May 2020

Natural Language Explanations For Unfulfilled Queries

Guillermo Garrido

Francisco Aliaga

Mike Kozhevnikov

Enrique Alfonseca

Lilian Zia

See next page for additional authors

Inventor(s)
Guillermo Garrido, Francisco Aliaga, Mike Kozhevnikov, Enrique Alfonseca, Lilian Zia, Chintu Kumar, Madelaine Plauché, Katherine Vadella, and James Giangola

Natural Language Explanations For Unfulfilled Queries

ABSTRACT

User requests cannot sometimes be fulfilled by a virtual assistant. In such cases, the virtual assistant typically informs the user that the question cannot be answered or the command cannot be performed, without providing an explanation of the reason for the failure to fulfill the user's request. This disclosure describes techniques that enable a virtual assistant to provide the user a helpful explanation of why a particular request was not fulfilled. Further, the virtual assistant response can include information on how the user's query was understood.

KEYWORDS

- Virtual assistant
- User query
- User command
- User intent
- Query understanding
- Query interpretation
- Failed request
- Failed command
- Smart speaker

BACKGROUND

Users interact with virtual assistants, provided via devices such as smart speakers, smart displays, tablets, smartphones, wearable devices, e.g., by asking questions or issuing commands. In order to provide answers to the queries or perform the requested actions, the virtual assistant first attempts to understand the query and decipher the underlying user intent. The virtual

assistant may fail to generate a satisfactory response for various reasons, e.g., speech recognition errors, inability to decipher query intent, absence of data, lack of functionality to answer the type of query, etc. In such failure cases, the virtual assistant typically informs the user that the question cannot be answered or the command cannot be performed, with a generic response such as "I'm sorry, I cannot answer that" or the like.

Such responses do not inform the user whether the failure resulted from the command not being recognized or understood appropriately, from the desired information being available, from the requested action being outside of the functional capabilities of the virtual assistant, from request fulfillment being blocked by policies, or for some other reason. As a result, the only recourse for the user is to keep trying by repeating or refining the original request or to abandon the use of the virtual assistant.

DESCRIPTION

This disclosure describes techniques for a virtual assistant to provide natural language explanations to the user when a user request cannot be fulfilled. In such cases, the techniques described in this disclosure enable a virtual assistant to offer the user a reason why the user's request cannot be fulfilled, instead of simply stating that the request cannot be satisfied. Further, the virtual assistant response may include information on how the user's query was understood.

Such an informative response enables the user to understand the reason why their request was not fulfilled. To that end, natural language explanations that explain request fulfillment failures are formed in one or more ways such as:

- **what was understood**: repeating the user's command to ensure that it was transcribed correctly by automated speech recognition, e.g., "Did you say: 'Tell me nutritional information for chicken pizza'?"

- **why the request failed**: referencing specific entities extracted from the user's request and embedding the entities in explanations of the failure, e.g., "Sorry, I don't know nutrition facts for chicken pizza."
- **how the situation could be remedied**: guiding the user in determining how to proceed by providing topical information and/or alternate requests that can be fulfilled, e.g., "I don't have nutritional information for chicken pizza; want to see nutrition facts about pizza?"

Such functionality can be implemented as a component within the virtual assistant. With permission from the user, the user's voice input is processed to map it to the user's intent as inferred from the input. In addition, if the user permits, the user input is mapped to relevant contextual cues that can offer corresponding natural language explanations. The mapping between the user input and contextual cues can be pre-programmed in the form of rules and/or assigned dynamically by employing an appropriate trained machine learning model.

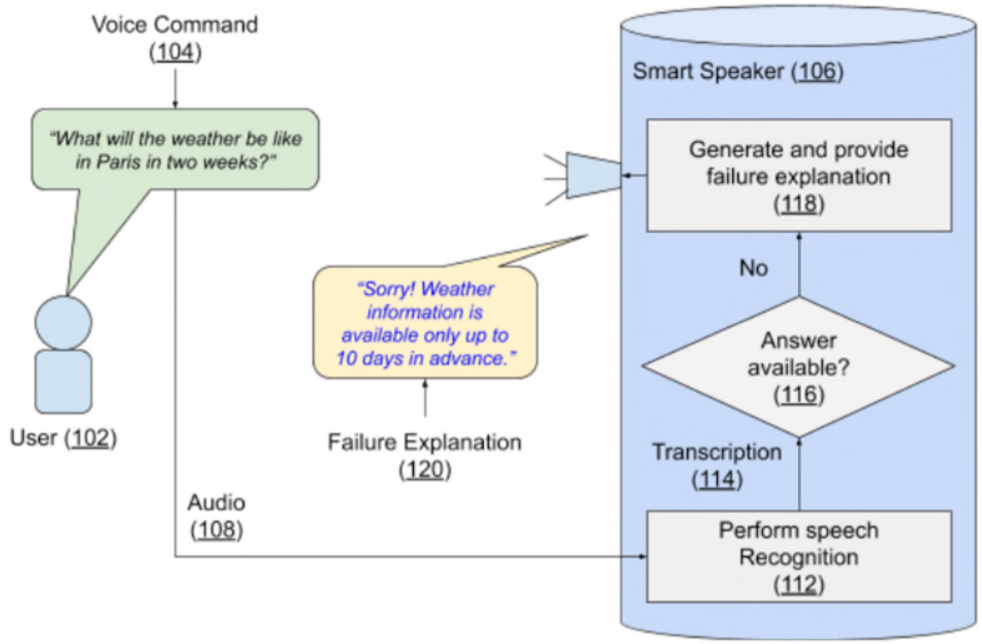

Fig. 1: Provision of natural language explanation for failure to serve a user's request

Fig. 1 shows an operational implementation of the techniques described in this disclosure. A user (102) issues a voice command (104) to a smart speaker (106) that implements a virtual assistant. The audio (108) of the command is analyzed using speech recognition techniques (112) to generate a transcription (114) of the user's request.

It is determined if an answer is available, e.g., the virtual assistant can fulfill the query. If the answer is available, a response is generated and provided to the user (not shown). If the answer is not available, a failure explanation (120) is generated and provided to the user (118), e.g., as a spoken response.

The explanation can be generated based on mapping of the query intent and contextual cues (as permitted by the user) to a natural language explanation. The mapping can be pre-programmed via rules or can be learned from data using machine learning techniques. The failure explanation can be generated by mapping intent representations produced at a query understanding stage to natural language explanations using pre-programmed rules or by using machine learning techniques.

In the example illustrated in Fig. 1, the user's query is for the weather in Paris in two weeks. The reason for the failure is that the virtual assistant has access to weather information for the next 10 days, while the requested period is outside of this range. The failure explanation "weather information is available only up to 10 days in advance" provides the user clear guidance regarding the failure. Other queries that fail for other reasons, e.g., speech transcription errors that led to insufficient understanding of the user intent (e.g., failure to understand an entity name, such as a name of a song requested by the user), lack of functionality (e.g., the virtual assistant not having functionality to answer queries in particular domains), etc. are responded to with an explanation of the failure reason.

From a user experience (UX) point of view, it is more helpful for the user to receive an explanation when the user's request cannot be fulfilled, rather than simply being informed that the virtual assistant is unable to perform the desired action. The explanations can help users understand why the system was unable to handle their request and, if possible, modify the request to a form and/or scope that the virtual assistant is capable of serving. Implementation of the described techniques thus improves the user experience of using a virtual assistant.

The techniques can be implemented in a virtual assistant or other query fulfillment tools that provide information or execute commands in response to user requests. With user permission, queries received via speech, keyboard, or other input mechanisms can be processed and the natural language explanations of failure can be provided via any available user interface mechanism, such as spoken response, displayed response, etc.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's queries), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

User requests cannot sometimes be fulfilled by a virtual assistant. This disclosure describes techniques that enable a virtual assistant to provide the user a helpful explanation of why a particular request was not fulfilled. Further, the virtual assistant response can include

information on how the user's query was understood. The explanation helps users understand why the request was not fulfilled, and submit a modified request that the virtual assistant can fulfill. Provision of failure explanations improves the user experience of interaction with a virtual assistant.