Chapter 85
State-of-the-Art Assistive Technology for People with Dementia

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ABSTRACT

The work is motivated by the expanding demand and limited supply of long-term personal care for People with Dementia (PwD), and assistive technology as an alternative. Telecare allows PwD to live in the comfort of their homes for a longer time. It is challenging to have remote care in smart homes with ambient intelligence, using devices, networks, and activity and plan recognition. Our scope is limited to mostly related work on existing execution environments in smart homes, and activity and plan recognition algorithms which can be applied to PwD living in smart homes. PwD and caregiver needs are addressed in a more holistic healthcare approach, domain challenges include doctor validation and erroneous behaviour, and technical challenges include high maintenance and low accuracy. State-of-the-art devices, networks, activity and plan recognition for physical health are presented; ideas for developing mental training for mental health and social networking for social health are explored. There are two implications

of this work: more needs to be done for assistive technology to improve PwD's mental and social health, and assistive software is not highly accurate and persuasive yet. Our work applies not only to PwD, but also the elderly without dementia and people with intellectual disabilities.

INTRODUCTION

Long-term personal care or hands-on assistance is getting more expensive and difficult in many developed countries. This is directly related to:

- Demographic trends of the population living longer and having fewer children.
- Higher economic costs of professional healthcare and lesser government subsidies.
- Increased workload for healthcare professionals and insufficient residential care facilities.
- Dementia is a common, multiple-stage, and long-duration disease.

Dementia is caused mainly by Alzheimer's disease and Dementia with Lewy Bodies, and is significantly more common in the elderly population over 65 years old. People with Dementia (PwD) gradually lose memory and cognition, meaning that they lose their ability to carry out Activities of Daily Living (ADLs are familiar tasks for day-to-day function), learn, solve problems, and communicate.

Worldwide, there are more than 20 million PwDs, with more than 4 million new cases every year. PwDs projected to increase by 100% in developed countries and 300% in Asia by 2040 (Ferri et al., 2005). In Europe, about 2% of the elderly population have mild dementia, which is around 2 million PwD (Information Society Technologies (IST) Program, 2009).

It is generally acknowledged that PwDs have common patterns of symptom progression. There are 7 stages with loose classifications of mild (Stages 2 and 3), moderate (Stages 4 and 5), and severe (Stages 6 and 7). In summary, PwD will exhibit no symptoms in Stage 1, and start to have some mental and social health problems in Stages 2 and 3. PwD will exhibit severe mental and social health problems and some physical health problems in Stages 4 and 5, and will completely lose all physical, mental, and social abilities in Stages 6 and 7. After diagnosis, PwD die within an average of 4 to 6 years and can vary from 3 to 20 years (Reisberg et al., 1984). Dementia can be mitigated with medication, more specifically, moderate-to-severe Alzheimer's disease can treated with consumption of memantine (Reisberg et al., 2003). If the PwD is personally cared for at home, most caregivers (usually PwD's spouse or children) are known to be under extreme stress and require some form of assistance (Belle et al., 2006).

The current practice is to place PwD with severe dementia in residential care: community-based group homes and supervised apartments. Healthcare professionals will be assigned to look after PwD and has to be physically present in order to prompt PwD step-by-step in ADLs. An alternative to personal care is assistive technology, more specifically cognitive assistance. With the right devices, networks, activity and plan recognition, assistive technology can possibly accommodate the aging populations needs with minimal primary caregivers stress and at an affordable healthcare cost. In addition, many elderly has substantial amount of disposable income and are not adverse to using technology (Brewster, & Goodman, 2008). Therefore, only assistive technology can help to scale long-term care to many PwD and it seems that assistive technology which monitors human behaviour will eventually become more robust for common use (Philipose, 2009).

Assistive technology touches across broad fields such as health science (ADLs and cognitive errors), electrical and electronics engineering (sensors and networking protocols), and computer

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