Automated Suggested Responses for Deaf and Hard of Hearing Individuals

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ABSTRACT

Everyone, including those who are deaf and hard of hearing (DHH) should have equal access to technology which intends to facilitate communication between one another. Although various tools, such as Automated Speech Recognition (ASR), enable hearing and DHH people to understand each other's messages, hearing individuals benefit from the ease of effort tools provide while DHH individuals need to exert more effort than their hearing peers to respond. Therefore, a need exists to provide DHH people with the ability to quickly and easily reply to messages. We propose a tool to generate a collection of suggested responses that users can select to quickly reply with based on the subject and content of preceding messages. We will create an API service, design a chat application to utilize the service and conduct a human-user study to evaluate the usability of the tool.

INTRODUCTION

While a wide array of technology has improved communication between hearing and DHH people, there is still room for improvement. Specifically, the ease in which participants in a conversation exert effort to send messages to each other should be equally distributed, regardless of one's disabilities or lack thereof. In the case of some tools like chat applications or even pencil and paper, both hearing and DHH people spend roughly the same level of effort in writing messages to each other. However, other technologies like ASR reduce the effort of sending messages for hearing individuals while DHH individuals are not provided with a tool with the same effect. Though ASR enables understanding between hearing and DHH people, the technology makes the communication process easier for hearing individuals but not for the DHH. ASR accepts sound as input and translates spoken words into text, making the speaker's message readable to the listener. Since ASR is not usable for DHH people due to large discrepancies in their speech [2], the DHH would require resorting to an interpreter or writing their message on a device or on paper. Since requesting an interpreter requires some considerable time, and writing a message usually takes longer than speaking, there is an unequal distribution of work between hearing and DHH participants during conversations.

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PROPOSED SOLUTION

Our goal to reduce efforts in replying to messages for DHH people involves the ability to select an appropriate response, based on the subject and content of a preceding message, instead of having to type out the reply. Some recent tools like Gmail's Smart Compose and Smart Reply [1] utilize machine learning to predict what responses to reply with in order to spend less time and effort writing emails. We seek to apply this concept of providing predicted responses not only for the DHH, but for all people, to minimize the time and effort required in writing messages to others.

To provide automatically-generated responses for DHH people, we propose an API service to return a collection of suggested responses based on a message and its subject context provided as parameters. The reason for creating an API service is so that a variety of applications, whether for desktop, mobile, web or other devices, can utilize the functionality. The API will take in as input the previous message context. In the backend, the API will compare the subject and context to a pre-programmed collection of related responses, and then output the collection as possible responses. To accomplish this, we will use a corpus of conversational chat messages and Natural Language Processing (NLP) to compute the most likely responses. To process the previous chat dialogue, we will use the NLTK library's dialogue act classifier and a Naive-Bayes classifier to determine the dialogue act type and the predicted dialogue acts, based on the existing corpus. The API will output these responses as a list.

After we implement the API, we will create a chat application to demonstrate how the suggested responses would look and feel. To evaluate the effectiveness, efficiency and satisfaction of our API and chat application, we will conduct a human-user study with DHH participants. We chose this population because DHH people should be given as much ease in communication as hearing people, who might make use of ASR technology, for instance, to simplify communication with their deaf and hard of hearing peers.

Due to the countless number of possible responses, our API service should be able to provide the ability to save new text

not yet learned by the tool for future use. Also, since many conversation subjects exist, we will focus on providing responses for just one subject due to the time constraints of this project.

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