A Rough Set Based Approach to Find Learners' Key Personality Attributes in an E-Learning Environment

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ABSTRACT

One of the challenges in personalized e-learning research is how to find the unique learning strategies according to a learner's personality characteristic. A learner's personality characteristic may have many attributes, and all of them may not have equal values. Correlation analysis, regression analysis, discriminator function, and educational psychology have been used to find solutions, but these methods have their shortcomings. This article proposes an improved approach based on rough set theory to find the key personality attributes and evaluates the importance of these attributes. The approach has been successfully used in the actual e-learning environment for a major research university in China.

Keywords: dimension reduction; learning strategy; personality characteristic; personalized e-learning; rough set

INTRODUCTION

Nowadays, there has been a shift from the Industrial Age to the Information Age and many of traditional instructional models are no longer suitable for today's society characterized by rapid change, global communication, and high technology (Reigeluth, 1997a, 1997b). Reigeluth maintains that one of the key results of this shift is that instruction needs to be customized rather than standardized and it needs to be learner-centered and help people learn and develop their potential. The

instructor needs to become a facilitator, empowering the learners to construct their own knowledge, rather than being the sole source of direction and knowledge in the class (Reigeluth, 1997a, 1997b, 1999).

The combined power of new communications and computer technologies is the driving force in this approach. The World Wide Web can be fruitfully employed to support every aspect of e-learning. The key aspect of hypermedia is that it should provide easy access to information within an interactive and customizable environment. The Web-like linking of ideas that characterizes hypermedia is more akin to the functioning of human cognition than the traditional linear structure found in most educational programs. Also, as a Web structure grows rapidly, it is easy for end users to customize the learning environment (Reigeluth, 1999).

The economic revenues made by the online personalization industry reached US$1.3 billion in 2000 and US$5.3 billion in 2003. In 2001, Vermetten, Lodewijks, and Vermunt (2001) predicted that by 2003, 85% of the global 1000 Web sites would use some form of personalization. The worldwide revenues for personalization software rose from US$10.85 million in 2000 to US$93.4 million in 2005 (Kobsa, Koenemann, & Pohl, 2001).

Some fundamental learning theories show that learning strategies are vital aspects of personalized learning (Liu & Huang, 2002; Liu, Li, & Zheng, 2004). Studies in educational psychology show that learning strategies are greatly affected by the learner's personality characteristic (Liu & Huang, 2002; Vermetten et al., 2001). Personality characteristic refers to often subtle but relatively stable traits that are part of a person's inner being. Physiologically, the characteristic includes physical traits that can be distinguished by human senses. Psychologically, the characteristic includes intellectual types, personal interests, motivation, emotion, will, and others (Yang & Wang, 2003).

Finding a learner's key personality characteristic attributes is a challenging job. First, it is necessary to describe a learner's characteristic and obtain it quantitatively. Second, it is important to discover the key attributes because the personality characteristic consists of hundreds of attributes and the importance of these attributes is not equal, with some attributes even being redundant. If all attributes in a personalized e-learning environment are considered, the problem of "dimension disaster" becomes unavoidable. One example will be an e-learning university where thousands of students are enrolled and each of them needs hundreds of attributes to describe her characteristic. In this situation, finding appropriate strategies for each student is a challenging problem. Let us assume that an e-learning university has 3000 students. In order to describe a learner's characteristic, the following features are generally needed: demographic data, individual traits, user knowledge level, user skills, user interests, learning styles, user goals, learning

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