Chapter 8
Toward an Agent Framework that Assists the Individuals with Mild Memory Impairment

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ABSTRACT

With the increasing average life expectancy of world population, there are more and more dementia patients and the need of assistive technology emerges. According to the literature, the progress of cognitive impairment can be suppressed to be slower if the patients are constantly in calm mood. An effective way is suggested by keeping them in social relationship with the others. This paper presents a project with the goal of developing a framework for supporting dementia patients. This project features a conversational agent that can serve as a companion for dementia patients. Currently it has limited conversational ability but can generate back channel feedbacks, such as head nods and verbal acknowledgment, on the basis of acoustic information in the user's speech. In order to compensate the companionship of the agent and the ability to assist the user's memory, we are developing a memory vest which is equipped with portable devices including an Android smartphone, two IC audio recorders, and a digital video recorder to log the daily life of the patient. The gathered activity history database can then be used to enrich the dialogue ability of the agent and for helping the user to recall his / her own memory.

1. INTRODUCTION

With the advances in medical technology, the average life expectancy of world population is increasing. Since the probability of becoming cognitively impaired increases with age (roughly 10% of over 65 years old people), one side effect of increasing life expectancy is the emerging number of dementia patients. It is said that currently there are already around 40 million dementia patients all over the world. The situation is particularly severe in developed countries where the problem of aging population proceeds.

Japan, probably is the country in the most severe situation over the world. According to a recent statistical data report, the number of dementia patients in Japan has already exceeded two million (1.6% of the population), and the percentage will keep increasing to 4.45 million (4.1% of the population) by 2035 (Ministry of Health, Labour and Welfare, 2008).

On the other hand, another social phenomena associated with the transition to modern society is the growing occurrence of "lonely death," i.e. people who live alone and died alone without being noticed. This is due to the increasing number of nuclear families and decreasing marriage rate of modern society. Particularly for elderly people who go out less frequently than young people, the lack of social relationship and the stress of being feeling lonely is considered to accelerate the progress of dementia. The connection with the separately living younger family of the children of elderly people (if available) is getting its importance.

Due to the fact that there is no really effective treatment of dementia available, the only way to relieve the situation is to assist the daily life of dementia patients or to prevent the progression of its symptoms. Reminiscence or life review (Butler, 1974) is a well-known method to slow the progress of the most prominent symptom of dementia and memory impairment. It is also reported in the literature (Lazarov et al. 2005; Kempermann, Gast, & Gage, 2002) that repetitive stimuli on cognitive functions in the environment are also effective in suppressing the degradation of specific cognitive abilities.

Pollak (Pollack, 2005) summarized current research trend of three assistive functions for elderly people with cognitive impairment:

- Ensuring that the elder is safe and that he/she performs the necessary daily activities, and, if not, alerting a caregiver
- Helping the elder to compensate for his/her impairment by assisting in the performance of daily activities
- Assessing the elder's cognitive status

In particular, we believe that a conversational humanoid can perform the third function stated above. Conversation is a very high-level cognitive activity and involves large brain areas, language understanding, language production, and so on. It is believed that keeping engaging in conversation can activate brain activities, i.e. can mitigate the progress of cognitive impairment. The assessment should be natural, and it should not be unduly stressful for elderly people. If the agent system (Wang, 2009) can assess the patient's cognitive status through conversations, that will be a more natural way of measuring the cognitive status of the patients. Moreover, interpersonal communication is one of the most preferable daily activities for elderly people.

This paper presents our undergoing project aiming to assist forgetful elderly or dementia patients in earlier stage, i.e. the individuals on whom mild memory (cognitive) impairment has already appeared but still can (or have to) live alone. The potential extension to cover the second function and mitigate the lonely death problem is also kept in mind. We propose a prototype of a listener agent kiosk and a conversation log system that collects data for assessment. In order to compensate the agent's companionship for the target users and develop long-term relationship with the user, it is essential to make the agent memorize not only past interactions but also the daily life of the patients to allow them to feel that the agent is together with them. We then propose a set of recording devices (digital video recorder and two IC audio recorders) which are put in a wearable way and are operated by the patient himself / herself, the memory vest. This is used to log the user's daily activity for memory recall of both the user and the agent

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