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Building respectful interface agents

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Abstract

To provide personalized assistance to users, interface agents have to learn not only a user's preferences and interests with respect to a software application, but also when and how the user prefers to be assisted. Interface agents have to detect the user's intention to determine when to assist the user, and the user's interaction and interruption preferences to provide the right type of assistance without hindering the user's work. In this work we describe a user profiling approach that considers these issues within a user profile and a decision making approach that enables the agent to choose the best type of assistance for a given user in a given situation. We also describe the results obtained when evaluating our proposal in the tourism domain, and we compare these results with some previous ones in the calendar management domain.
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1. Introduction

Research on Interface Agents has mainly concentrated on learning users' habits, preferences and interests to provide them personalized assistance with the tasks they perform with software applications. However, few efforts have been directed towards learning how to best assist the user, that is providing the right help, at the right time, and in the right way.

A user can perform different tasks with a given software application. Thus, it is very important for an interface agent to know, at every moment, the task the user is carrying out because it gives the context in which the user is working. By taking this context into account, the agent may infer the user's intention and try to collaborate with him/her in a respectful way. In addition, if the agent knows

the user's intention, it will avoid interrupting him/her at an improper moment. Users generally do not want to be interrupted while working on an specific task, unless this interruption is strongly related to the task they are performing, or it has a high priority for them (Rudman and Zajizek, 2006). Also, users differ in their preferences about how and when they want to be assisted, and even a single user may differ in the type of assistance he/she prefers for different contexts (Schiaffino and Amandi, 2004, 2006; Serenko et al., 2007).

Consider for example the following situation. An employee of a tourist agency has the intention of arranging a tour for a client named John Smith. To achieve this, he/she has to perform a set of tasks in the application, such as selecting John Smith from the list of clients, creating a new tour, entering the location, the type of accommodation, the estimated dates, the tour price, and finally sending an email to John Smith with the proposal. The sooner the agent detects the user's intention, the better it will assist him in accomplishing his intention. In our approach, we use Plan Recognition to detect the user's intention. Plan recognition aims at identifying the goal of a subject based on the actions he/she performs (Kautz, 1991). The goal usually

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has one or more associated plans that can predict the subsequent user behavior. Furthermore, the user's interaction history can be used to refine the context that he/she is implicitly setting, by considering not only the possible tasks that he/she will probably perform next, but also the attributes of those tasks. Thus, an interface agent can observe the user while he/she is working with an application to detect each action performed on the graphical user interface and determine what the user's intention is.

Following our example, once the agent has detected that the user wants to create a tour for John Smith, it can use the information contained in the user profile to assist him. For example, the agent can suggest the employee the preferred type of accommodation or the means of transport for John Smith, it can complete these fields automatically, and offer to send an email to John Smith. However, different users may have different preferences about the type of assistance they welcome from an interface agent. For example, some users may prefer the agent to automatically complete all the tasks it can, while others just prefer to receive suggestions (Schiaffino and Amandi, 2004). Moreover, this information is strongly dependent on the situation in which the agent is about to assist the user. In our approach, the information needed to determine what type of assistance a user wants to receive in a given situation is contained in the user interaction profile. This profile also comprises the expected modality of the assistance. In a certain context the user might want just a notification containing a complaint from a client while in a different context the user might prefer an interruption.

In summary, to assist a user successfully, interface agents have to detect: a user's intentions, learn a user's preferences and habits with respect to a software application, and a user's interaction and interruption preferences. In this work, we propose a profiling approach to acquire the different components of the user profile mentioned before, and a decision making algorithm that uses this profile to decide how to best assist a user.

Our profiling approach uses, first, plan recognition to detect a user's intentions. Then, we use two user profiling methods we developed, namely *WATSON* and *IONWI*, to learn a user's interaction and interruption preferences (Schiaffino and Amandi, 2006). Finally, we combine the different components of the user profile in a decision making algorithm that enables an interface agent to decide how to best assist a user in a given situation.

The rest of the work is organized as follows. Section 2 presents an overview of our proposed approach. Section 3 describes how to detect a user's intention using plan recognition. Section 4 describes how to learn a user's interaction and interruption preferences. Section 5 presents the results obtained when evaluating our approach in the tourism domain. Then, Section 6 analyzes some related works. Finally, Section 7 presents our conclusions and future work.

2. Proposed approach

A user profile typically contains information about a user's interests, preferences, behavioral patterns, knowledge, and priorities, regarding a particular domain. However, such information is not enough to personalize the interaction with a user. The user's intentions with a software application and his/her interaction preferences play a relevant role in user-agent interactions. To obtain the components of our user interaction profile, we developed two profiling methods: *WATSON* and *IONWI*. *WATSON* learns a user's assistance preferences, that is, when a user wants a suggestion, a warning, an automated action or no assistance. *IONWI* learns a user's interruption preferences, that is, when a user prefers an interruption and when a notification. To achieve their goals, these user profiling methods analyze the user's interaction with the agent recorded when observing the user's behavior, and consider the feedback provided by the user after the agent assisted him/her. An overview of our proposal is shown in Fig. 1. In the following sections we describe our approach in detail.

2.1. Our user profile

In our approach, a user profile should contain information about the user's intentions with a software application, and about the user's interruption and assistance preferences (see Fig. 1). We therefore add to the classic user profile[1] information about the situations or contexts in which the user: requires a suggestion to deal with a problem, needs only a warning about a problem, expects an action on his or her behalf, does not want the agent's help. In turn, we include in the user profile the situations or contexts in which the user: accepts an interruption from the agent, or wants a notification rather than an interruption.

Thus, our user profile comprises:

$$User\ Profile = Classic\ User\ Profile + User\ Intentions$$
$$+ User\ Interaction\ Profile$$
$$User\ Interaction\ Profile = User\ Assistance\ Preferences$$
$$+ User\ Interruption\ Preferences$$

We define the user intentions as the set of all the possible intentions the user can be trying to achieve, each of them with an associated certainty:

$$User\ Intentions = \{\langle User\ intention,\ Certainty \rangle\}$$

We define the assistance preferences as a set of problem situations or contexts with the required assistance action and a parameter (certainty) indicating how sure the agent is