

METHODS FOR UNDERSTANDING INCOMPLETE NATURAL LANGUAGE QUERY

RELATED APPLICATIONS

This application claims the priority to and benefit of U.S. Provisional Application No. 62/107,213 filed Jan. 23, 2015, which application is hereby incorporated by reference.

BACKGROUND

[0001] Various computing devices use language understanding applications (e.g., digital assistant applications) to receive inputs from users. Language understanding applications, however, often receive incomplete inputs such as textual and audio inputs. For example, as a user types or gestures, the input is incomplete at least until the user stops inputting the input. Thus, real-time interpretation of input requires understanding of incomplete input. Real-time understanding of incomplete natural language expressions may improve both computer and user efficiency, as requiring a user to complete the expression wastes user time and slows down the time it takes for a computer to deliver a response to a user. In this regard, digital assistant applications may have the need to interpret incomplete textual inputs and audio inputs.

[0002] Interpreting incomplete inputs presents challenges. For example, a user may desire the computer to perform a specific action (or actions) when entering incomplete input. An "action" is any function executable on a computer, e.g., "create a meeting," "get a route," "create a task," "set an alarm," and the like. A "desired action" is a specific action or actions that a user seeks to perform while entering incomplete input (the desired action(s) will be referred to herein as "the intent of the user" or "user intent"). Some language understanding applications supply autocomplete suggestions to a user based on incomplete input. However, these suggestions fail to address the user's intent, e.g., fail to facilitate performance of a desired action.

[0003] It is with respect to these and other general considerations that aspects of the technology have been made. Also, although relatively specific problems have been discussed, it should be understood that the embodiments should not be limited to solving the specific problems identified in the background.

SUMMARY

[0004] The disclosure generally relates to interpreting incomplete natural language inputs by a computing device. In aspects of the technology, one or more devices take an action based on the incomplete natural language expression. For example, an incomplete natural language expression may be received by a computing device as input. The input may be one or more of textual, gesture, or speech input. From this incomplete natural

The invention claimed is :

1. A system comprising:

at least one processor; and

memory encoding computer executable instructions that, when executed by at least one processor, perform a method for interpreting incomplete natural language expressions, the method comprising:

receiving input from a client device, the user input comprising an incomplete natural language expression, wherein the incomplete natural language expression is a string of characters with one or more missing characters ;

extracting one or more n-grams from the incomplete natural language expression;

analyzing the extracted one or more n-grams to determine a set of possible domains;

assigning a confidence level to each possible domain of the set of possible domains, wherein the confidence level for at least one possible domain exceeds a predetermined confidence threshold;

predicting an intent of a user associated with the at least one possible domain; and

initiating at least one domain application for performing the predicted intent;

predicting at least one slot for executing at least one function;

receiving a selection, wherein the received selection indicates confirmation that the at least one function reflects an actual intent of the user; and

training a natural language analysis component based on at least the received selection indicating confirmation.

2. The system of claim 1, further comprising:

presenting a graphical user interface for initiating the at least one domain application, the at least one domain application associated with at least one function for performing the predicted intent.

3. The system of claim 1, further comprising:

analyzing contextual information to determine the set of possible domains.
4. The system of claim 1, wherein the set of possible domains includes a calendar domain, an alarm domain, and a travel domain.
5. The system of claim 1, wherein the n-gram is a word n-gram, a partial word n-gram, or a character n-gram.
6. A computer implemented method, comprising :

receiving input from a client device, the user input comprising an incomplete natural language expression, wherein the incomplete natural language expression is a string of characters with one or more missing characters ;

extracting one or more n-grams from the incomplete natural language expression;

analyzing the extracted one or more n-grams to determine a set of possible domains;

assigning a confidence level to each possible domain of the set of possible domains, wherein the confidence level for at least one possible domain exceeds a predetermined confidence threshold;

predicting an intent of a user associated with the at least one possible domain;

initiating at least one domain application for performing the predicted intent;

predicting at least one slot for executing at least one function; and

receiving a selection, wherein the received selection indicates confirmation that the at least one function reflects an actual intent of the user;

training a natural language analysis component based on at least the received selection indicating indicating confirmation and the contextual information.
7. The method of claim 6, further comprising:

presenting a graphical user interface for initiating the at least one domain application, the domain application associated with at least one function for performing the predicted intent.

8. The method of claim 7, further comprising:

predicting at least one slot for executing the at least one function; and

receiving a selection, wherein the received selection indicates confirmation that the at least one function reflects an actual intent of the user.
9. The method of claim 6, wherein assigning a confidence level comprises assigning a number from 1 to 0 to each possible domain.
10. The method of claim 6, further comprising:

analyzing contextual information to determine the set of possible domains.
11. The method of claim 6, wherein the set of possible domains includes a calendar domain, an alarm domain, and a travel domain.
12. The method of claim 1, wherein the n-gram is a word n-gram, a partial word n-gram, or a character n-gram.
13. A computer readable storage device storing instructions that when executed perform the method of :
- receiving textual input from a client device, the user input comprising an incomplete natural language expression, wherein the incomplete natural language expression is a string of characters with one or more missing characters;
- extracting one or more n-grams from the incomplete natural language expression;
- analyzing the extracted one or more n-grams to determine a first set of possible domains;
- assigning a confidence level to each possible domain of the first set of possible domains, wherein the confidence level for at least one possible domain exceeds a predetermined confidence threshold;
- predicting the intent of a user associated with the at least one possible domain;
- initiating at least one domain application for performing the predicted intent;

predicting at least one slot for executing at least one function; and

receiving a selection, wherein the received selection indicates confirmation that the at least one function reflects an actual intent of the user;

training a natural language analysis component based on at least the received selection indicating confirmation.

14. The computer readable storage device of claim 13, further comprising :

presenting a graphical user interface for initiating the at least one domain application, the domain application associated with at least one function for performing the predicted intent.

15. The computer readable storage device of claim 14, further comprising :

predicting at least one slot for executing the at least one function; and

receiving a selection, wherein the received selection indicates a confirmation that the at least one function reflects an actual intent of the user.

16. The computer readable storage device of claim 13, wherein assigning a confidence level comprises assigning a number from 1 to 0 to each possible domain.

17. The computer readable storage device of claim 13, further comprising :

analyzing contextual information to determine a second set of possible domains.

18. The computer readable storage device of claim 13, wherein the set of possible domains includes a calendar domain, an alarm domain, and a travel domain.

19. The computer readable storage device of claim 13, wherein the n-gram is a word n-gram, a partial word n-gram, or a character n-gram.