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Endlessly Browsable Topic Recommendations

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ABSTRACT

Some users of search engines may not want to (or may be unable to) type in or speak out a search query. As another example, users may have limited or no knowledge of popular search platforms or engines. There is currently no mechanism for a search engine to recommend related topics to a user to enable a semi-autonomous browsing experience that can be endless. This disclosure describes techniques that utilize a topic graph to enable users to browse topics or explore interesting and contextual information without requiring the entry of a search query.

KEYWORDS

- Suggestion engine
- Collaborative filtering
- Recommender system
- Recommendation engine
- Knowledge graph
- Hierarchical knowledge graph
- Entity graph
- Topic graph
- Concept graph
- Endless browsing
- Image search
- Video search
- Information discovery
- Information exploration
- Entity hierarchies

BACKGROUND

Some users of search engines may not want to (or may be unable to) type in or speak out a search query. For example, they may not have a specific search intent; rather, they may want to browse for interesting web content or want to explore topics that are related to their topics of interest. As another example, users may have limited or no knowledge of popular search platforms or engines. There is currently no mechanism for a search engine to recommend related

topics to a user to enable a semi-autonomous browsing experience that can be endless and that does not rely on a user-specified search query.

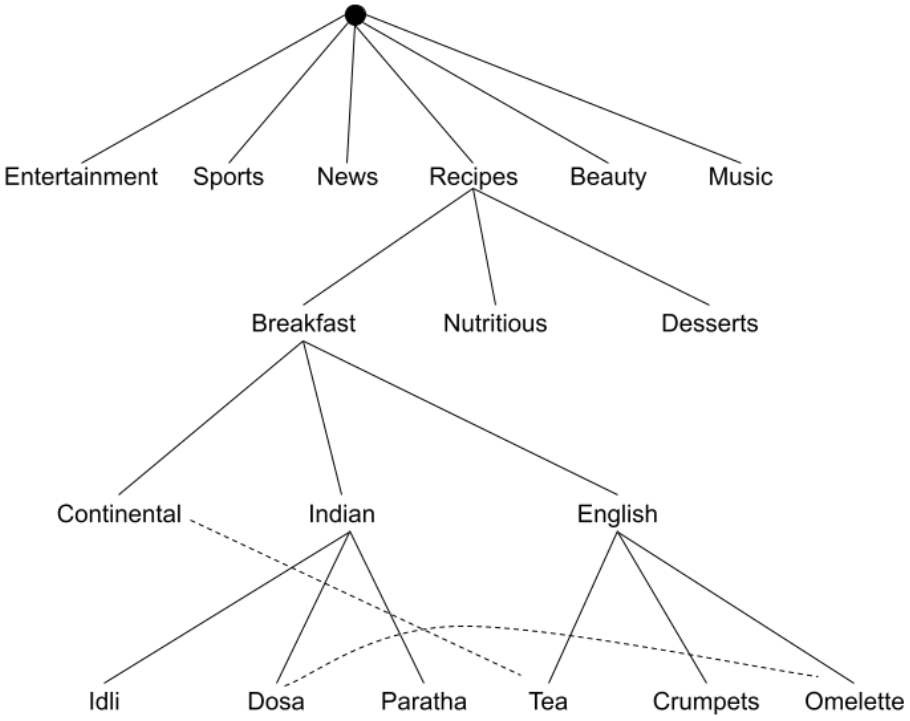

Fig. 1: A topic graph

A topic graph represents a network of real-world entities, e.g., objects, events, situations, or concepts. It stores the relationship between them in the form of a graph. Fig. 1 illustrates an example of a topic graph. As illustrated, a topic graph can be very deep and very broad, e.g., each topic having several related topics, each related topic having other related topics, and so on. A topic graph need not have exclusively tree-like (top-down) connections between its nodes. Nodes can also be connected across siblings or generations. In the example of Fig. 1, the entity ‘dosa’ is associated with ‘omelette’ to indicate that the two go with each other, or ‘tea’ is linked to ‘continental’ to indicate that tea can be part of a Continental breakfast as well as English breakfast.

DESCRIPTION

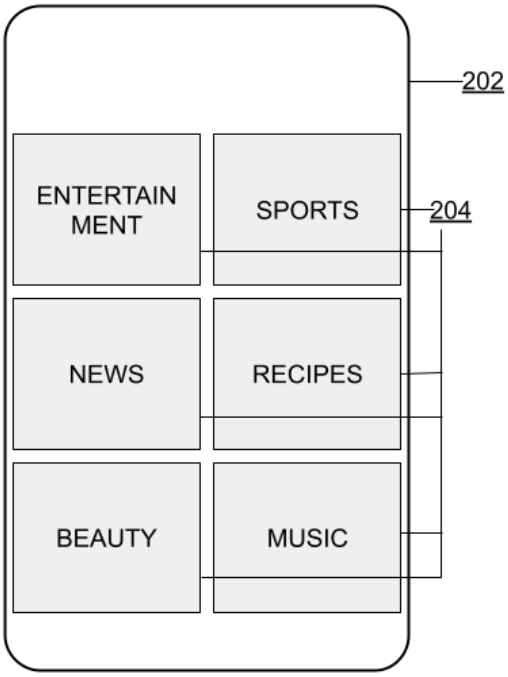

Fig. 2: A tiled representation of the top level of a topic graph

This disclosure describes techniques that enable users to browse topics in an endless manner without requiring the entry of a search query via text or voice. As illustrated in Fig. 2, the user initiates browsing entities or topics from a user interface (202) that lists very broad topics (204). With user permission, the broad topics in the user interface can be selected based on the user's preferences.

The broad topics can be arranged in the form of tiles, as illustrated in Fig. 2, or in other suitable user interface design. As the user clicks, taps, or scrolls on a tile corresponding to a topic, related topics are surfaced. The user journey containing subsequent selections (e.g., via taps) of topics can be based on an underlying topic graph or recommendation engine.

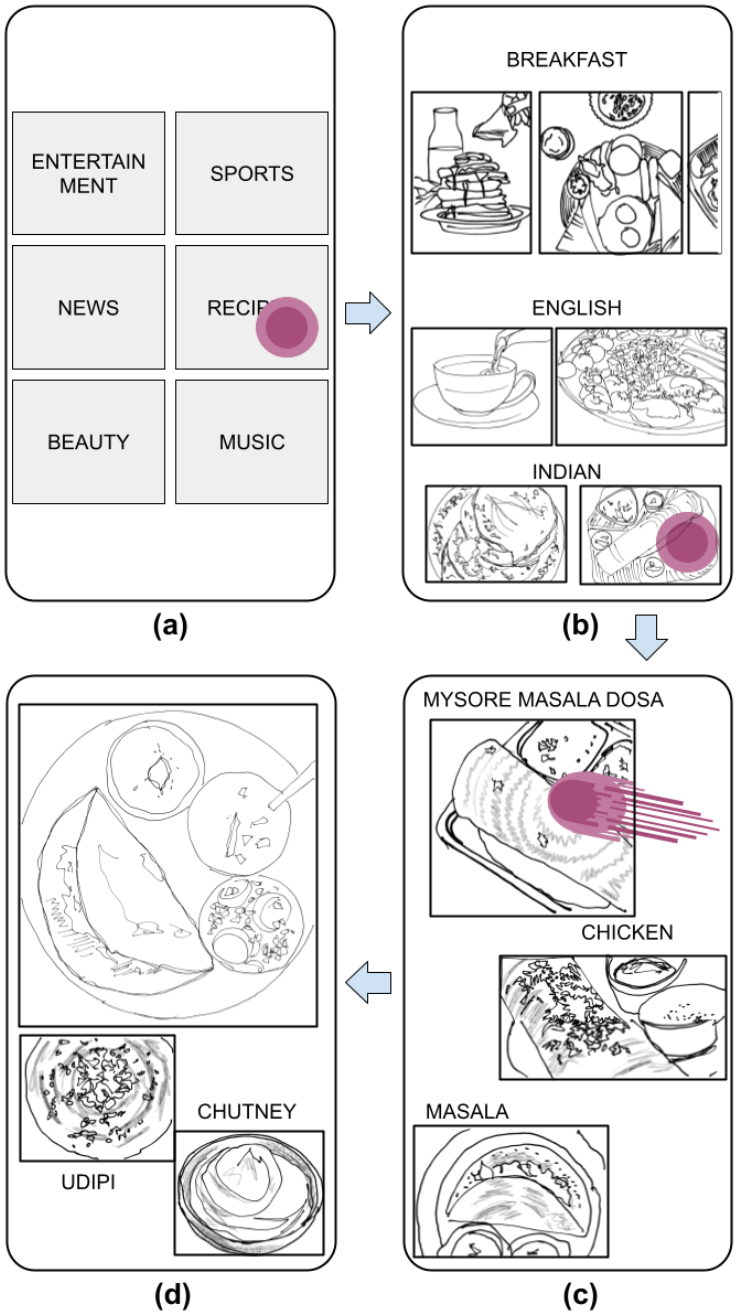

Fig. 3: Iterative surfacing of related topics

Fig. 3 illustrates an example user journey through various topics as the user taps on them. In Fig. 3(a), of several top-level topics (‘entertainment,’ ‘sports,’ ‘recipes,’ etc.), the user taps on ‘recipes,’ the tapping action indicated by the purple concentric circles. Upon tapping, the user is led to related topics (Fig. 3(b)) represented visually (images or video). These topics are

selectable (e.g., via tap, click, scrolling, etc.) and upon selection, are replaced by other related topics (Fig. 3(c)). The user can also scroll (sideways, in this example, but in any direction), rather than tap, on a particular topic (Fig. 3(c)) to reveal further related topics (Fig. 3(d)). Content such as images, videos, short videos, stories, Q&A, etc., related to the topic is also available for the user to scroll or browse through. The user can select any topic to view the associated content. Tapping and scrolling are both endless, e.g., fresh topics are selected from the topic graph and served to the user via the user interface no matter how many times the user interacted with the user interface via tapping, scrolling, or other action.

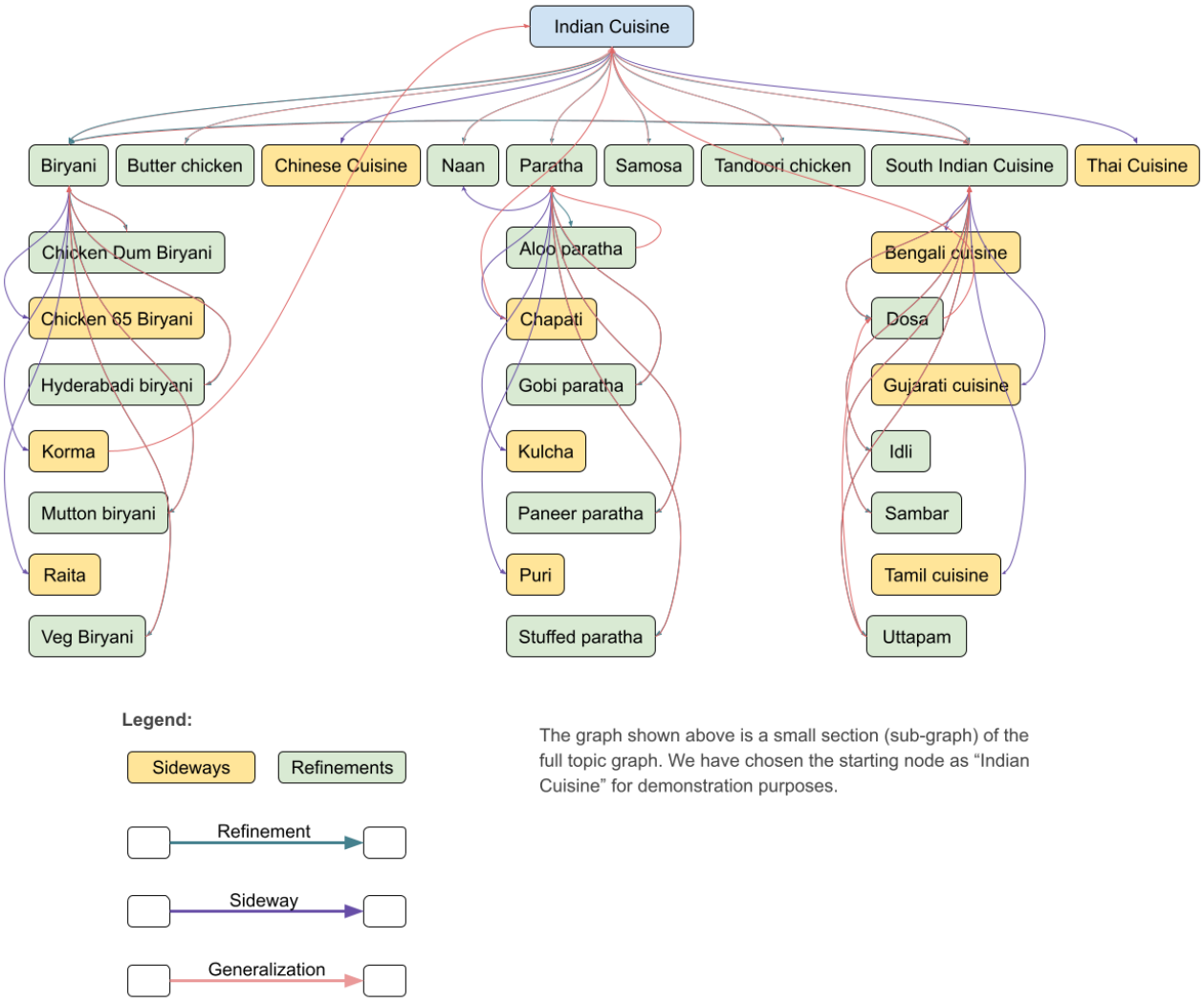

Fig. 4: A topic graph showing different types of pairwise relationships between entities

Fig. 4 illustrates an entity (or topic) graph with different types of pairwise relationships, refinements, generalizations, sideways relationships, etc. The topic graph can be constructed using various techniques such as collaborative filtering, entity trend analysis, mining structured data on the web, entity co-occurrence signals, etc. The graph can be implicitly represented by a machine learning (ML) model where the relationships are obtained by performing inference in the model with a topic of interest and the relationship-type as input. When a user taps on a topic, which maps to a node on the graph, they are led to a nearby node in the graph. The nearby node is probabilistically selected, such that the next node can be a child (e.g., a refinement), a parent (e.g., a generalization), a sibling (e.g., an associate or a sideways relationship), etc., with varying probabilities. With user permission, the probabilities can be set based on user preferences and/or the user's browsing history. The probabilities can be selected to provide a higher likelihood of choosing refinements or sideways relationships and can be updated based on user interaction. If a leaf node is reached, e.g., no further refinements are possible, then the user is either led upward through the topic graph, e.g., through a generalization or the user can choose one of the sideways topics (if present) to continue their journey.

Content such as images, videos, short videos, stories, Q&A, etc. corresponding to a topic in the topic graph is retrieved from appropriate search backends. Thus, at each step of the user journey, the user can either tap on a topic or simply consume content directly related to the topic. In this manner, a user can browse the topic graph endlessly, thereby performing a walk on the underlying graph, to view interesting and related topics as well as content associated with them. The user interface, powered by the topic graph, enables the user to continuously and visually explore related concepts. In the graph of Fig. 4, an example walk or journey for a user can be

‘healthy breakfast’ → ‘south Indian breakfast’ → ‘idli’ → ‘poha’ → ‘sambar’ → ‘vegetarian dishes’ …

Traversal through the topic graph occurs without requiring the user to enter or specify (verbally or otherwise) search queries, or being able to read a language supported by the search engine. While the tiled user interface of Figs. 2-3 shows words, icons/images that map to the categories can be used to enable the user to browse without being able to read the language. Since a node in the traversal is relatively close to the immediate previous node, results are contextual to the user’s current interests. An escape feature enables the user to quickly get out of the present topic, which may be a node deep in the topic graph and return to the top-level screen.

In this manner, the techniques of this disclosure provide a browsing experience to users that do not possess adequate reading or typing skills in popular search engines. In case of typing, the user may know how to type but may be unwilling to do so, e.g., because typing can be slow when using standard mobile and desktop non-English keyboards, as compared with typing the same query transliterated in English using an English keyboard. Also, for voice input, only a handful of languages are well covered by state-of-the-art speech-to-text technology. Certain language speakers may face difficulty in performing the search query by using voice input alone.

With permission from the user, results served from the topic graph may be based on user preferences and/or browsing history. In the absence of such permission, personalization is not performed. Without personalization, users can still enjoy high quality results served from the topic graph.

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 the collection of user information (e.g., information about a user’s browsing history, 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 enable users to browse topics or explore interesting and contextual (based on a current topic) content in an endless manner without requiring the entry of a search query by typing or voice inputs.