Chapter 13
Pedagogical Software Agents for Personalized E-Learning Using Soft Computing Techniques

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ABSTRACT

Due to the emerging e-learning scenario, there is a need for software agents to teach individual users according to their skill. This chapter introduces software agents for intelligent tutors for personalized learning of English. Software agents teach a user English on the aspects of reading, translation, and writing. Software agents help user to learn English through recognition and synthesis of human voice and helps users to improve on handwriting. Its main objective is to understand what aspect of the language users wants to learn. It deals with the intuitive nature of users' learning styles. To enable this feature, intelligent soft computing techniques have been used.

INTRODUCTION

Agent is a computer programs that simulate a human relationship by doing something that another user can do for other user. Agent can be human, robot, software, pedagogical. A human agent has eyes, ears, and other organs for sensors; hands, legs, mouth, and other body parts for actuators (Russell & Norvig, 2003). A robotic agent has cameras and infrared range finders for sensors and various motors for actuators. The sensors for software agent are keystrokes, file contents, received network packages whereas displays on the screen, files, sent network packets act as actuators for software agent. Two common types of notions are also associated with the agent namely weak notion and strong notion. In generally,

the characteristic such as autonomy, social ability, reactivity and pro-activeness are considered to be as weak notion of the agent. Whereas belief, desire, intention are known as strong notion of the agent.

(Dincer, S., & Doganay, 2015) Pedagogical software agent along with computer-assisted instruction programs would enhance motivations among the learners. In order to increase the motivation level to the highest, these programs should be personalized. In this regard, Intelligent tutoring system (ITS) have been implemented with the use of artificial intelligence techniques. Here, the primary objective is to integrate the notion of co-operation to the teaching-learning process using multi-agents. Particularly, the focus is on techniques and methods that would allow users to work in a co-operative way taking into account external human agents and internal agents modelled in the machine (computer). Thus, intelligent software agent technology can be extended to intelligent tutoring systems in such way that the need for social context for learning can be fulfilled (Giraffa & Viccari, 1998).

Pedagogical agent software need to model, the knowledge and human pedagogical behaviour, correctly. In addition it has to model non-instructional behaviour as well. For example, the societal norms and values for acceptable behaviours also have to be considered. (Sun, & Zhang, 2009) Pedagogical agent system also can be regarded as information delivery or as a social event. It is observed that, pedagogical agents have the potential to broaden the bandwidth of social communication between computers and students and increase student engagement and motivation.

This chapter introduces a pedagogical agent that teaches English Language to users, based on the aspects of reading, translation and writing. This requires a mixture of three domain areas like artificial intelligence, image processing and speech processing. According to John McCarthy (2004) artificial intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but Artificial Intelligence does not have to confine itself to methods that are biologically observable. Therefore, Artificial Intelligence is an important part of pedagogical agent as it deals with teaching a human and making it an automated task, which was earlier done by human tutors.

Similarly, Speech Processing is a branch of Artificial Intelligence. It mainly comprises of speech recognition and speech synthesis by the machines. Further, Machine Translation (MT) is also integrated with speech processing to devise Speech-to-Speech Translation Systems (S2ST).

Speech processing mechanism consists of the following categories within it:

- Speech recognition which deals with analysis of the linguistic content of a speech signal.
- Recognition that aims to recognize the identity of the speaker.
- Speech coding is a specialized form of data compression.
- Voice analysis for medical purposes.
- Speech synthesis is an artificial synthesis of speech, usually computer-generated speech.

Another aspect of pedagogical agent is Image Processing. Basic definition of Image processing is that, it is a form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or, a set of characteristics or parameters related to the image. This chapter focus on character recognition from images in order to improve one's handwriting. The input image is captured from the webcam and then image is processed. Based on image processing techniques, handwriting of user is analysed and then guidance is provided to improve the handwriting. With the current state-of-art, the large number and variety of languages and the increasingly global nature of life, the human interests in learning natural languages is drastically increasing. Interestingly, the

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