some realistic use cases.

INTRODUCTION

During these last few decades, the advent of technologies related to Internet, the World Wide Web, and pervasive/mobile computing, had drastically impacted the Information and Communication Technology (ICT) professionals and practitioners skills. Therefore, there is increasingly needs not only for ICT specialists with up-to-date skills but also for those specialists who could rapidly adapt their skills and demonstrate willingness to learn in a rapid and sustained pace. ICT companies and professionals try therefore to overcome this rapid change by making use of e-Training systems. These systems are mainly intended to evolve one's company core competencies and its employees' competences and e-skills. They consequently, provide, deploy and deliver e-Training services and resources within relevant environments. Those e-training services generally take advantages of new learning trends to allow employees to learn without constraints related to time and place and adapt learning to one's employee's needs and/or one's company competencies development strategy.

In this context, many research works have emerged to differently address issues related to adaptability of learning content and paths, reconfiguration of the e-Training system, the delivery of e-Training services and content accordingly to Software as a Service (SaaS) model using Cloud platforms or infrastructures or also embedding or delivering these services to mobile clients and hand held devices. The result was different categories of systems varying from Intelligent Tutoring Systems (ITSs) to ubiquitous, mobile and pervasive learning systems. Actually, bounds between those categories tend to be blurred and many hybrid systems combining ITSs functionalities to those of ubiquitous or mobile learning systems are more and more being developed.

For instance ITSs are mostly intended to competency and knowledge transfer and focus specifically to adapt learning content, activities and paths to support learners with intelligent tutoring behavior. They are designed to intelligently simulate a "real" teacher or tutor and use specifically Artificial Intelligence techniques to model human knowledge and behavior, to make reasoning and solve problems.

Conversely to ITSs, mobile, ubiquitous or pervasive learning systems categories adapt mostly their behavior accordingly to the user's context and her/his surrounding environment in order to provide more contextualized or situated learning contents and processes (Abowd, Dey, Brown, Davies, Smith, & Steggles, 1999). They rely more on human tutors than ITSs. They are however, considered to be more advantageous to incremental learning, based on very short and fine grained activities and resources delivery.

To take advantages from both system's categories, the learning system dealt with in the present paper will be an hybrid ITS addressed specifically to the ICT skills domain where e-Training services and resources are intelligently embedded and /or configured accordingly to targeted devices and also consumed and delivered on demand from the cloud accordingly to a SaaS model. More specifically, each targeted device will contain a hybrid ITS's instance with specific services and resources. Therefore, the first aim of the present paper is to define, characterize and model this kind of hybrid ITS and specify the services it provides.

However, building this kind of system or system's instance, will face many challenging issues. Indeed, in order to achieve a given e-Training objective, several pedagogical approaches, e-Training paths, activities and resources could be combined in different ways. Efficiency of each combination depends strongly on several constraints either pedagogical or organizational. Measuring efficiency and providing the most relevant combination or orchestration of training activities, resources and paths remains and open and challenging problem especially for enterprises where choices and decisions face several constraints as time, budget, targeted core competencies, pre-requisites, relevance of available resources

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