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Summarizing Existing Conversation For Newly Added Participants In Online Communication

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SUMMARIZING EXISTING CONVERSATION FOR NEWLY ADDED PARTICIPANTS IN ONLINE COMMUNICATION

ABSTRACT

Systems and methods of assisting a user newly added to a communication thread are disclosed. The system includes one or more users connected through a server in a network. The system further includes various machine learning models running on the server to summarize a conversation and to identify user-specific content. The method includes providing a customized summary to the newly added user with previous discussion points, other users involved, action items assigned, attachments added, etc. in the form of an easily readable short snippet of text. The method may also include suggesting adding one or more other users to the conversation at a specific time. The disclosed system and method could result in conversations in the virtual world becoming more like real world conversations by reducing the entry barrier for a new user to a pre-existing conversation.

BACKGROUND

In a computer-mediated communication involving multiple participants, existing users can invite one or more new participants to the exchange anytime during the period of communication. This could be done to make sure that the newly added user is aware of the content of the conversation or to assign action items relevant to the new user. A problem that arises for the newly added user is that they first need to scan the entire conversation to find out what it is about, who is involved already, and why they were added to the conversation. That is, the user needs to find out whether they were added just to make sure that they are informed or to find action items that were assigned to them. While this is not a big problem for users that are added early in a conversation, it can be cumbersome if someone is added late to a conversation.
and has to go through substantial amount of text. This is also ineffective for all the existing users who may rely on the newly added user for any further action.

**DESCRIPTION**

Systems and methods of assisting a user added to a virtual conversation (chats, emails) are provided herein. The system, as illustrated in FIG. 1, includes one or more input devices engaged in a conversation, either via a server or nearby Bluetooth or peer-to-peer interaction, to which a new user is invited. The system is used to implement a method that allows for automating the user introduction and assisting the newly added user to contribute effectively to the ongoing conversation. The conversation may be any digitally exchanged conversation such as instant messaging, email, chat, audio or video conferencing or a social networking service. The computing device can be a smartphone, a wearable, laptop, tablet, desktop, or a vehicle computer. The system further includes a generic machine learning model that can summarize textual content.

**FIG. 1: System for assisting a newly added participant in a conversation**

A method for assisting a user that was recently added to a conversation is provided, as
illustrated in FIG. 2. The method includes summarizing a conversation for the one or more newly added users as follows. In an ongoing conversation, a participant adds a new user. The system analyzes the new user’s data including that user’s conversation history, previously stored data etc. The system feeds this data to a set of machine learning models that may a) summarize the content in general for a new user, b) identify content relevant to the new user, and c) identify or suggest new participants to the conversation. The system retrieves the content identified as relevant to the new user’s interest based on the machine learning models and prepares a conversation summary, including action items, if any. The summary may include the previous discussion points, other users involved, action items assigned, attachments added, etc. The method may provide an easily readable summarization of the entire state of the conversation as a short snippet of text that is informative to the user. The method may additionally include highlighting in a different color or by other means, portions of the chat/email log or the summary that may be relevant to the user being added or CC’ed to the conversation. The method may optionally include further steps of providing machine translation, suggesting a response automatically or generating headlines. The method may also include suggesting adding one or more other new users to the conversation at a specific time.
An interesting aspect in obtaining training data for the machine learning system is that it may be bootstrapped from various other data sources relating to the user. For example, when reading various conversations, the user might scroll back through the discussion and spend more time reading specific paragraphs that are of interest to him. Such interaction may be used for generating user-specific training data. Beyond this, the user might be naturally interested in particular types of discussions, news feeds, etc. and these signals may be used as an additional filtering source.

The machine learning model that summarizes a conversation thread can make use of recurrent neural network technology stack applied in machine translation, automated response suggestion or headline generation. The system can optionally include a second set of machine learning models that can predict if and who should be added to the conversation, and when a
suggestion to add a specific user should trigger. The system includes a user-specific model that learns to predict what is relevant for the user, given a user-specific feature-vector. The system includes several architectural features in order to allow highlighting parts of a conversation that would be relevant to a particular user. In another instance, the system may include an additional output layer trained to process the entire conversation, say for a certain number of words, and output for every word a score whether the word is relevant to the added user. The scores are then used as inputs for a highlighting feature included in the application. The highlighting feature may keep only the words with scores above a particular threshold. Additionally, the summarization model is parameterized by the length of the summary it outputs. Such a system may allow the newly added user to select the length of the summary he wishes or select from multiple available length summaries.

Another set of machine learning models can predict if and who should be added to the conversation, and when a suggestion to add a specific user should be triggered. This may be either done independently for each participant already in the conversation (taking into account the particular contacts the user has), or globally per conversation whenever the set of potential participants is well defined, such as in a corporate environment, where the set of potential participants may be all the employees. This may be done in a hierarchical way – the model may first output a set of potential new users and then the more specific model described above may run to identify paragraphs relevant for those users and use that output to give the original writer suggestions to add the external user to the conversation.

In one example, the newly added user receives a short textual summary of the conversation in the following manner. The user is first copied to an ongoing email exchange. The user receives the email with a built-in option to show conversation summary at a length he/she
may prefer. When the user selects the desired length, the output is a summary from the machine learning model of the entire exchange by default, and the user is given the option to expand particular parts of the summary to visualize the original conversation thread. Relevant parts of the summary are highlighted. A user interface (UI) affordance pops up, getting the exact text snippets relevant to the user immediately after the user was added to a conversation. The UI affordance has a scrollable behavior which allows the user to go from one snippet to the next one in incremental time order. Alternatively, the user can set up the UI to visualize the importance of different parts (e.g. words) of the conversation stylistically. For example, a scheme using different shades of grey can have the most important parts in black, unimportant parts in white and other parts in a shade that is an interpolation between the two. The system then allows the user to highlight parts that are relevant for him/her and suggest new users to be added to the conversation. The suggestion appears at the time of copying individuals who need to be alerted about a certain paragraph or as an automatic suggestion.

The systems and methods offer several advantages by augmenting existing products and building a stronger user experience than what currently exists. As described above, the method aims to mimic non-virtual conversations, i.e., being introduced to a group, being introduced into a conversation, and into virtual conversations. The use of the systems and methods may result in conversations in the virtual world becoming more like real world conversations and lowering the entry barrier for a new user to a pre-existing conversation. This will lead to a better user experience, overall.

The method additionally includes protecting the privacy of a user and detecting the tone about which that third person is being spoken about. In one example, the model does not suggest adding the external user if the topic of conversation is gossip. Further, in situations in which the
systems and methods discussed herein may collect location information about users, or may make use of personal information (e.g., exact location, device data, opinions, network data), users are provided with one or more opportunities to control how information is collected about the user and used in one or more described features. Each user for which personal information is to be collected is presented with one or more options to allow control over the information collection relevant to that user, to provide permission or authorization as to whether the information is collected and as to which portions of the information are to be collected. For example, users can be provided with one or more control options over a communication network. 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.