

Application of Information and Communication Technology to Create E-Learning Environments for Mathematics Knowledge Learning to Prepare for Engineering Education

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EXECUTIVE SUMMARY

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators should develop in their students including NCTM process standards (problem solving, reasoning and proof, communication, representation, and connections), NRC's report Adding It Up (adaptive reasoning, strategic competence, conceptual understanding, procedural fluency, and productive disposition), and Common Core State Standards in Mathematics (ICT application) to support mathematics teaching and learning. There is a need to provide effective ways that

technology can be integrated into mathematics classrooms. Mathematical methods and techniques are typically used in engineering and industrial fields. It can also become an interdisciplinary subject motivated by engineers' needs. Mathematical problems in engineering result in rigorous engineering application carried out by mathematical tools. Therefore, the solid understanding and command of mathematical knowledge is very necessary. This chapter presents the introduction of currently available ICTs and their application to create e-learning environments to prepare for the students' future engineering education.

BACKGROUND

Data integration techniques or information and communication technologies have been intensively used in different data mining applications such as data clustering, classification, association rules mining, sequential pattern mining, outlier detection, feature selection, and information extraction in the industrial and environmental research via air quality monitoring network. A huge increase in the number of papers and citations in the area has been observed in the previous decade, which is clear evidence of the popularity of these techniques. These have included the adoption of such kind of methodologies in the research field of polarization-difference imaging for observation through scattering media (Rowe, Pugh, Tyo, & Engheta, 1995), biologically inspired self-adaptive multi-path routing in overlay networks (Leibnitz, Wakamiya, & Murata, 2006), a biologically inspired system for action recognition (Jhuang, Serre, Wolf, & Poggio, 2007), programmable self-assembly using biologically-inspired multiagent control (Nagpal, 2002), biologically inspired growth of hydroxyapatite nanocrystals inside self-assembled collagen fibers (Roveri et al., 2003), biologically inspired cognitive radio engine model utilizing distributed genetic algorithms for secure and robust wireless communications and networking (Rieser, 2004), biomimetics of biologically inspired technologies (Bar-Cohen, 2005), biologically inspired computing (De Castro & von Zuben, 2005), and biologically inspired algorithms for financial modeling (Brabazon & O'Neill, 2006). Before we start to give the introduction of these techniques in the research field of industrial operation and environment sustainability, the brief introduction will be given for these techniques.

Artificial Neural Networks

In computer science and related fields, artificial neural networks are models are derived from animal central nervous systems (Wang & Fu, 2008). The biologically neural networks are capable of machine learning and pattern recognition. They can

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