Chapter 8

Intelligent Mobile Learning Systems for Learners with Style

Tracey J. Mehigan
University College Cork, Ireland

Ian Pitt
University College Cork, Ireland

ABSTRACT

The advent of modern wireless technologies and devices has seen a shift towards the design and development of mobile educational systems. The uptake of mobile technology will enable learners to reap the benefits of anytime, anyplace, ubiquitous learning.

The development of personalized user models, designed to meet specific learner needs through analysis of individual learning styles, can lead to improved learning outcomes for students. However within electronic and mobile learning (mLearning) systems, the development of didactic profiles for this purpose is currently achieved through the pre-completion of questionnaires by system users. This is time consuming, however, and where user specific information is excluded, standardized learning content is presented to the user, potentially leading to decreased motivation.

Recent research has indicated that it is possible to identify certain aspects of a user’s learning style automatically, based on the way they interact with a system. Using various measures, researchers have been able to determine user’s scores on the Global/Sequential and Visual/Verbal dimensions of the Felder-Silverman Learning Style Model (FSLSM). Spada et al. (2008) showed that it is possible to gather learning style data through analysis of mouse-movement patterns. However, while such methods are useful in traditional eLearning environments, they cannot be employed in mobile environments. Other interactive technologies, such as eye tracking and accelerometers, offer a potential means to gather data on interaction and so facilitate the development of automatically adaptive mLearning environments.

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This chapter discusses the development of intelligent personalized user models for mLearning. Previous research findings are reviewed, indicating that it is possible to identify aspects of a user’s learning style through biometric technologies. A user interface model is presented, designed to intelligently detect the learning-style of individual’s using a mobile learning environments and adapt learning content accordingly. The application of the model to a mLearning system is described.

INTRODUCTION

Meeting the needs of specific learners can lead to advantages over traditional “one-style-fits-all” teaching practices. In most cases, adaptive learning systems are based on the identification of learning-styles. The main purpose of such adaptive learning systems is the adjustment of the learning process to suit the individual learner. Individuals are presented with appropriate learning objects according to their fit within the scales of a learner-style model. Such systems can increase learners’ motivation and thus improve learning outcomes.

Adaptive systems have mostly relied on the completion of learner-style and personality questionnaires to profile individual learners. However, this method of assessment can be time consuming, and thus off-putting for students, resulting in reduced motivation to learn. Research has indicated that it is possible to detect a user’s learning-style through their behavior patterns when interacting with a learning system. This research has mainly focused on the use of such methods within eLearning environments. However, most existing approaches to the automatic detection of learning style (e.g., Spada et al., 2008) cannot be applied in mobile environments because of the user interaction techniques involved, for example, analysis of mouse movement patterns. It is therefore necessary to develop a method of detection suitable for use with mobile environments.

Background

Research has indicated that it is possible to identify a learner’s learning-style within an eLearning system. In most cases, the research has involved the categorization of learning-style in accordance with the Felder-Silverman Learning Style Model (FSLSM). In this model, “learners are characterized by values on the four dimensions. These dimensions are based on major dimensions in the field of learning-styles and can be viewed independently from each other” (Graf, 2007). Most practical work has focused on the Global/Sequential dimension of the model.

Mouse movement patterns were examined by Spada et al., (2008) as a means of gathering data for the detection of learning-styles. This research found a high degree of correlation between the way in which an individual uses a mouse and their learning-style, as determined using the Felder-Solomon Index of Learning-Styles (FSILS) questionnaire. The researchers were thus able to predict scores on the Global/Sequential dimension of the FSLSM with a high level of confidence, based on measurements of mouse acceleration. This approach was used to determine the Global/Sequential dimension of an individual’s learning-style solely through the way in which they used a mouse whilst interacting with an educational Website. Changes in mouse coordinate as the user moved the input device were recorded. Students also completed the FSILS Questionnaire, which was incorporated into the Website. The results indicate a strong correlation between maximum vertical speed of mouse movement (y axis) and Global/Sequential dimension score. The correlation coefficient was found to be $r=-0.8$, indicating that students with a lower maximum vertical speed tend to be more Sequential, while students with a higher maximum vertical speed tend to be more Global.

Other researchers have considered user behavior patterns in LMS (Learning Management Systems), including scrolling and time spent on...
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