413

RadioMe: Adaptive Radio to Support People with Mild Dementia in Their Own Home

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Abstract. People with dementia and their carers are experiencing a complicated and highly personal health journey. The RadioMe system, an adaptive live radio system enriched with reminder possibilities and agitation detection and intervention with personalised calming music, is being developed to support people with mild dementia in their own home. RadioMe is an ongoing, interdisciplinary project, combining expertise on dementia, music therapy, music computation and human computer interaction.

Keywords. agitation detection and intervention, dementia, ongoing project

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1. Introduction

As the proportion of older people within the world population increases, illnesses and syndromes which predominantly affect individuals in later life are becoming more prominent. Dementia is one of these, with additional 10 million cases predicted each year[2]. People with dementia experience a number of different symptoms related to a decrease in brain functioning and the progression of the illness can vary significantly between individuals. In the milder stages of dementia, people often can manage to life in their own home, especially when they have family members like spouses or children to support them, while in later stages it can become necessary to provide them with more support in care homes. Technological solutions for people with dementia (PwD) often focus on support in activities of daily living or overall monitoring, both of them and their environment [1]. This often involves sensors collecting and analysing environmental [2] or physiological data [3,4], typically combined with machine learning approaches.

The RadioMe[3] project takes the same approach and brings together dementia, music therapy, music computation and human computer interaction experts to build a system used in the homes of PwD, integrating support into an adaptive radio system. Sensors in a wearable device in combination with machine learning detect agitation in PwD and the system then provides a personalised intervention designed for the individual. In addition, the system can be used to provide reminders to support PwD in their everyday tasks.

2. RadioMe Project

The RadioMe system captures a live radio stream and detects its content regarding speech and music [5,6] and plays this stream for the person with dementia, who is wearing a Samsung Galaxy Watch4[4]. The smartwatch sends sensor data (currently heart rate and accelerometer data) to the system laptop via wifi, which is collected and logged there. A machine learning model analyses the incoming data to detect if the person with dementia is agitated. The model is currently based on data from a healthy older control group collected during stress test studies using another device [7]. We are at the moment in the process of collecting realistic data with the system devices directly from PwD in their homes to improve and adjust the model and test the hardware setup. When the system detects agitation, calming music, specifically selected for this individual in sessions with music therapists, will be smoothly integrated into the radio stream to mitigate the agitation event. We are currently investigating how this music would be best presented by the system. In addition, the radio system can present auditory reminders, set in a Google calendar (at the moment), to allow support with day to day activities. We are currently conducting focus groups to investigate the requirements of the PwD and their carers.

The RadioMe project is very much ongoing and we are in the process of improving our understanding of the different aspects of this kind of system. The project will support people with dementia in their own home by providing agitation detection and intervention and reminder presentation during a live radio stream and could make an immense difference for people with dementia and carers both.

References

[1] Ienca M, Fabrice J, Elger B, Caon M, Pappagallo AS, Kressig RW, et al. Intelligent Assistive Technology for Alzheimer's Disease and Other Dementias: A Systematic Review. Journal of Alzheimer's Disease. 2017;56(4):1301-40.

[2] Enshaeifar S, Zoha A, Markides A, Skillman S, Acton ST, Elsaleh T, et al. Health management and pattern analysis of daily living activities of people with dementia using in-home sensors and machine learning techniques. PLoS ONE. 2018;13(5):1-20.

[3] Spasojevic S, Nogas J, Iaboni A, Ye B, Mihailidis A, Wang A, et al. A Pilot Study to Detect Agitation in People Living with Dementia Using Multi-Modal Sensors. Journal of Healthcare Informatics Research. 2021.

[4] Khan SS, Zhu T, Ye B, Mihailidis A, Iaboni A, Newman K, et al. DAAD: A framework for detecting agitation and aggression in people living with dementia using a novel multi-modal sensor network. IEEE International Conference on Data Mining Workshops, ICDMW. 2017;2017-Novem:703-10.

[5] Venkatesh S, Moffat D, Kirke A, Shakeri G, Brewster S, Fachner J, et al. Artificially synthesising data for audio classification and segmentation to improve speech and music detection in radio broadcast. ICASSP, IEEE International Conference on Acoustics, Speech and Signal Processing - Proceedings. 2021;2021-June:636-40.

[6] Venkatesh S, Moffat D, Miranda ER. Investigating the effects of training set synthesis for audio segmentation of radio broadcast. Electronics (Switzerland). 2021;10(7).

[7] Di Campli San Vito P, Shakeri G, Ross J, Yang X, Brewster S. Development of a Real-Time Stress Detection System for Older Adults with Heart Rate Data. Accepted for publication at: Proceedings of the 16th International Conference on PErvasive Technologies Related to Assistive Environments (PETRA '23), July 5–7, 2023, Corfu, Greece. 2023.