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Ranking trip search results based on user travel history

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ABSTRACT

Online services for searching and booking trips or vacations rank results based on user specified search terms. These services do not make use of the travel history of users. Techniques described score the uniqueness of a trip based on past user trip parameters, accessed upon specific user permission. Recommendations are effectively provided to users by ranking and displaying search results based on these uniqueness scores. Users can also select an option to display results similar to past trips. During a search, users can be prompted with hints comparing parameters of the trip being searched with parameters from past trips.

KEYWORDS

- Travel

- Trip planning

- Trip history

- vacation

- Trip recommendation

BACKGROUND

Users are interested in identifying vacation options for trips in unique locations or that provide unique experiences. The uniqueness of a place or experience is personal depending on the places visited and activities performed by users in the past. In some cases, users may seek options similar to past trips. Online trip research services typically rank the results based on terms searched by users. The services are not based on parameters from prior user trip or activity history.

DESCRIPTION

With user permission, the techniques described in this disclosure score the uniqueness or similarity of searched trips in comparison with past user trips. Trip results are ranked and displayed accordingly. For example, a user's trip history data is analyzed to rank future trips in terms of novelty, the extent to which the trip search results inversely overlap with previous user trips in terms of parameters such as trip location, activities, climate, cuisine, culture, etc.

The techniques alert users to specific similarities or differences compared to past trips through a convenient user-interface and enables users to make an informed selection of either novel or similar experiences. For example, while researching a vacation to Cuba, a user who previously visited Puerto Rico is provided a prompt through a user interface alerting the user that: "This trip is similar to your trip from 2 years ago to Puerto Rico but Cuba offers these new experiences compared to the Puerto Rico trip." Users can also vote up or vote down the presented experiences. Such user votes are used to tailor future scoring and ranking of results.

Parameters such as location, activities, climate, season, etc. are used to compare two trips using a machine learning prediction model. The model converts selected parameters into vectors and generates embeddings in a multi-dimensional space. In the multi-dimensional space, the vectors for trips with similar characteristics are close to each other and those for dissimilar trips are spaced apart. Similarity or dissimilarity between trips is measured using a score that corresponds to the distance between the respective trip vectors in the multidimensional space. Based on this distance, the results are ranked higher based on high level of similarity with the user's previous trips (if the user prefers the same type of trips). Alternatively, if the user prefers novel trips or has indicated no clear preference, results are ranked higher based on high level of

dissimilarity with the user's previous trips. The user can specify this preference explicitly via the user interface.

The signals input to the prediction model can include processed outputs of other models or neural networks. For example, pre-trained embeddings for trip description text (from recurrent neural networks), pretrained embeddings for trip reviews (e.g., from sentiment analysis neural networks), image signals (e.g., from convolutional neural networks), standard location signals (e.g., from GPS neural networks), and other signals can be used to further enhance predictions. These signals are used by a sequential neural network to compute the similarity metric for trips, e.g., using the straight-line distance between any two trip embeddings as the similarity score.

With user permission, resources (e.g., documents, photos and videos) corresponding to past trips along with information from public or private knowledge bases about specific trip destinations is also used to create embeddings for the model. Trip location and participant data, trip reviews and comments, articles, photos, videos, maps, reviews, etc. are example sources of data inputs for multi-dimensional embedding.

Prior knowledge about particular trip destinations, such as differences or similarities between two trips, and representative trips can be used to train the prediction model. Embedding distance between destinations that are similar, e.g., Fuerteventura and Tenerife, is small. Using data available for these trips, parameters can be embedded for the two trips in a high-dimensional space with distance between the embeddings calculated to be a low value. Embeddings for dissimilar trips, e.g., Florence and Mauritius, would have a large distance between them.

After training an initial model, user travel history (e.g., trips/vacations liked/disliked by users) can be used, with specific user permission for such use of user data, to train future

iterations of the prediction model. Moreover, use feedback on recommendations provided during research for a trip can be used to further tune the model, if permitted by users.
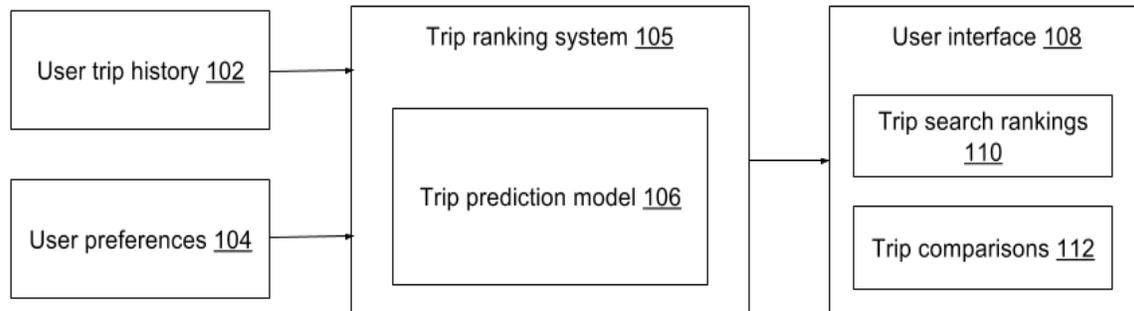
Fig. 1: Example user trip prediction model

When a user searches for trips, the trip prediction model (106) in Fig. 1 runs inference on trip search results and user trip history (102) to generate trip search rankings (110). User preferences (104) or criteria (e.g., similar or unique experiences) for ranking trip results can be provided through a user interface (108). The interface also provides trip comparisons (112) by highlighting similarities/differences. For example, when a user researches beaches in Cuba, the user interface may highlight that the beaches in Puerto Rico (that the user visited previously) are similar but emphasize that culture and cuisine in these locations is different. The interface also enables users to provide feedback by voting up/down on the trip recommendations or rankings. Techniques described here may be used by online travel and vacation portals, mobile applications, virtual assistant applications, 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

Techniques described employ a mechanism for scoring the uniqueness or similarity of a trip compared to user travel history and then rank trip results from the user search accordingly. A user interface may be provided to record user preferences as well as feedback vis-a-vis the recommendations. This user interface can also provide helpful hints during a trip research, for example, highlighting similarities and differences between different aspects of the trip under consideration and previous user trips, thereby enabling users to make informed decisions.