

Augmenting Cognition With a Digital Episodic Memory

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Current technology makes it increasingly feasible for personal assistance systems to create an augmented episodic memory that supplements their users' own episodic memory. After considering the question of what such an augmented episodic memory might be useful for, we present a proof-of-concept system SPECTER that realizes this idea. We consider in turn the challenges of (a) automatically capturing and appropriately representing information about the user's actions and experiences; (b) enabling the user to review and revise the information captured; (c) offering functions based on the episodic memory that can help the user deal more effectively with everyday situations; and (d) determining in what situations to make these functions available proactively.

1 Introduction

The idea that human cognition can usefully be augmented by digital memories is old and familiar: Most people now rely on electronic appointment calendars, contact lists, and to-do lists to cope with the demands of everyday life.

It is a bit less obvious how a particular type of digital memory—a digital episodic memory, which essentially contains records of a person's past experiences—might be useful. Sure, it may be nice to reflect on the events of one's last vacation, especially if the episodic memory in question includes concrete media like photos; but in what ways can recollections from the past help us to perform tasks in the present and the future? This question is becoming increasingly relevant as the technological means for automatically capturing a person's actions and experiences increase (cf., e.g., [7]).

This paper summarizes research in a project whose primary goal was to investigate ways in which an automatically constructed digital episodic memory can be created and exploited to help people deal with the everyday world. Its relevance to the topic of AI and human cognition does not lie in any attempt to simulate human cognition. Instead, the strategy is to (a) understand some of the functions that a particular aspect of human cognition (episodic memory) has in some practically relevant situations; and (b) design and test an augmentation of that aspect of cognition that can serve the same functions, thereby enhancing the person's overall cognitive performance in certain types of situation. As we will see, the added value of this sort of support is greatest (a) with subtasks for which human cognitive processing is least well adapted and (b) in cases where the results of the system's augmented processing can be combined immediately with other types of processing by the system.

The system in question—called SPECTER—is in principle applicable in a wide variety of situations. For concreteness in this brief paper, we will refer to examples mainly from a shopping domain, in which the system was most extensively tested. We will also include occasional examples from other domains to illustrate the generality of the functions of the system.

To get an initial idea of how an augmented episodic memory can be useful in a shopping setting, consider the

following scenario: You are browsing through the CDs in a CD store together with a friend, looking for something that you might like to add to your collection. You pick up a CD that looks appealing in some ways, though you have never heard of it before. Your friend says: "This CD is a lot like that one by 'Heavy Metal, Inc.' that you listened to part of on the Amazon website yesterday and didn't especially like." In this case, the reference to a previous experience is an efficient way of conveying a good deal of information about the newly encountered object. Note that your friend is not only reminding you of an experience of yours; she is also allowing you to benefit from some knowledge that she has that you do not have: knowledge about the properties of the CD that you are looking at.

Note also that part of the useful contribution of your friend is a matter of timing: You would not want to be reminded continually and indiscriminately of past experiences; reminders should come at a point at which you can make some use of them. Accordingly, one of the subtasks that need to be handled by a system like SPECTER is that of identifying appropriate situations for presenting reminders. An appropriate *triggering rule* for a reminder in our example scenario might be "While I'm shopping, remind me of similar products that I've recently seen and either liked or disliked".

As we will see below, there are a number of other ways in which an augmented episodic memory can enhance a shopping experience. Since these functions combine aspects of reminding and recommending, we have coined the term *recomindation* to refer to them.

In the rest of this paper, after discussing some relevant previous research, we will discuss in turn several components of SPECTER which together yield the functionality required for recomindation and for analogous functions in other domains.

2 Related Work

2.1 Recommender Systems

The significance of exploiting an augmented episodic memory can be illustrated by a brief comparison of the recomindation paradigm with more familiar approaches to product