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Answering user queries based on aggregate information

ABSTRACT

People often consult others in their neighborhood for recommendations regarding specific household needs, such as appliances, furniture, kitchenware, etc. Many common household objects have the capability to connect to the Internet. However, there are no current mechanisms to obtain and present aggregate information about these items, e.g., for geographic neighborhoods. This disclosure describes techniques that use permitted information gathered from smart objects in households in a neighborhood to provide appropriate answers to user queries. The information is obtained with permission of the respective users that own the smart objects and can be incorporated within rule-based and/or machine learning based techniques to generate answers.

KEYWORDS

- Smart home
- Internet of Things (IoT)
- Smart appliance
- Virtual assistant
- Smart speaker

BACKGROUND

People often consult others in their neighborhood for recommendations regarding specific household needs, such as appliances, furniture, kitchenware, etc. These inquiries can take place in person or via online mechanisms, such as social media, messaging apps, etc. In the latter case, there may be cases when no one answers the question, or an answer is not received sufficiently quickly. For queries that do generate answers, only a subset of the entire group responds, thus

creating a potential for biases and inaccuracies. Moreover, it is likely that the number and quality of responses is significantly lower for queries reflecting highly specific needs, such as "Which air-conditioner is suitable for cooling to 16-18 degrees Celsius even when outside temperature exceeds 40 degrees Celsius?" or "Which washing machine is suitable for the amount of use expected by a large family that washes 2-3 loads per day?"

Such information obtained from neighbors can help for shopping-related queries. For instance, a person shopping for air conditioners may find it useful to know the brands of air conditioners that are most popular in the community, and a person who wishes to buy a washing machine may benefit from knowing the percentages of top-loading and front-loading washers in the neighborhood. Using similarity among households can further increase the benefit of the information. For example, a family shopping for a washing machine can benefit from aggregated information on washing machines owned by households in the neighborhoods that have similar family sizes and compositions. Many common household objects have the capability to connect to the Internet. However, there are no current mechanisms to obtain and present aggregate information about these items, e.g., for geographic neighborhoods.

DESCRIPTION

This disclosure describes techniques that use permitted information gathered from smart objects in households in a neighborhood to provide appropriate answers to user queries. The information is obtained with permission of the respective users that own the smart objects and can be incorporated within rule-based and/or machine learning based techniques to generate answers.

The techniques leverage the presence of common household objects and appliances, such as TVs, refrigerators, washing machines, coffee makers, utensils, pieces of furniture, etc. that are

augmented with smart capabilities along with the ability to connect to the Internet. Many of these objects are classified under the Internet of Things (IoT). Many such objects also provide mechanisms that allow them to be accessed and operated by a virtual assistant.

Object owners, e.g., members of a household, are provided with options to share data regarding objects/ appliances in their household for the purposes of helping the neighborhood community. The users can choose to deny data sharing, restrict it to specific objects, and to specific types of data. If the parties in a household permit, relevant data, e.g., make and model of an appliance, operational characteristics, etc. can be obtained from household objects. For example, the attributes of an object can be obtained from the manufacturer and/or appropriate indexed databases that contain such information. For instance, the attributes recorded for a washing machine can be load type, capacity, dimensions, energy consumption, etc. The information obtained from a large number of households can be aggregated, e.g., at a neighborhood level.

A trained supervised machine learning algorithm can then be applied to process the neighborhood-level data. The output of the model can be used to respond to user queries, if relevant. For instance, answers can be provided to questions such as “What is the most efficient washing machine for large families?” In addition, rule-based techniques can be used to answer queries, e.g., “Are front-loading washers popular in my neighborhood?”

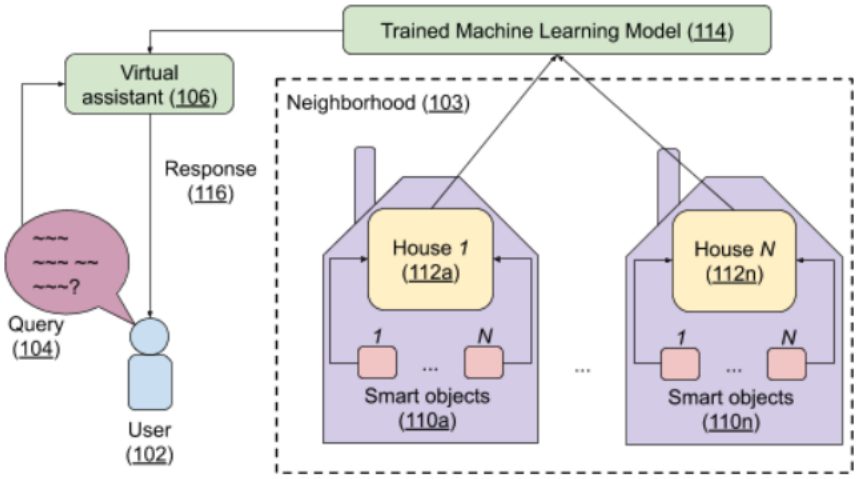

Fig. 1: Answering queries based aggregate information from household objects

Fig. 1 shows an example of use of the described techniques. A user (102) living in a neighborhood (103) issues a household-related query (104), e.g., to a virtual assistant (106) or other query-answering system. Aggregated information from the neighborhood (houses 112a-112n) is obtained, with permission, and is provided to a trained machine learning model (114). For example, such information can be obtained from smart household objects (110a-110n), e.g., via a respective virtual assistant application for each household, with corresponding permissions. Aggregation is performed such that no individual household-specific information is provided to the model or revealed in answers generated by the model. The output of the machine learning model and/or a rule-based system are used to formulate a response (116) to the user's query. Certain queries, e.g., for which not enough aggregated data is available, are not responded to, or an enlarged neighborhood sufficient to obtain aggregated data, is used to determine the answer. Aggregation is performed such that data from at least a threshold number of households is aggregated for use in responding to queries.

Use of the disclosed techniques provides a convenient and efficient way to obtain relevant information about one's community, such as the brands of appliances that are popular in

the neighborhood. The techniques described in this disclosure provide an effective and convenient user experience to obtain data-driven answers regarding household needs. As such, the techniques can augment or replace informal, inefficient, and imprecise current mechanisms, such as asking neighbors in person and/or online. The techniques can be integrated within any software and/or hardware system, e.g., virtual assistant applications, smart speakers, home device hubs, 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 social network, social actions or activities, profession, a user's preferences, or a user's current location), 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, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. 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

This disclosure describes techniques that use permitted information gathered from smart objects in households in a neighborhood to provide appropriate answers to user queries. The information is obtained with permission of the respective users that own the smart objects and can be incorporated within rule-based and/or machine learning based techniques to generate answers. The answers provided are based on aggregated data.