Chapter 6
User Modeling in Soft Computing Framework

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ABSTRACT

Nowadays, the systems that interact with the user, including computers, are improving very quickly. In this improvement, a great goal for the near future is to create systems able to adapt its behavior according to the needs of a particular user. The key element for this purpose is the user model. In this context, a goal of user modeling is to increase the effective use of computers and many other systems that require more sophistication in its interaction with the user. To achieve this goal, it is necessary to know how the users behave. Then, the anticipation of certain aspects of human behavior, such as goals, actions or preferences is possible. In this chapter, the development of user models using soft computing is presented. The main approaches to different user modeling are reviewed, and the main techniques used to develop user models are discussed. Also, a particular example is explained in detail.

INTRODUCTION

Recognizing the behavior of others is a significant aspect of many different human tasks in different environments. There are new theories which claim that a high percentage of the human brain is used for predicting the future, including the behavior of other humans (Mulcahy & Call, 2006). If we consider a social context, there are many situations in which humans recognize (or try to recognize) the plan underlying the behavior of others in order to make predictions based on that recognition.

In addition, humans usually think about the past and plan for the future. To illustrate this idea, the Estonian neuroscientist Endel Tulving (2004) uses the following tale: A girl attended a party but she was not able to eat her favorite dessert because there were no spoons available. Facing the possibility of attending the party again, she took a spoon to bed. This girl took the spoon not because she

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currently needed it, but because she would need it in the future.

To predict the behavior of others is important, for instance, in assisting them (Kuniyoshi et al., 1994), imitating them (Bakker & Kuniyoshi, 1996) or detecting changes in their behavior (which can serve as indicator of malicious or damaging misuse in many services). When this process is carried out by a software agent or a robot based on set of observations, it is known as *plan recognition* or *agent recognition*. Most existing techniques for *plan recognition* assume the availability of carefully hand-crafted *plan libraries,* which encode the a-priori known behavioral repertoire of the observed agents; during run-time, plan recognition algorithms match the observed behavior of the agents against the plan-libraries, and matches are reported as hypotheses. Unfortunately, techniques for automatically acquiring plan-libraries from observations, e.g., by learning or data-mining, are only beginning to emerge.

In this chapter we will focus on User Modeling (UM) and we mainly consider systems developed using soft computing techniques. These systems acquire information about a user (or group of users) so as to be able to adapt their behavior to that user or group. Therefore, if a system is able to create a user model, the system can be tailored to the needs of a particular use. For example, a TV system could be able to create the model of the user who use it and suggest different choices based on past preferences. In this case, if the user always record his/her favorite TV series, the system should recognize this task and shows a message when the TV system was not activated for recording it, or recommend similar TV series or movies about the same topic, etc. For this purpose, the information arising from the human-computer system interface should be treated and analyzed to create the TV user profile.

Finally, we need to consider that nowadays large quantities of information are produced at a fast rate by users of the Internet, consumer markets, etc. Therefore, there exists the need to cope with huge amounts of data and it is very interesting to use it for analyzing the user who created that information.

WHAT IS USER MODELING (UM)?

UM is the process of profiling users by observing them in action. It is very important to consider that the model is created by observation. It is different from asking users about how they behave when they are using a certain system. It is different from talking with expert users who may know how users are suppose to behave. In fact, users themselves usually do not know how to describe what they do, especially if they are familiar with the tasks they perform. It happens because users usually behave leaving out activities that they do not even notice they are doing. They emphasize activities that they find difficult or boring and they do not realize that there are other ordinary activities that they perform, too. It means that the *true* could not exactly be what they believe to be true (Hackos & Redish, 1998).

Research on UM can be traced back to the early 1970s, but it was in the mid-1980 when interesting research works on this area appear. Since the early 1990s, we are witnessing and information revolution; currently, the World Wide Web and other new platforms have populated the lives of an increasing number of people with many different computing systems and large quantities of information are produced at a fast rate. These aspects tend to increase the need for user modeling and personalization.

Cohen et al (1982) propose two kinds of plan recognition depending on the role the observed agent plays in the recognition task: *keyhole* and *intended* recognition. This classification can be also considered in the area of UM. In *keyhole* recognition, the observed agent does not attempt to impact the recognition process, as if it is recognized through a *keyhole.* In *intended* recognition, the observed agent knows that it is being observed