Virtual-Interviewer: A Conversational Agent Designed to Facilitate Cognitive Health Screening in Older Adults

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***Abstract*—Across the globe, shifting age demographics have resulted in an increasing number of older adults with a decreasing number of younger adults to support them. This trend is expected to continue, making it imperative to devise mechanisms capable of automating some clinical tasks. We propose a dialog system that can conduct structured, natural-language interviews with older adults. Collecting these interviews is often a first step in detecting dementia and other age-related cognitive health issues, and we hope that this system will alleviate clinical burden and facilitate its early diagnosis.**

I. Introduction

Populations around the world are aging [1], making cognitive health issues such as dementia of increasingly critical concern. Although cures for these issues remain out of reach, researchers believe that early diagnosis can mitigate their effects [2]. Diagnosis typically requires data collected using cognitive tests or in-person interviews, which can be resource-intensive, and stressful for patients. Here we propose a conversational agent capable of conducting interviews to collect cognitive health information. Dialog systems have been deployed for health-related applications in the past [3, 4], but to the best of our knowledge, applying such a system to collect cognitive health data from older adults is quite novel.

II. Task Description

The proposed system models interviews after the "Boston Cookie Theft Description Task" [5]. In this task, participants are shown an image in which a woman is washing dishes in her kitchen while a young girl and boy steal a cookie. Participants are asked to describe all events in the image. There is no specific time limit for the task, and they may end the conversation whenever they want.

III. Proposed System Architecture

Figure 1 shows the architecture of the proposed dialog system. The architecture contains two main modules: an initialization module and a dialog manager (DM). Given an input image, the initialization module will employ image captioning and visual question answering models to define a semantic representation of the image. Topics associated with the key image components are stored internally for further use. The conversation will then be initiated using predefined general questions or instructions. In later stages of the conversation, the DM will use the current context (e.g., user utterance, topics covered by previous utterances, wait time) to select an appropriate response type. The DM will first attempt

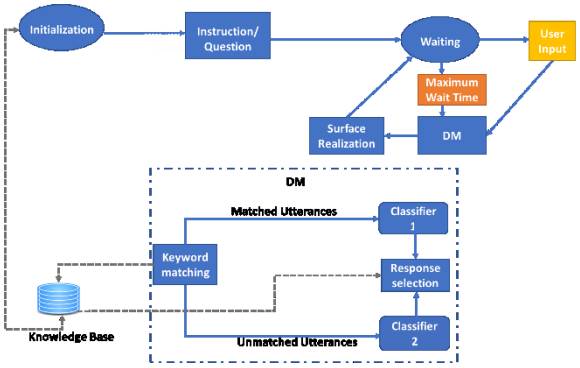

Figure 1: Proposed conversational agent architecture.

to match the user utterance to one of the topics associated with the image. Two classifiers will be applied to the matched or unmatched data; each will be trained using utterance-response type pairs from the Cookie Theft Description subset of the DementiaBank dataset [5]. The first classifier, applied to matched data, will select from general response types: *turntake* (e.g. "mhm", "okay", "uh-huh", etc.), *positive feedback* ("right", "doing great", laughing, etc) or *remaining silent*. The second classifier, applied to unmatched data, will select from more specific response types: *answer* ("yes", "no", etc.), *question* ("anything else?", "what do you see going on over here?", etc.), or *thanking* ("okay, thank you very much", "okay, that's fine", etc.). These response types are based on our analysis of real conversations present in the DementiaBank corpus which are annotated following the schema defined in ISO 24617-2 [6]. Finally, the selected response type will be transformed into a natural-language surface realization using a template-based approach.

References

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