

Unobtrusive sensing technologies to monitor and coach elderly with dementia: Track, Trace & Trigger

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1 Background

Due to an increasing aged population creating immense rises in health expenditure and residential care costs, the number of people living independently with dementia will increase significantly in the coming decades [1]. To facilitate extended independent living of people with dementia researchers investigated potential solutions such as smart homes that involve the use of sensors coupled with algorithms to detect deviant use of home equipment or falls [2]. While these are important areas of research, there is also a need to provide solutions for monitoring of and caring for behavioural symptoms and emotional wellbeing of elderly with dementia. Patients in the early stage often face emotional disturbances like anxiety, apathy or depression whereas in moderate stages behavioural problems like agitation and sleep disorders are a common feature [3]. However, current monitoring devices for behaviour and emotion like cameras or wearables are obtrusive, making elderly feel uncomfortable, and are sensitive to privacy breaching [2]. Our current project therefore centers around the development of a novel, unobtrusive Wi-Fi-disturbance- and acoustic-based sensing system designed to automatically annotate behaviour and emotion of elderly with dementia, connected to a persuasive care platform for caregivers to provide valuable information regarding daily functioning and behavioural and emotional state. Moreover, we assess how these monitoring data can be used to initiate certain acoustic cues (automatically, in the right moment) to trigger behaviour or induce relaxation and wellbeing in elderly with dementia. We apply a multimethod participatory development process that is used to create fundamental knowledge building blocks.

2 Approach

To realize a good fit between technology, context and stakeholders the project applies the first three phases of the CeHRes Roadmap [4] for the holistic development of eHealth technology, combining value-based design and persuasive technology.

Contextual inquiry and value specification: The main goals of the contextual inquiry are to provide an overview of the current situation, its issues and relevant stakeholders. Multiple methods are used including a literature review investigating behavioural and emotional parameters in dementia, desk research to identify relevant stakeholders, and interviews with formal and informal caregivers to identify needs and expectations of technology with respect to behaviour and emotion of elderly with dementia. Within the value specification, focus groups with experts in the field are organized to explore values towards unobtrusive monitoring at home including privacy and ethical issues. A value map will be created using the Analytic Hierarchy Process [5], a multi-criteria value-ranking method. Results from contextual inquiry and value specification will be translated into system- and service requirements.

Design unobtrusive sensing system: The design stage centers around how to generate valuable data and transfer them to caregivers via our care platform in a user-friendly and persuasive way. The system which analyzes motion, speech features and physiological data will be trained in experimental set-ups involving test subjects both with (ecological setting) and without dementia (lab-setting). Machine learning techniques are applied in order to improve accuracy in annotating behaviour and emotion.

Design acoustic trigger system and framework: Identified requirements will be used to develop a data-driven persuasive trigger system which prompts acoustic triggers based on the behavioural and emotional state of the patient. We involve both patients and caregivers for studying the feasibility of this unobtrusive coaching strategy. In a last step, the input from all phases will be used to develop a toolkit for unobtrusive monitoring and coaching that optimizes ageing in place, reduces the burden of care and positively influences wellbeing of people with dementia.

3 Current progress

The project currently is in the contextual inquiry phase. The preliminary focus of the monitoring system has been determined based on literature and expert advice. Besides, different interview studies with formal and informal caregivers of people with dementia are started based on gathering fundamental knowledge about needs and expectations of unobtrusive sensing technology that will result into system- and service requirements. Preliminary results will be presented.

References

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