

# An Adaptive Mobile Learning System with the Support of Learning Diagnosis

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**Abstract:** In this article, we present an adaptive mobile learning system to provide learners with adaptive learning contents according to learners' abilities and learning preference by the specifications of mobile devices. We used both Bayesian inference and content adaptation technologies to construct a dynamic learner model and to create adaptive contents for learners in a Web-based mobile learning environment. Bayesian inference mechanism facilitates the diagnostic procedure of learners' abilities (including knowledge levels and learning styles) to construct a complete learner model. Content adaptation facilitates friendliness in a learner-system interaction by using heterogeneous mobile devices from anywhere at anytime to access personalized learning materials.

**Keywords:** Content adaptation, Bayesian inferences, learning styles, mobile learning

## Introduction

Most of the Web-based contents are typically authored and accessed by desktop-based computers. Learners often wish that they can use various mobile devices to access the same learning content in a Web-based learning environment. We present an *adaptive mobile learning system* (AMLS) which supports both learner adaptation and device adaptation for constructing an adaptive learning environment. In our approach, *learner adaptation* is the process of automatically adjusting learning contents based on the abilities and preferences of individual learners. *Device adaptation* is the process of automatically transforming the source content to an adaptive content according to the specifications of mobile devices. To achieve this aim, we use *learning diagnosis* and *content adaptation* mechanisms to support the construction of an adaptive mobile learning environment.

## 1. Learning Diagnosis

A learning diagnosis consists of a knowledge diagnosis and a learning style diagnosis for evaluation of learners' knowledge level and learning preference. Knowledge level is an estimation of a learner's knowledge about a concept (variable). We used the BN (Bayesian Network) inference mechanism [2] to diagnose and deduce the knowledge level of a learner, according to the probabilistic inference of the potential misconception. A potential misconception is a misconception which has not been identified or diagnosed by a common knowledge test.

In order to monitor the learning behavior of individual learners, we construct another BN model to deduce learning styles based on the information of the learning activities



Figure 1. The result of learning diagnosis on PC and mobile phones

carried out by the learners, such as average reading time per webpage, the frequency of reading and replied emails, the frequency of access discussion forums, attending meetings, video-conference, and reading materials. We adopted the Felder-Silverman learning style model [3] to develop a learning-style identification approach for a mobile learning. Learners' Web-based learning behavior was collected and calculated by AMLS for each learning style dimension in BN models. The type of learning style for the learner will be diagnosed as a set value [*Active, Sensing, Visual, Sequential*] as a key to decide the learning assistance recommendation. Figure 1 shows the result of learning diagnosis presented in both PC-based and mobile devices for a learner.

## 2. Content Adaptation

The page splitting approach was used for text content adaptation in mobile devices. Page splitting is a technique for dividing a long text into a series of smaller fragments (i.e., sub-pages) to be properly displayed on the small client screen. If a Web page contains more than one sub-section, an index page which contains hyperlinks to its sub-pages will be created. We also used transcoding approach for graph transformation [1]. CC/PP specifications, such as Model, BitsPerPixel, ColorCapable, ScreenSize, ImageCapable, and CcppAccept, were implemented in the device profile database for the support of content adaptation. For example, a color JPEG in the server can be transcoded into a small, grayscale image in mobile devices to comply with low network bandwidth and display resolutions in the device.

## 3. Conclusions

We propose an adaptive mobile learning system which exploited both learner adaptation and device adaptation to create an adaptive learning environment according to the learners' abilities and device's specifications. With the assistance of BN inference mechanism, AMLS can diagnose not only learners' potential misconceptions but also learning styles for learning diagnosis, that saves human instructor's effort in learning diagnosis. Further research is encouraged to improve the content presentation in AMLS when managing a learning context and arranging content in heterogeneous mobile devices.

## References

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