

論文の内容の要旨

論文題目 Empathic Tutoring Character Agents Interacting with Learner's States
学習者状態とインタラクションする共感的教育キャラクターエージェントの研究

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This thesis describes the research work on e-learning interface with multiple tutoring character agents to improve the learning process with learners.

In chapter 3, we present the Character Agent Tutoring System that uses real-time interaction with numerous interactions to effectively communicate nonverbal information. Empathic Tutoring System (ETS) uses character agents for online learning. Eye movement tracking and other physiological measures are used to personalize character agent behaviors (affective and instruction) in an e-learning environment. A prototype system reacts to learner's eye information in real-time, recording eye gaze and pupil dilation data (plus heart rate and skin conductance) during learning. Based on these measures, character agents inferred the attentional and motivational status of the learner and responded accordingly with affective and instructional behaviors. Character agents engage and direct the learner's attention while providing both generalized system help and personalized advice about the learning content.

In chapter 4, we describes Multiple Agents Interface, an e-learning interface with multiple tutoring character agents. We review evidence concerning the relative effectiveness of multi-agent systems and introduce a multiple agent system that we have developed for online instruction. A user test is carried out that compares one and two agent versions of the learning system. The results are interpreted in terms of their implications for selecting when and how more than one agent should be used in online learning. We conclude with some recommendations on when multiple agents may help online learners to interact with the learning environment more easily and efficiently.

In chapter 5, we describe the interface using real-time eye movement information to facilitate empathy-relevant reasoning and behavior. Eye movement tracking is used to monitor user's attention and interests, and to personalize the ESA behaviors. The system reacts to user eye information in real-time, recording eye gaze and pupil dilation data during the learning process. Based on these measures, the ESA infers the attentional focus and motivational status of the learner and responds accordingly with affective (display of emotion) and instructional behaviors. In addition to describing the design and implementation of empathic software agents, this chapter will also report on some preliminary usability test results concerning how users respond to the empathic functions that are provided.

In chapter 6, we describe Multiple Modal Interaction Interface, the system using multiple modal learner input information for the real-time interaction for multiple learners. The system provides the platform for communicating and exchanging the information during the learners' learning process. The learner's facial information, voice information, as well as mouse movement, is obtained in real-time and the character agents give the feedback to learners based on these kinds of information. Each type of the data is a modular, which makes the system easy to integrate and update. The interface is customizable. Based on these measures, the interface infers the focus of attention of the learner and responds accordingly with affective and instructional behaviors.

In chapter 7, we describe the platform and communication for character agent in the system. There are kinds of online communication tools currently but still the information from human, especially the emotional, attention data are not used widely, and partly it is because it is still difficult to communicate with multiple channels of data, especially the non-verbal information without non-verbal information of users. Our system focuses on it and tries to get multiple channels of information easily and visually and includes numbers of aiding functions/interface to help online users get involved into the online environment. Our system includes two main elements:

1. Personal agents which perform multiple roles for each user for online communication.
2. Platforms created from Personal agents for multiple users

We introduce the design of platform and agent communication model, and the programming flow in detail. Finally, we introduce the design of agent part.

As conclusion, by getting information about learner response (such as eye movement data and bio-signals data), character interfaces such as ETS can interact with the learner more efficiently and provide appropriate feedback. From preliminary assessment of usability, ETS had a beneficial effect on learner motivation and concentration during learning. This result suggests that there may be a larger role for empathic tutor agents to play in acting as guides to learning content. Such agents can provide important aspects of social interaction when the student is independently working with e-learning content. This type of agent-based interaction can then supplement the beneficial social interactions that occur with human teachers, tutors, and fellow students within a learning community. Character agents provide a style of collaborative learning, e.g., if the learner does not know answer, s/he can ask either the character for a hint. This approach could be extended to allow interactions with or other online learners.

Promising areas for future study include improvements to the collection of eye information and bio-signals, and analysis of video data recorded during online chat sessions to search for correlations between the video and physiological data. The use of multiple character agents within empathic tutoring systems represents another interesting direction for this type of research.