

Chapter 21

Giving Personal Assistant Agents a Case-Based Memory

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ABSTRACT

We consider Personal Assistant (PA) agents as cognitive agents capable of helping users handle tasks at their workplace. A PA must communicate with the user using casual language, sub-contract the requested tasks, and present the results in a timely fashion. This leads to fairly complex cognitive agents. However, in addition, such an agent should learn from previous tasks or exchanges, which will increase its complexity. Learning requires a memory, which leads to the two following questions: Is it possible to design and build a generic model of memory? If it is, is it worth the trouble? The article tries to answer the questions by presenting the design and implementation of a memory for PA agents, using a case approach, which results in an improved agent model called MemoPA.

INTRODUCTION

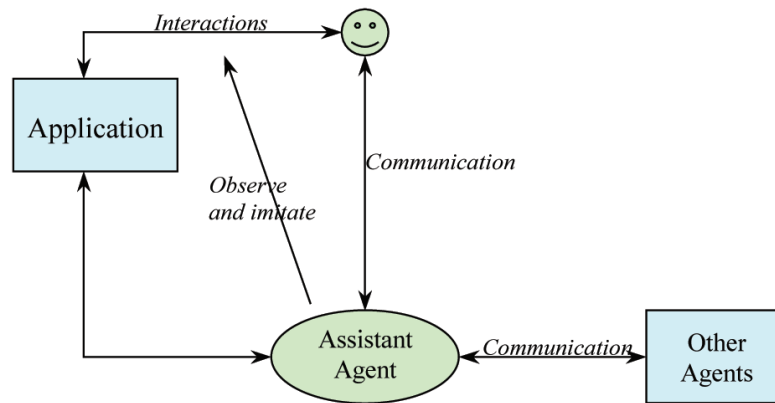
Computer applications require efficient interfaces. Complex applications have shown the limits of “point & click” interfaces. Such direct manipulations are no longer ideal especially for untrained users. Consequently, a new style of interface has been proposed, using the concept of intelligent agent. It was introduced into the Human-Machine

Interaction (Lieberman, 1997; Maes, 1994), giving birth to the concept of *personal assistant* (PA) agent, also called *interface agent* in the literature (Middleton, 2002). Unlike the direct manipulation approach, the PA agent is regarded as a virtual secretary that can execute tasks autonomously by interacting with a set of service agents (Figure 1). As indicated by Lieberman, the approach has potential productivity advantages.

PA agents are one of the most compelling sub-domains of agent research (Modi, Veloso, Smith,

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Figure 1. A prototype of PA agent by Maes (1994)



& Oh, 2004). In the early works (Maes & Kozierek, 1993; Mitchell, Caruana, Freitag, McDermott, & Zabowski, 1994), PA agents were developed for reducing the workload of the user by handling tasks on his behalf, hiding the task complexity, learning and adapting to the users' preferences, as well as collaborating with other agents (Lashkari, Metral, & Maes, 1994). The tasks could be either routine tasks like scheduling meeting or handling email (Modi et al., 2004), or more specific tasks like browsing and suggesting web links (Lieberman, 1995). After that, many systems and prototypes of PA agents have been built for a variety of areas, but recently personal assistants have raised a great interest as can be seen from specialized meetings like the AAAI 2007 Spring Symposium, Interaction for Intelligent Assistants¹ or important programs like DARPA PAL² (Personal Assistants that Learns).

Designing and building PAs is a difficult task since it requires integrating different research domains like reasoning, planning, scheduling, natural language processing, or multi-modal interfaces (Guzzoni, Baur, & Cheyer, 2007). Most of the previous work has focused on learning and adapting to the user's preferences and goals, assuming that once the agent knows what a user wants, it can provide effective assistance. In practice, a successful PA agent is supposed to possess many

kinds of knowledge to perform tasks autonomously by inferential reasoning. It can learn from failures and adapt to new tasks (Wobcke, Ho, Nguyen, & Krzywicki, 2005). However, if the agent has no memory it will ignore past experiences. Thus, when dealing with a new task similar to a task it has already performed, the agent will reprocess the task from scratch. Therefore, it is important to give PAs a memory mechanism. However, doing so increases the complexity of the agent, which leads to two questions: Is it feasible? Is it worth it?

In the article we address the issue of developing a generic mechanism that can be integrated seamlessly into the previous dialog mechanism of the agent, and that should be transparent for the user and easy to implement for the application designer. The work concerns a new research field, Cognitive Informatics (CI) (Wang, 2003), a study of cognitive and information sciences that investigates the internal information processing mechanisms and processes of the natural intelligence generated by the human brain. A major problem of our work is to acquire and formalize situations automatically from the natural language dialogs and from the results of the tasks that were completed. In order to explain our design choices we need first to describe the structure and behavior of our assistant agent, which is done briefly in the next section.

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