Developing a Voice Assistant for Users with Dementia

# Introduction

Dementia is one of the leading causes of disability among the global elderly population which causes the deterioration of cognitive functioning. People living with dementia require constant care; however the number of caregivers is not sufficient to match the growing number of dementia cases. As modern advances in healthcare cause the average age of the world’s population to rise, so too is the number of elderly persons living with dementia that require care and support (WHO 2019).

There is great promise for voice assistants[[1]](#footnote-1) (VAs) such as Apple’s Siri and Amazon’s Alexa to support care-givers and patients by managing routine tasks such as setting medication reminders, carrying out mental stimulation exercises, and alerting human carers when needed. Such devices could reduce the work of care-givers and enable persons living with dementia to have more independence. Unfortunately, current consumer products are not sufficiently reliable or simple enough to provide support for even healthy elderly users (A. Reis*et al.* 2018). These products are primarily cloud-based, leaving users unable to utilize many of their features if disconnected from the internet. Current products respond to commands and to be used as a care-giver would need to be able to infer a task from a less explicit statement. For example, a confused question such as, “Where did Alice go?” while Alice is not present should be treated as a command to call Alice.

Although current products are marketed as being easy-to-use, they still require a degree of technical understanding to be used effectively. While younger users (“Digital Natives”) of these products may find it easy to adapt to their use, older generations (“Digital Immigrants”) have more difficulty learning the technology. Furthermore, as these products are intended for general use, they are not suitable for users with special needs.

This project aims to develop a prototype VA that is tailored for users living with dementia. This prototype will include features common to current VAs such as setting reminders, performing search queries, and calling contacts. The VA will also include ease-of-use considerations made for elderly users and additional features designed to maintain user independence and reduce the effects of cognitive decline. The ability to perform critical tasks without requiring an internet connection.

Companionship and social relationships have been consistently shown to be very important for maintaining both physical and mental health. For the elderly, social relationships are hampered by difficulty communicating (A. Palmer *et al.* 2016). The proposed VA could help overcome this obstacle and assist early-stage dementia sufferers with maintaining their social relationships and health. The VA could also provide a degree of companionship itself. Improved voice synthesis will make VA’s more relatable.

In this paper, I review current literature surrounding the challenges faced by people who are or know someone living with dementia and review the current state of VA technology including its shortcomings. This information is then used to list the requirements of a VA to assist people living with dementia. This paper then describes the stages taken in the implementation process of such a VA and the difficulties faced in each.

* Dementia is a MHC
  + What does it do?
  + What is its spread?
* How is Dementia a problem?
  + People need care but there are not enough care-givers
  + Dementia common among the elderly
  + Increase in average age
* What is a key problem area
* How have people tried to solve this problem?
  + Care services
    - Overworked
    - Expensive
    - Labourous
* What can be done to help?
  + Voice Assistants
* Why did you research this?
* Why are you writing this report
* Current options are primarily cloud-based, leaving vulnerable users unable to utilize them if web connection goes down
* The current state of voice synthesis is also lacking and can be hard to relate to for users who require companionship
  + Research shows that companionship is important
  + Historically, users have been able to relate to even less advanced AI.
* Virtual assistant can offer brain-training exercises that could help elderly users keep focused
* Certain terminology or phrasing should be used when speaking with persons living with dementia
* Ethical concerns – Collecting and storing data

Challenges for users living with dementia.

* Poor speech makes speech detection difficult
* Outline the rest of the paper
* Introduce roadmap of project

# Literature Review

* Gather and summarize papers on the prevalence of dementia as a problem and the benefits of VAs
* Use a repeatable process to collect papers
* Differences between digital immigrants and digital natives
* Differences between elderly and people living with dementia

# Project Plan

Outline of project

### Requirements of the VA

List future features

# Identifying Anxiety

## Introduction

* Short paragraph explaining the need to understand the identifiers of GAD in order to detect them

## Research

* Focused research about GAD’s symptoms and identifiers
* Primarily medical papers

## Conclusion

* Highlight key identifiers that could potentially be identified systematically

# Identifying Anxiety from Text

## Introduction

## Algorithm Research

* Review of
* If possible, relate to papers about previous approaches from main Literature Review

## Prototype

* Describe process of creating a prototype that implements one (or more) of the methods found above
* Test and review prototype

# Generating Text from Audio

## Introduction

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## Literature Review

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# Identifying Anxiety from Audio

## Introduction

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## Literature Review

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# Evaluation of Developed System

While persons suffering with late-stage dementia will likely still require constant support, this system should allow persons with early stage dementia and pre-dementia to continue living independently for a longer period before requiring more consistent care.

# Further Research

Most dementia cases are present in countries with low income. Sufferers in these countries would not directly benefit from the development of the proposed voice assistant; however reducing the dependency on human care-workers in developed countries will open the possibility of aid for lower income countries.

Studies on dementia are often done in high income countries, how effective the techniques developed are for low income countries is uncertain.

# Appendices

## References

## Bibliography

# Notes

Approximately one sixth of all adults suffer from a mental health condition, one of the most common of which is Generalized Anxiety Disorder (GAD). Mental health conditions that are treated early have a greater success rate, and because anxiety is often a precursor or symptom of other illnesses, it is imperative that it can be recognised quickly. Mental health conditions such as anxiety are particularly difficult to diagnose but can be detected by analysing behavioural identifiers such as tone of voice, choice of language, erratic thought patterns, and restlessness. Sentiment analysis and machine learning techniques have been successfully applied to historical text and audio data to detect these behavioural characteristics in individuals and systematically diagnose mental health conditions. An efficient approach to diagnosing anxiety would reduce the time taken to address and provide treatment, and improve the ability to diagnose further conditions. The proposed system attempts to recognize potential indicators of GAD in real-time audio without background knowledge of the individual.

1. There is no consensus on a general term for this class of products. Alternative terms include intelligent virtual assistant (IVA), intelligent personal assistant (IPA), and smart speaker. For this document the term voice assistant (VA) will be used. [↑](#footnote-ref-1)