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A BDI approach to infer student's emotions in an intelligent learning environment

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Abstract

In this article we describe the use of mental states approach, more specifically the belief-desire-intention (BDI) model, to implement the process of affective diagnosis in an educational environment. We use the psychological OCC model, which is based on the cognitive theory of emotions and is possible to be implemented computationally, in order to infer the learner's emotions from his actions in the system interface. In our work we profit from the reasoning capacity of the BDI model in order to infer the student's appraisal (a cognitive evaluation of a person that elicits an emotion), which allows us to deduce student's emotions. The system reasons about an emotion-generating situation and tries to infer the user's emotion by using the OCC model. Besides, the BDI model is very adequate to infer and also model students affective states since the emotions have a dynamic nature.

Keywords: Architectures for educational technology system; Distance education and telelearning, Human–computer interface; Intelligent tutoring systems; Interactive learning environments; Media in education

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1. Introduction

Due to the traditional dichotomy in the Western society between reason and emotion, which was inherited from Descartes' dualist vision of the mind and body, in the last century little attention has been paid to the role of the affectivity in cognition and learning. As it occurred in a real class, educational computing environments considered only the cognitive capacities of the student and his knowledge in order to make the system more customized to him.

However, recent works of psychologists and neurologists have been pointing out the important role of the motivation and of the affectivity in cognitive activities, such as learning (Damasio, 1994; Izard, 1984). Psychologists and pedagogues point out the way that the emotions affect learning (Goleman, 1995; Piaget, 1989; Vygotsky, 1994). Due to this important role of the affectivity in learning, researchers of the computer in education field have studied techniques of artificial intelligence in order to turn the educational systems more customized also for the affective states of the student.

The field of artificial intelligence that researches about emotion in computers is called "affective computing". Picard (1997) defines affective computing as "computing that relates to, arises from or deliberately influences emotions". Following Picard (1997), an affective (computational) system must have a few of the following capacities: (1) recognize, (2) express, or (3) possess emotions. We observe that the affective computing field is divided into two major branches of research interest. The first one studies mechanisms to recognize human emotions or to express emotions by machine in human–computer interaction. The second branch investigates the simulation of emotion in machines (emotion synthesis) in order to discover more about human emotions and to construct more realistic robots. In Fig. 1, we can see a schema that illustrates the two branches of the affective computing field.

The researchers of computer in education are more concerned with the former branch of investigation of the affective computing research, since they are especially interested in recognizing the student's emotions and showing emotions in the interaction between the artificial tutor and the student.

In order to adapt the system to the student's affectivity, the system should recognize the student's emotions. For example, when the student is disappointed with his performance, he will probably abandon the task. The system needs to know when the student is disappointed in order to encourage him to carry on studying and accomplish the task. The affective history of the

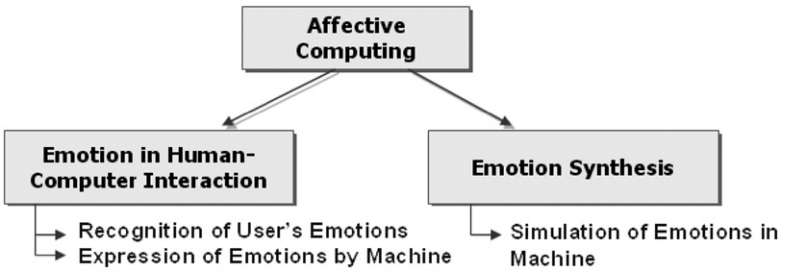

Fig. 1. The research branches of the affective computing field.