Location Based Ranking of Real World Locations

BACKGROUND

[0001] Many online computer systems offer listings of goods and services for sale, rent, and reservation (for simplicity, "booking" generally) that have or are associated with real world locations that have intangible value to the prospective consumer. For example, in a given city, certain neighborhoods, and even particular streets are more desirable than others. A consumer factors the location into their decision whether to book a listing. Existing online computer systems that provide bookings rank listings using location, for example, using a radial distance between a given listing and the designated center of a city, or a reference point, such as a tourist attraction, as one consideration in the ranking. While the exact ranking mechanism used by these systems varies, however, incorporating location based strictly on radial distance from fixed reference points into a ranking system carries with it the risk of over or underweighting the location of the booking relative to every other factor in the ranking.

[0002] Online accommodations and reservations systems provide a suitable example. Typically, the distance between a listing and a user's location is a factor in ranking listings, and these systems generally sort listing from closest to the user to furthest. For example, a user may decide that four miles for a restaurant reservation is a reasonable distance to travel, but fifty miles is unreasonable. However, if two listings are merely a mile apart, then distance becomes much less predictive of whether a prospective user will book one listing over another. As cities are often on the scale few miles, often mere distance is not a useful distinguishing factor in rankings of listings.

SUMMARY

[0003] An online booking system allows users to create listings of goods or services, search listings created by other users, and book listings of interest to them. The online booking system includes a search function that, responsive to a search query, ranks listings at least in part based on location relevance scores. The location relevance score of a listing is based on the listing's location, and a location specified in the search query. In various embodiments, the location relevance score includes at least one of a city relevance subscore, a neighborhood subscore, and a distance subscore. Generally, the city relevance subscore quantifies the probability that a searching user actually intended to search for listings in a city other than the city specified in a search query. Generally, the neighborhood relevance subscore quantifies the popularity of specific neighborhoods within a city to determine the

probability a searching user will book in a listing's neighborhood. Generally, the distance relevance subscore determines a distance between a listing's location and a location specified in a search query.

[0003A] According to a first aspect, there is provided a computer implemented method for providing listings available for booking to a user based on historical booking information associated with other users, the computer implemented method comprising: receiving a search query from a client device associated with a user, the search query including a query city; accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing cities, at least one of the listing cities being different from the query city; accessing a plurality of historical search queries including the query city and a plurality of historical bookings in the plurality of listing cities; determining, by a computer processor, a location relevance score for each of the listings based on a city relevance subscore, the city relevance subscore for a listing indicating a probability that the user will book the listing in the listing city given (i) the query city included in the search query and (ii) the historical bookings in the listing city; ranking the listings based at least in part on the city relevance subscore; responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

[0003B] According to a second aspect, there is provided a computer implemented method, for providing listings available for booking to a user based on historical booking information associated with other users, the computer implemented method comprising: receiving a search query from a client device associated with user, the search query including a query city; accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing neighborhoods in the query city; accessing a plurality of historical bookings in the query city; determining, by a computer processor, a location relevance score for each of the listings based on a neighborhood relevance subscore, the neighborhood relevance subscore indicating a probability that the user will book the listing in the listing neighborhood given (i) the query city included in the search query and (ii) historical bookings in the listing neighborhood in the query city; ranking the listings based at least in part on the neighborhood relevance subscore; responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

[0003C] According to a third aspect, there is provided a non-transitory computer readable medium storing instructions for providing listings available for booking to a user based on historical booking information associated with other users, the instructions, when executed by a processor, cause the processor to: receiving a search query from a client device associated with a user, the search query including a query city; accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing cities, at least one of the listing cities being different from the query city; accessing a plurality of historical search queries including the query city and a plurality of historical bookings in the plurality of listing cities; determining, by a computer processor, a location relevance score for each of the listings based on a city relevance subscore, the city relevance subscore for a listing indicating a probability that the user will book the listing in the listing city given (i) the query city included in the search query and (ii) the historical bookings in the listing city; ranking the listings based at least in part on the city relevance subscore; responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

[0003D] According to a fourth aspect, there is provided a non-transitory computer readable medium storing instructions for providing listings available for booking to a user based on historical booking information associated with other users, when executed by a processor, cause the processor to: receiving a search query from a client device associated with user, the search query including a query city; accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing neighborhoods in the query city; accessing a plurality of historical bookings in the query city; determining, by a computer processor, a location relevance score for each of the listings based on a neighborhood relevance subscore, the neighborhood relevance subscore indicating a probability that the user will book the listing in the listing neighborhood given (i) the query city included in the search query and (ii) historical bookings in the listing neighborhood in the query city; ranking the listings based at least in part on the neighborhood relevance subscore; responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The invention has other advantages and features which will be more readily apparent from the following detailed description of the invention and the appended claims, when taken in conjunction with the accompanying drawings, in which:

[0005] FIG. 1 is a block diagram of a computing environment for an online booking system that ranks listings of goods or services using a location relevance score, according to one embodiment.

[0006] FIG. 2 is a block diagram of an online booking system that ranks listings of goods or services using a location relevance score, according to one embodiment.

[0007] FIG. 3 is a flow chart for ranking listings of goods or services using a location relevance score, according to one embodiment.

DETAILED DESCRIPTION

System Overview

[0008] FIG. 1 is a block diagram of a computing environment for an online booking system that ranks listings of goods or services using a location relevance score, according to one embodiment. FIG. 1 and the other figures use like reference numerals to identify like elements. A letter after a reference numeral, such as "113A," indicates that the text refers specifically to the element having that particular reference numeral. A reference numeral in the text without a following letter, such as "113," refers to any or all of the elements in the figures bearing that reference numeral (e.g. "113" in the text refers to reference numerals "113A" and/or "113B" in the figures).

[0009] The network 105 represents the communication pathways between users 103 (e.g., consumers) and the online booking system 111. In one embodiment, the network is the Internet. The network can also utilize dedicated or private communication links (e.g. WAN, MAN, or LAN) that are not necessarily part of the Internet. The network uses standard communications technologies and/or protocols.

[0010] The client devices 101 are used by the users 103 for interacting with the online booking system 111. A client device 101 can be any device that is or incorporates a computer such as a personal computer (PC), a desktop computer, a laptop computer, a notebook, a

entertainment venues, resorts, etc. If the online booking system is a rideshare reservation system, then the listing module 203 provides a user interface for listing available rides.

[0017] The listing module 203 is configured to receive a listing from a user describing the good or service being offered, a time frame of its availability, a price, a location, and other relevant factors. For example, for an accommodation reservation system, a listing includes a type of accommodation (e.g. house, apartment, room, sleeping space, other), a representation of its size (e.g., square footage, or number of rooms), the dates that the good or service is available, and a rental rate (e.g., per night, week, month, etc.). The listing module 203 allows the user to include additional information about the good or service including photographs and other media.. The location information for a listing provides specific reference to a physical location or area in the real world, and may include a country, state, city, and neighborhood of the listing, geographical coordinates, mailing addresses, or other suitable location specifying information. The listing module 203 is also capable of converting one type of location information (e.g., mailing address) into another type of location information (e.g., country, state, city, and neighborhood) using externally available geographical map information. Listings created using the listing user interface are processed by the online booking system 111 and stored in the database 201.

[0018] In some online booking systems 111, some listings are temporary, are available for booking one time only, and/or are capable of being deleted by the listing user. The listing module 203 stores these historical, unavailable listings in database 201. The online booking system 111 uses these historical listings to analyze the behaviors of users in creating, searching, ranking, and booking listings. Historical listings may be encrypted or otherwise protected so that they are not available to anyone other than the operator of the listing system.

[0019] The booking module 207 provides a user interface and processing logic for users to view and book listings created by other users. The booking module 207 receives payment information from booking users, and securely transmits the payments to listing users. Any user information transmitted as part of the purchase process is encrypted for user privacy and protection. Upon completion of a booking, the booking is encrypted and stored as historical booking information in database 201.

[0020] The review module 209 provides a user interface and processing logic to receive reviews of the listings offered by other users, providing evaluations, feedback, and other commentary about a listing, and is one means for doing so. Completed reviews be included within and appear alongside listings, so that future users interested in booking the listing can evaluate the listing with the reviews in mind. Reviews are stored alongside their associated

determined for the user, or a user's geographic location may be generalized where location information is obtained (such as an address, city, or neighborhood), so that a particular location of a user cannot be determined. Thus, the user may have control over how information is collected about the user and used by the online booking system 111.

Location Relevance

[0027] The location relevance module 213 computes a location relevance score for each of a number of listings to be ranked by the ranking module 211. The location relevance score R_i for a given listing *i* is determined based on at least one of a city relevance subscore R_{Ci}, a neighborhood relevance subscore R_{Ni}, and a distance relevance subscore D_i. An example formula for the determination of the location relevance score R_i is described below the separate descriptions for the determination of the subscores and R_{Ci}, R_{Ni}, and D_i that may contribute to the location relevance score R_i.

[0028] To determine each of these subscores, the location relevance module 213 geocodes the location information from the search query. Geocoding is the process of identifying geographic coordinates associated with the location information. Geocoding generates a query country Q_{I*}, a query city Q_{C*}, and in some cases a query state Q_{S*}(or another regional equivalent) from the location information. Here, the asterisk * denotes a current search query for which the location relevance module 213 is currently determining the value of the location relevance score R_i. This distinguishes versus the query country Q_I, query state Q_S, and query city Q_C from historical search queries and bookings stored in database 201 that are used in determining the city R_{Ci} and neighborhood relevance subscores R_{Ni}.

City Relevance

[0029] The city relevance subscore R_{Ci} represents relevance of city C_i to a user who enters a search query including a query city Q_{C*}, query country Q_{I*}, and (in some cases) query state Q_{S*}. While it may seem obvious that if the user entered a query city Q_{C*}, they must be interested in that query city specifically, this is not necessarily the case. Often users are aware of the names of major cities only, and they are unaware of smaller cities located in proximity to larger cities. For example, if the query city Q_{C*} was "Santa Cruz," it is not necessarily a given that the user intended to look for listings in Santa Cruz only. For example, the user may only know of "Santa Cruz", and may be unaware of these other nearby cities, such as Aptos and Capitola, which are popular resort towns. This is a very common problem, as users typically know the names of major cities, such as Manhattan, Los Angeles, San Francisco, etc., but not the names of nearby towns and cities, but which users do in fact

increased frequency of listings and bookings for a given neighborhood relative to others is taken indicative of a higher degree of intangible value of that neighborhood to consumers.

Distance Relevance

[0049] Generally, the distance relevance subscore D_i quantifies the distance between the location of the search query and the location of a listing, such that listings that are ranked further away are ranked lower using a non-linear function of distance. The reason a non-linear function is used is because greater distances impose more than a simple linear increase in inconvenience or cost to users; in other words, being ten miles away from a desired location is more than simply twice as inconvenient than being five miles away. In one embodiment, this distance *d* is determined from a center of a query city or neighborhood, as determined by geographical extent or population density. In another embodiment, an external data source may provide the geographical location from which the distance *d* is determined. In another embodiment, the distance *d* is measured based on a distance between the listing *i* and a user's current location, for example as provided by the client device 101 (e.g., a smart phone).

[0050] The distance relevance subscore D_i may be a sigmoidal, exponential, stepped, piecewise linear, or any other type of function. In one embodiment, D_i is determined according to

$$D_i = \frac{a}{1 + e^{(d/b) - c}}$$

where *a* is the distance between the location specified in the query, and *b*, *c*, and *d* are configurable constants.

Location Relevance Example

[0051] In one embodiment, the location relevance module 213 determines the location relevance score R_i for a listing *i* is determined according to:

$$R_i = \begin{cases} R_{Ci} \cdot (1 + R_{Ni}) & \text{if } Q_{C*} = C_i \text{ city has neighborhoods} \\ R_{Ci} \cdot (1 + D_i) & \text{if } Q_{C*} = C_i \text{ no neighborhoods} \\ R_{Ci} & \text{if city data available} \\ D_i^2 & \text{if no city data available} \end{cases}$$

where the city relevance subscore R_{Ci}, the neighborhood relevance subscore R_{Ni}, and the distance relevance subscore D_i are determined as described above. In alternate embodiments, other types of data not mentioned here may be used to determine location relevance score R_i in addition to or in place of the subscores described here.

[0052] Determining the location relevance score R_i according to this function allows the location relevance score R_i to vary depending upon the search query and the data available to the online booking system 111. Depending upon the search query, historical listing, booking,

CLAIMS

1. A computer implemented method for providing listings available for booking to a user based on historical booking information associated with other users, the computer implemented method comprising:

receiving a search query from a client device associated with a user, the search query including a query city;

accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing cities, at least one of the listing cities being different from the query city;

accessing a plurality of historical search queries including the query city and a plurality of historical bookings in the plurality of listing cities;

determining, by a computer processor, a location relevance score for each of the listings based on a city relevance subscore, the city relevance subscore for a listing indicating a probability that the user will book the listing in the listing city given (i) the query city included in the search query and (ii) the historical bookings in the listing city;

ranking the listings based at least in part on the city relevance subscore;

responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

2. The computer implemented method of claim 1, wherein the historical bookings include at least one booking located in one of the listing cities that is different from the query city.

3. The computer implemented method of claim 1,

wherein the city relevance subscore for a listing is based on a first function if the query city is the same as the listing city, and

wherein the city relevance subscore is based on the first function and an additional weighting factor if the query city is different from the listing city.

4. The computer implemented method of claim 1, wherein the city relevance subscore for the listing is based on a number of historical bookings in the listing city that occurred during a same web browsing session as historical search queries including the query city.

5. The computer implemented method of claim 4, wherein the city relevance subscore for the listing is further based on a total number of historical bookings that occurred during a same web browsing session as historical search queries including the query city.

6. The computer implemented method of claim 1, wherein the city relevance subscore for the listing is further based on a total number of historical bookings in the listing city .

7. The computer implemented method of claim 1, wherein the city relevance subscore for the listing is based on a number of listings in the listing city.

8. The computer implemented method of claim 1, wherein the city relevance subscore for the listing is based on a number of listings in the listing city and a total number of listings in the plurality of listings.

9. A computer implemented method, for providing listings available for booking to a user based on historical booking information associated with other users, the computer implemented method comprising:

receiving a search query from a client device associated with user, the search query including a query city;

accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing neighborhoods in the query city;

accessing a plurality of historical bookings in the query city;

determining, by a computer processor, a location relevance score for each of the listings based on a neighborhood relevance subscore, the neighborhood relevance subscore indicating a probability that the user will book the listing in the listing neighborhood given (i) the query city included in the search query and (ii) historical bookings in the listing neighborhood in the query city;

ranking the listings based at least in part on the neighborhood relevance subscore;

responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

10. The computer implemented method of claim 9, wherein the historical bookings are for listings from a plurality of listing neighborhoods in the query city.

11. The computer implemented method of claim 9, wherein the neighborhood relevance subscore for the listing is based on a number of historical bookings in the listing neighborhood.

12. The computer implemented method of claim 11, wherein the neighborhood relevance subscore for the listing is further based on a total number of historical listings in a listing city of the listing neighborhood.

13. The computer implemented method of claim 9, wherein the neighborhood relevance subscore for a listing is based on a number of available listings in the listing neighborhood.

14. The computer implemented method of claim 13, wherein the neighborhood relevance subscore for a listing is further based on a total number of available listings in a listing city of the listing neighborhood.

15. The computer implemented method of claim 9, comprising:

accessing a plurality of historical listings that are no longer available for booking by users, each of the historical listings located in one of the listing neighborhoods in the query city; and

wherein the neighborhood relevance subscore for one of the listings is further based on the historical listings.

16. A non-transitory computer readable medium storing instructions for providing listings available for booking to a user based on historical booking information associated with other users, the instructions, when executed by a processor, cause the processor to:

receiving a search query from a client device associated with a user, the search query including a query city;

accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing cities, at least one of the listing cities being different from the query city;

accessing a plurality of historical search queries including the query city and a plurality of historical bookings in the plurality of listing cities;

determining, by a computer processor, a location relevance score for each of the listings based on a city relevance subscore, the city relevance subscore for a listing indicating a probability that the user will book the listing in the listing city given (i) the query city included in the search query and (ii) the historical bookings in the listing city;

ranking the listings based at least in part on the city relevance subscore;

responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

17. The computer readable medium of claim 16, wherein the historical bookings include at least one booking located in one of the listing cities that is different from the query city.

18. The computer readable medium of claim 16,
wherein the city relevance subscore for a listing is based on a first function if the query city is the same as the listing city, and
wherein the city relevance subscore is based on the first function and an additional weighting factor if the query city is different from the listing city.

19. The computer readable medium of claim 16, wherein the city relevance subscore for the listing is based on a number of historical bookings in the listing city that occurred during a same web browsing session as historical search queries including the query city.

20. The computer readable medium of claim 19, wherein the city relevance subscore for the listing is further based on a total number of historical bookings that occurred during a same web browsing session as historical search queries including the query city.

21. The computer readable medium of claim 16, wherein the city relevance subscore for the listing is based on a number of historical bookings in the listing city that occurred during a same web browsing session as historical search queries including the query city.

22. The computer readable medium of claim 21, wherein the city relevance subscore for the listing is further based on a total number of historical bookings in the listing city.

23. The computer readable medium of claim 16, wherein the city relevance subscore for the listing is based on a number of listings in the listing city.

24. The computer readable medium of claim 16, wherein the city relevance subscore for the listing is based on a number of listings in the listing city and a total number of listings in the plurality of listings.

25. A non-transitory computer readable medium storing instructions for providing listings available for booking to a user based on historical booking information associated with other users, when executed by a processor, cause the processor to:

receiving a search query from a client device associated with user, the search query including a query city;

accessing a plurality of listings available for booking by users, each of the listings located in one of a plurality of listing neighborhoods in the query city;

accessing a plurality of historical bookings in the query city;

determining, by a computer processor, a location relevance score for each of the listings based on a neighborhood relevance subscore, the neighborhood relevance subscore indicating a probability that the user will book the listing in the listing neighborhood given (i) the query city included in the search query and (ii) historical bookings in the listing neighborhood in the query city;

ranking the listings based at least in part on the neighborhood relevance subscore;

responsive to the search query, providing the listings in ranked order to the client device associated with the user, the listings provided in the ranked order without reference to the private user information associated with the plurality of historical bookings.

26. The computer readable medium of claim 25, wherein the historical bookings are for listings from a plurality of listing neighborhoods in the query city.

27. The computer readable medium of claim 25, wherein the neighborhood relevance subscore for the listing is based on a number of historical bookings in the listing neighborhood.

28. The computer readable medium of claim 27, wherein the neighborhood relevance subscore for the listing is further based on a total number of historical listings in the listing city of the listing neighborhood.

29. The computer readable medium of claim 25, wherein the neighborhood relevance subscore for a listing is based on a number of available listings in the listing neighborhood.

30. The computer readable medium of claim 29, wherein the neighborhood relevance subscore for a listing is further based on a total number of available listings in the listing city of the listing neighborhood.

31. The computer readable medium of claim 25, comprising:

accessing a plurality of historical listings that are no longer available for booking by users, each of the historical listings located in one of the listing neighborhoods in the query city; and wherein the neighborhood relevance subscore for one of the listings is further based on the historical listings.

ABSTRACT

An online booking system allows users to create, search, and book listings of goods or services. When a user searches for listings, the listings are ranked at least in part based on a location relevance score including at least one of a city relevance subscore, a neighborhood subscore, and a distance subscore. Generally, the city relevance subscore quantifies the probability that a searching user may have actually intended to look for listings in a city other than the city specified in a search query. Generally, the neighborhood relevance subscore quantifies the popularity of specific neighborhoods within a city as a replacement or addition to the distance subscore that determines a real world distance between a listing's real world location and a location specified in a search query.

(Figure 3)