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(54) Title: A SYSTEM AND METHOD FOR RANKING RECOMMENDATIONS

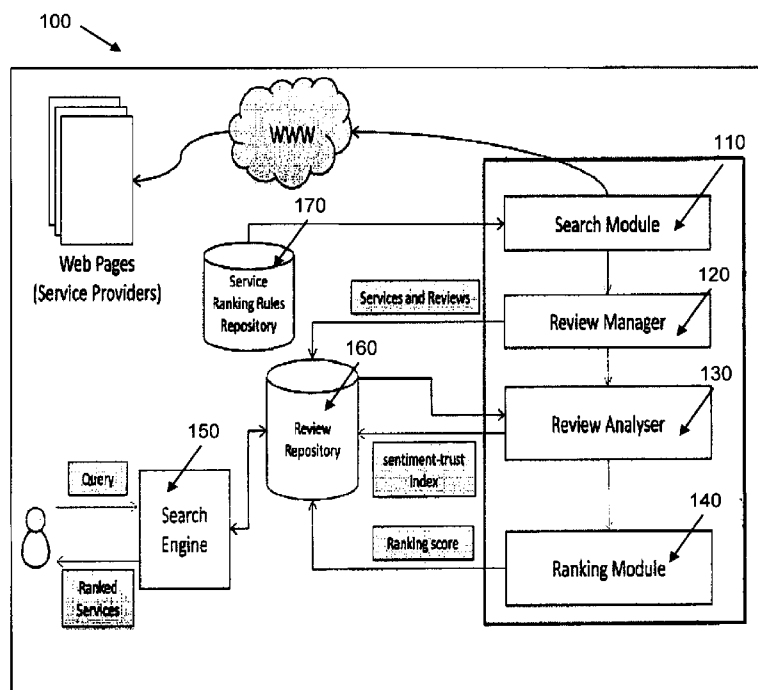


FIG. 1

[Continued on next page]



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

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a patent (Rule 4.17(ii))*

(57) Abstract: The present invention relates to a system and method for ranking recommendations. The system comprises of a search module (110), a review manager (120), a review analyser (130), a ranking module (140), a search engine (150), a review repository (160) and a service ranking rules repository (170). The system uses a set of rules to determine a sentiment-trust index value for ranking recommendations.

A SYSTEM AND METHOD FOR RANKING RECOMMENDATIONS

FIELD OF INVENTION

The present invention relates to a system and method for ranking
5 recommendations.

BACKGROUND OF THE INVENTION

A user can satisfy his or her information needs by entering a query into a
web search engine. However, the abundance of information available on the web
10 search engines is restricted if it is not classified or ranked in a way that is useful to
the user. Recently, many researches have conducted numerous studies in the
area of searching, including searching that comprises ranking. The ranking result
includes the analysis of user comments and user ratings.

15 An example of such method for ranking search queries is disclosed in
United States Patent Publication No. 2010/0262597 A1 which relates to
information search method and system aggressively using comments written by
users who have appreciated content. When a user enters a search query including
an emotional word, the emotional and non-emotional words are extracted. The
20 ranking result is adjusted according to 'checked' and 'unchecked' values of an
impression item which matches the emotional word of the found content.

In another example, United States Patent Publication No. 2006/0282336 A1
discloses an internet search engine and associated website which provides users
25 with ranked website search results, whereby the search engine and associated
website provide a critical rating function. The critics provide a rating and comments
in relation to a site, or to other online content. Ratings and comments are also
available to users.

30 However, the existing method of search ranking is only based on user
recommendation scores. Therefore, there is a need to provide a system method
that is capable to provide a relevant and accurate ranking result based on
sentiment analysis.

SUMMARY OF INVENTION

The present invention relates to a system and method for ranking recommendations. The system (100) for ranking recommendations comprising of a
5 search module (110) for retrieving information related to recommendation queries from world wide web; a search engine (150) for performing a search on the recommendations; and a review repository (160) for storing a collection of reviews on the recommendations retrieved, wherein the system (100) is characterised in that further comprising of a review manager (120) for extracting review comments about
10 the recommendations and ranking the sources of the reviews; a review analyser (130) for analysing the reviews; a ranking module (140) for ranking the recommendations; and a service ranking rules repository (170) for determining a trust value of the source of the reviews retrieved.

15 Preferably, the review repository (160) stores a collection of reviews retrieved along with trust values for the sources of the reviews on the recommendations and their categories on the type of recommendations.

Preferably, the service ranking rules repository (170) stores a set of rules to
20 determine a trust value for the sources of the reviews on the recommendations retrieved.

The method for ranking recommendations is characterised by the steps of retrieving information related to recommendation queries from the world wide web by
25 a search module (110); extracting user reviews on the recommendations from multiple sources by a review manager (120); ranking the sources by the review manager (120); determining a sentiment-trust index value of the recommendations by a review analyser (130); and ranking the recommendations by a ranking module (140).

30 Preferably, the step of retrieving information related to recommendation queries from the world wide web by the search module (110) includes sending queries about any recommendation to the world wide web; and retrieving user reviews along with the categories and metadata about the recommendations.

35

Preferably, the step of extracting user reviews on the recommendations from multiple sources and ranking the sources by the review manager (120) includes extracting the user reviews retrieved from the search module (110); tagging the reviews with a trust value using the metadata and category information retrieved from the search module (110) to rank the sources, wherein the trust value determines the trust factor of the source of the reviews; pre-processing the reviews to produce clean text to be analysed by the review analyser (130); and storing the reviews along with the trust values and the category which the reviews belong to in the review repository (160).

Preferably, the step of determining a sentiment-trust index value of the recommendations by the review analyser (130) includes selecting a recommendation to be analysed; selecting a review to be analysed; performing sentiment analysis on the review text, wherein the review analyser (130) generates numerical scores for sentiments and the confidence scores of the analysis; constructing a sentiment-trust index value using the results of the sentiment analysis, wherein the sentiment scores and confidence scores are multiplied to create an index, and wherein the index is then multiplied to their respective trust values tagged by the review manager (120) to create the sentiment-trust index values; and storing the sentiment-trust index values in the review repository (160).

Preferably, the step of ranking the recommendations by a ranking module (140) includes calculating the average sentiment-trust index of the recommendations, wherein the sum of the sentiment-trust index values constructed by the review analyser (130) are divided by the number of reviews retrieved; determining the rank of the recommendations by normalizing the ranking scores to ensure comparability; and storing the rank of the recommendations in the review repository (160).

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. 1 illustrates a system (100) for ranking recommendations according to an embodiment of the present invention.

FIG. 2 illustrates a flow chart of a method for ranking recommendations according to an embodiment of the present invention.

5 **FIG. 3** illustrates a flow chart of substeps for retrieving information and extracting user comment and rank the sources.

FIG. 4 illustrates a flow chart of the substeps for determining sentiment-trust index of the recommendations.

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FIG. 5 illustrates a flow chart of the substeps for ranking the recommendations.

DESCRIPTION OF THE PREFERRED EMBODIMENT

15 A preferred embodiment of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well known functions or constructions are not described in detail since they would obscure the description with unnecessary detail.

20 **FIG. 1** shows a system (100) for ranking recommendations according to an embodiment of the present invention. The recommendations can be on companies, products, services etc. The system (100) comprises of a search module (110), a review manager (120), a review analyser (130), a ranking module (140), a search engine (150), a review repository (160) and a service ranking rules repository (170). The system (100) ranks the sources of the reviews on the recommendations by
25 giving a trust value to each source before it ranks the recommendations by doing a sentiment analysis on the reviews.

The function of the search module (110) is to retrieve information related to recommendation queries from the world wide web. It is connected to the world wide
30 web, the service ranking rules repository (170) and the review manager (120). The review manager (120) is used to extract the review comments from multiple sources such as database, search engines etc. It also ranks the sources and stores them in the review repository (160). The review manager (120) is connected to the search module (110), the review repository (160) and the review analyser (130). The function
35 of the review analyser (130) is to analyse the reviews related to each

recommendation. It is connected to the review manager (120), the review repository (160) and the ranking module (140).

5 The ranking module (140) ranks the recommendations based on sentiment analysis, wherein the sentiment analysis evaluates textual input and classifies the text into sentiment classes such as positive, negative, neutral etc. It is connected to the review analyser (130) and the review repository (160). The search engine (150) is used to perform search and it is connected to the review repository (160) which comprises of a collection of user reviews retrieved. The review repository (160)
10 stores the collection in a specific data structure, wherein the data structure is composed of the review, its trust value and the category of the reviews. Finally, the service ranking rules repository (170) which comprises of a set of rules, determines a trust value of the source of the reviews retrieved by the search module (110). It is connected to the search module (110).

15

Referring now to FIG. 2, it shows a method for ranking search results according to an embodiment of the present invention. Initially, the search module (110) retrieves information related to recommendation queries from the world wide web. The review manager (120) then extracts the user reviews on the
20 recommendations from multiple sources and ranks the sources as in step 300. After ranking the sources, the review analyser (130) determines the sentiment-trust index value of the recommendations as in step 400. Finally, the ranking module (140) ranks the recommendations as in step 500.

25

Step 300 is further described in FIG. 3 wherein initially, the search module (110) sends queries regarding some recommendations of services such as restaurants, hotels, products etc. to the world wide web as in step 301. For example, when a user wants to search for a restaurant in Malaysia, the user sends a query on the recommendation of restaurants in Malaysia using the search module (110).

30

The search module (110) then searches for reviews of the queried services from the world wide web and retrieves user reviews along with the categories and metadata of the queries as in step 302. This is done by calling the service providers via an Application Programming Interface (API).

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Once the reviews are retrieved, the review manager (120) extracts the user reviews and tags the reviews with a trust value which determines the trust factor of the source of the reviews using the metadata and category information retrieved from the search module (110) as in step 303. This is achieved by applying the rules from the service ranking rules repository (170), wherein the service ranking rules repository (170) stores a set of rules to determine the trust value of the source of the reviews retrieved. The service ranking rules repository (170) includes the source category such as food, clothing movies, fashion etc.; whitelist which is a list of known authenticated sources according to each source category having numeric weightage for each item; and the activity levels of each source from the whitelist. The source category and whitelist are manually created and are configurable, while the activity levels are determined as a result of a periodic monitoring of the activity for the sources in the whitelist. The rule in the service ranking rules repository (170) is such that, if the current review is an item from the whitelist and the corresponding activity level is high, the trust value is assigned based on the weightage scores for the whitelist item and the activity level. An example of the rule is that for a food review, a review from a food review magazine has a higher trust value than a review from a blog user's web site.

The reviews retrieved by the search module (110) are also pre-processed by the review manager (120) by removing the unwanted elements such as advertisements from the websites of the world wide web to produce clean text to be analysed and stored in the review repository (160) as in step 304. The clean text herein refers to the actual review text that is shown in the website of the world wide web, without the unwanted elements. The reviews are stored in the review repository (160) along with the trust value of the sources of the reviews and the category which the reviews belong to.

Referring now to FIG. 4, there is shown a flow chart of substeps for the step 400, wherein the review analyser (130) determines the sentiment-trust index value of the recommendations. Initially, the review analyser (130) selects a recommendation and a review to be analysed as in step 401 and step 402.

It performs sentiment analysis on the review text as in step 403, wherein the review analyser (130) generates numerical scores for sentiments and the confidence

scores of the analysis. The sentiment analysis is determined by using a Context based Sentiment Lexicon (CSL) approach. The CSL comprises of a collection of words or phrases (T), the corresponding sentiments (S), grammatical elements (G), strength of the sentiments (ST) and the context information (C) which is represented as (T | S | G | ST | C). (Excellent | Positive | adjective | strong | any) and (Blazing | Positive | adjective | weak | technology) are two examples of CSL. The text to be processed is analysed and matched with data from the CSL. The sentiment score is determined by using the positive or negative items, wherein the number of positive items is divided by the sum of the positive items and negative items. On the other hand, to determine the confidence value, the number of strong values is divided by the sum of the strong values and weak values. The sentiment score is a value between 0 and 1, wherein a value near 0 mostly indicates a negative review and wherein a value near 1 mostly indicates a positive review. Similarly, the confidence score is also a value between 0 and 1, wherein 0 indicates the least confidence of a sentiment, whereas 1 indicates the most confidence in a sentiment.

Next, the review analyser (130) constructs a sentiment-trust index value using the results of the sentiment analysis as in step 404 using the equation below,

$$(P_i * C_i) * W_i$$

wherein P_i is the sentiment score, C_i is the confidence score and W_i is the trust values. These sentiment-trust index values are stored in the review repository (160) as in step 405.

If there are more reviews to be analysed, the process is repeated from step 402, but if there are no more reviews to be analysed, the process proceeds to step 500 wherein the ranking module (140) ranks the recommendations as in decision 406.

Moving on to FIG. 5, it shows a flow chart of substeps for the step 500, wherein the ranking module (140) ranks the recommendations. The ranking module (140) initially calculates the average sentiment-trust index of the recommendations as in step 501 using the equation below,

$$RS = \sum_{i=1}^n (P_i * C_i * W_i) * n$$

wherein RS is the rank of recommendation, P_i is the sentiment score, C_i is the confidence score, W_i is the trust values and n is the number of reviews.

If there are more recommendations to be analysed, the process is repeated from step 401, but if there are no more recommendations to be analysed, the process continues to step 503, wherein the ranking module (140) normalizes the ranking scores to ensure comparability as in decision 502. The ranking module (140) determines the ranking of the recommendations by normalizing the average sentiment-trust index calculated in step 501 using the equation below,

$$\text{Rank} = \frac{RS}{\sum_i^n RSi}$$

wherein the values produced are between 0 and 1. Finally, after determining the rank, the ranking module (140) stores the final rank score in the review repository (160) as in step 504. The highest score is on top of the ranking list while the lowest score is at the bottom of the ranking list. An example for ranking a recommendation for restaurant service is shown in Table 1 – 3.

Table 1

Service Type	ID	Services	Review Count
Restaurant	S1	KFC	5
	S2	Kampachi Japanese Restauran	3
	S3	Chili's Grill & Bar	3
	S4	Daorae	4

Table 2

Service	Review	Sentiment Score [P]	Confidence Score [C]	Sentiment Trust Index
S1	R1	0.5	0.3	0.15
	R2	0.9	0.2	0.18
	R3	1	0.1	0.1
	R4	0.2	0.7	0.14
	R5	0.45	0	0

Table 3

Services	Review Count	Average Sentiment Trust Index	Normalized Rank
S2	12	12	0.377358491
S7	11	1.1	0.034591195
S3	3	2.4	0.075471698
S6	4	2.4	0.075471698
S1	5	2.85	0.089622642
S8	15	8.55	0.268867925
S5	7	2.1	0.066037736
S4	2	0.4	0.012578616
		31.8	1

5 While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specifications are words of description rather than limitation and various changes may be made without departing from the scope of the invention.

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CLAIMS

1. A system (100) for ranking recommendations comprising:
- a) a search module (110) for retrieving information related to recommendation queries from the world wide web;
 - 5 b) a search engine (150) for performing a search on the recommendations; and
 - c) a review repository (160) for storing a collection of reviews on the recommendations retrieved,
- wherein the system (100) is characterised in that it further comprising:
- 10 i. a review manager (120) for extracting review comments about the recommendations and ranking the sources of the reviews;
 - ii. a review analyser (130) for analysing the reviews;
 - iii. a ranking module (140) for ranking the recommendations; and
 - 15 iv. a service ranking rules repository (170) for determining a trust value of the source of the reviews retrieved.
2. The system (100) as claimed in claim 1, wherein the review repository (160) stores a collection of reviews retrieved along with trust values for the sources of the reviews on the recommendations and their categories on the type of recommendations.
- 20 3. The system (100) as claimed in claim 1, wherein the service ranking rules repository (170) stores a set of rules to determine a trust value for the sources of the reviews on the recommendations retrieved.
- 25 4. A method for ranking recommendations is characterised by the steps of:
- a) retrieving information related to recommendation queries from world wide web by a search module (110);
 - b) extracting user reviews on the recommendations from multiple sources by a review manager (120);
 - 30 c) ranking the sources by the review manager (120);
 - d) determining a sentiment-trust index value of the recommendations by a review analyser (130); and
 - e) ranking the recommendations by a ranking module (140).
- 35

5. The method as claimed in claim 4, wherein the step of retrieving information related to recommendation queries from the world wide web by the search module (110) includes:
- 5 a) sending queries about any recommendation to the world wide web; and
- b) retrieving user reviews along with the categories and metadata about the recommendations.
6. The method as claimed in claim 4, wherein the step of extracting user reviews on the recommendations from multiple sources and ranking the sources by the review manager (120) includes:
- 10 a) extracting the user reviews retrieved from the search module (110);
- b) tagging the reviews with a trust value using the metadata and category information retrieved from the search module (110) to rank
- 15 the sources, wherein the trust value determines the trust factor of the source of the reviews;
- c) pre-processing the reviews to produce clean text to be analysed by the review analyser (130); and
- d) storing the reviews along with the trust values and the category which
- 20 the reviews belong to in the review repository (160).
7. The method as claimed in claim 4, wherein the step of determining a sentiment-trust index value of the recommendations by the review analyser (130) includes:
- 25 a) selecting a recommendation to be analysed;
- b) selecting a review to be analysed;
- c) performing sentiment analysis on the review text, wherein the review analyser (130) generates numerical scores for sentiments and the confidence scores of the analysis;
- 30 d) constructing a sentiment-trust index value using the results of the sentiment analysis, wherein the sentiment scores and confidence scores are multiplied to create an index, and wherein the index is then multiplied to their respective trust values tagged by the review manager (120) to create the sentiment-trust index values; and
- 35 e) storing the sentiment-trust index values in the review repository (160).

8. The method as claimed in claim 4, wherein the step of ranking the recommendations by a ranking module (140) includes:
- a) calculating the average sentiment-trust index of the recommendations, wherein the sum of the sentiment-trust index values constructed by the review analyser (130) are divided by the number of reviews retrieved;
 - b) determining the rank of the recommendations by normalizing the ranking scores to ensure comparability; and
 - c) storing the rank of the recommendations in the review repository (160).

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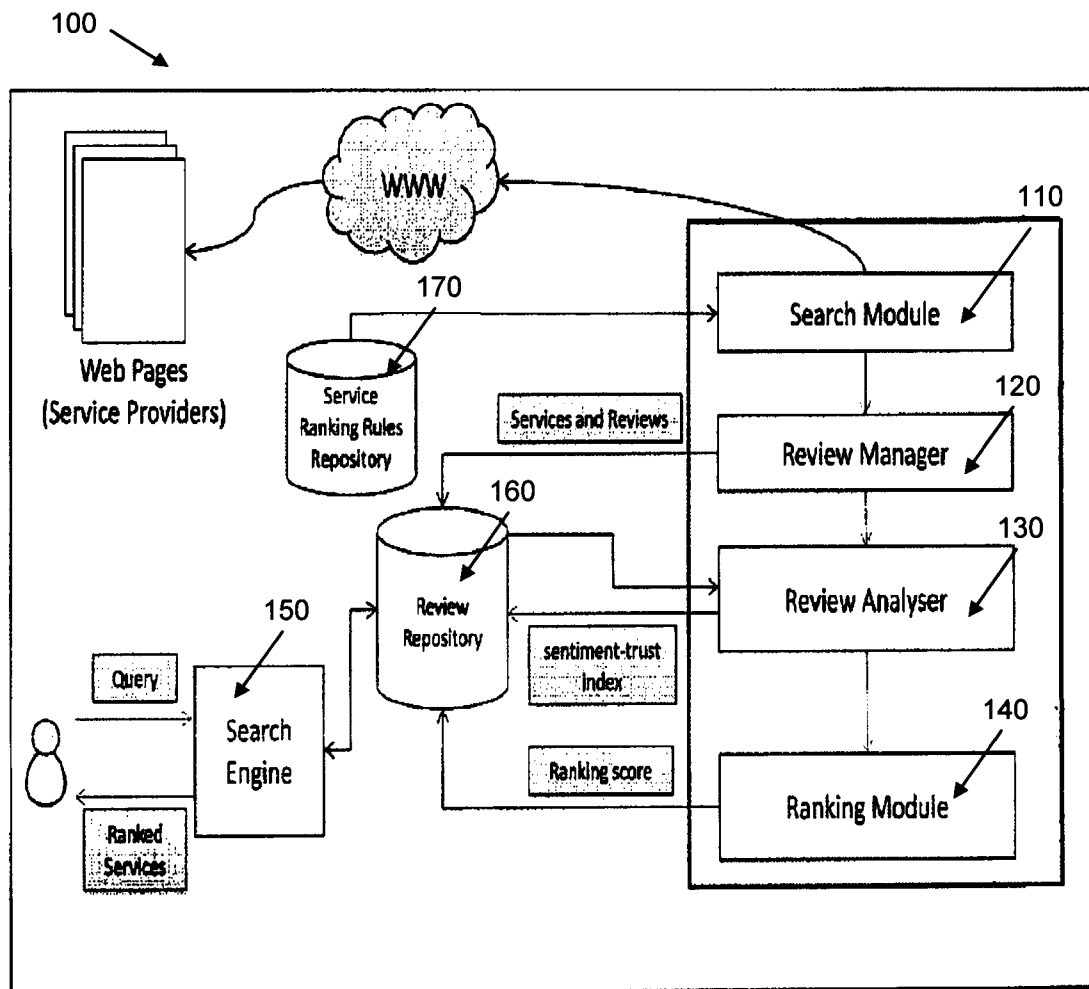


FIG. 1

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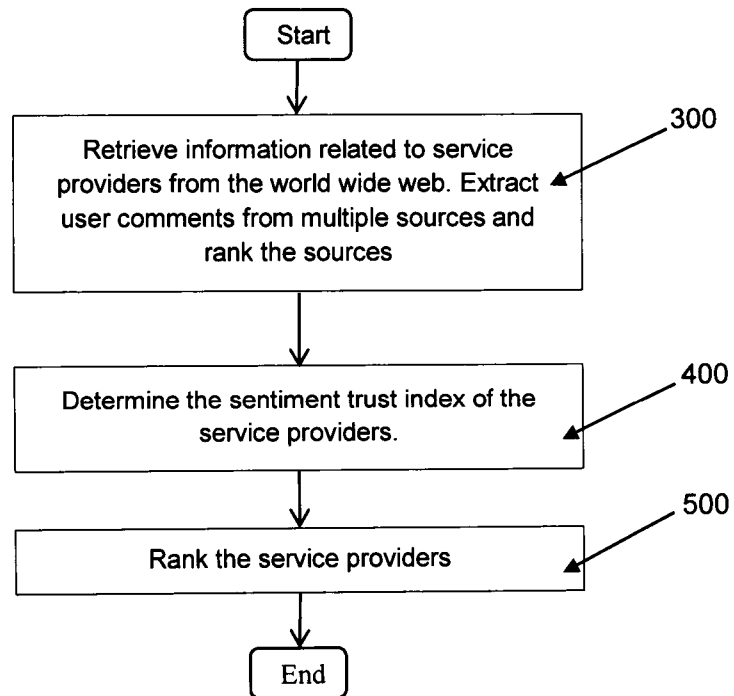


FIG. 2

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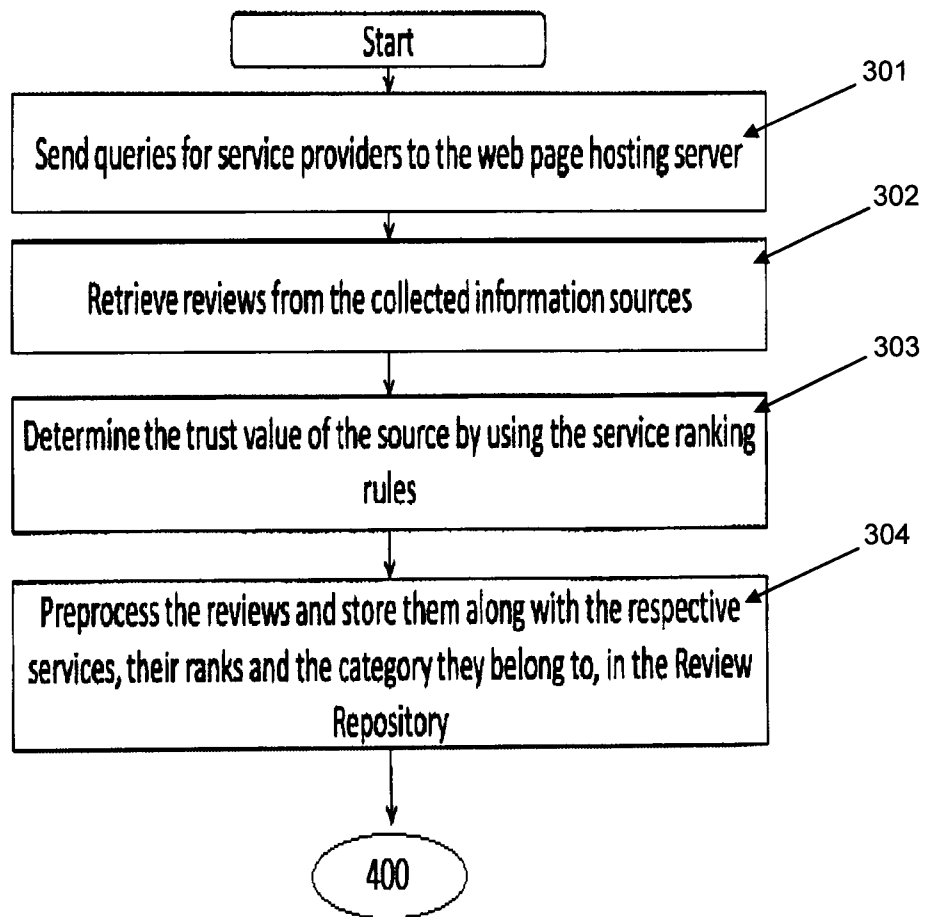


FIG. 3

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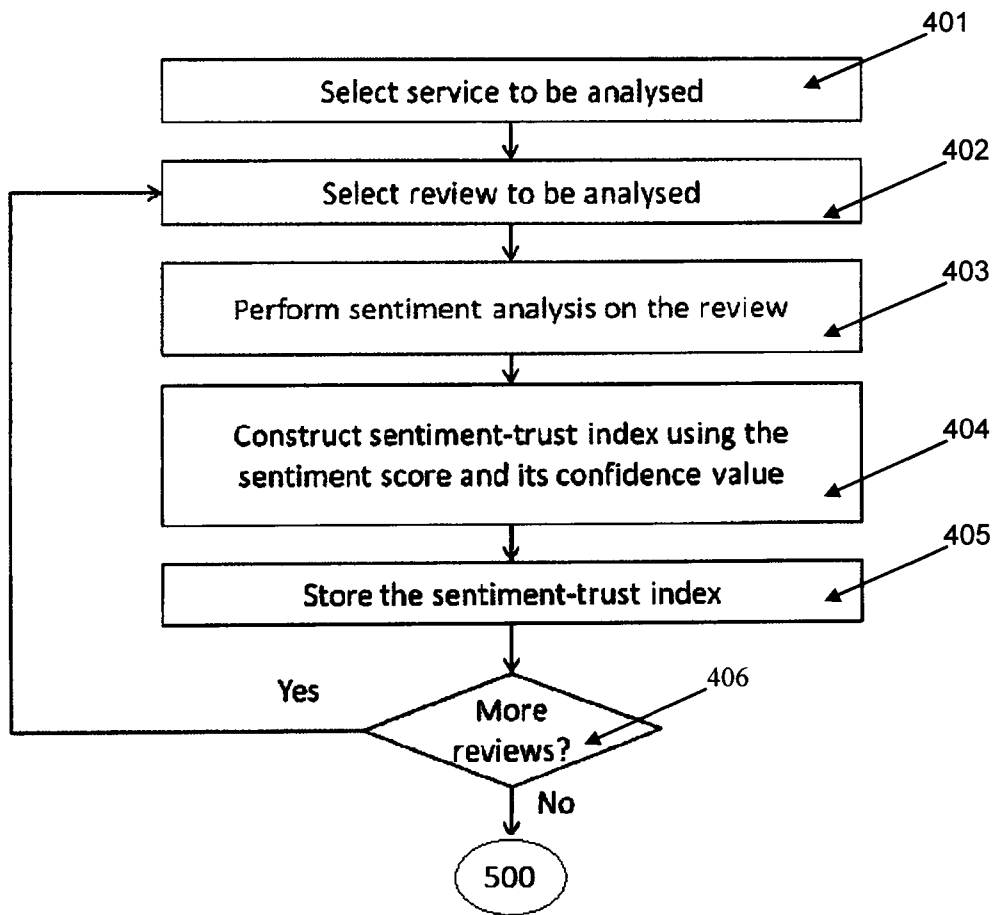


FIG. 4

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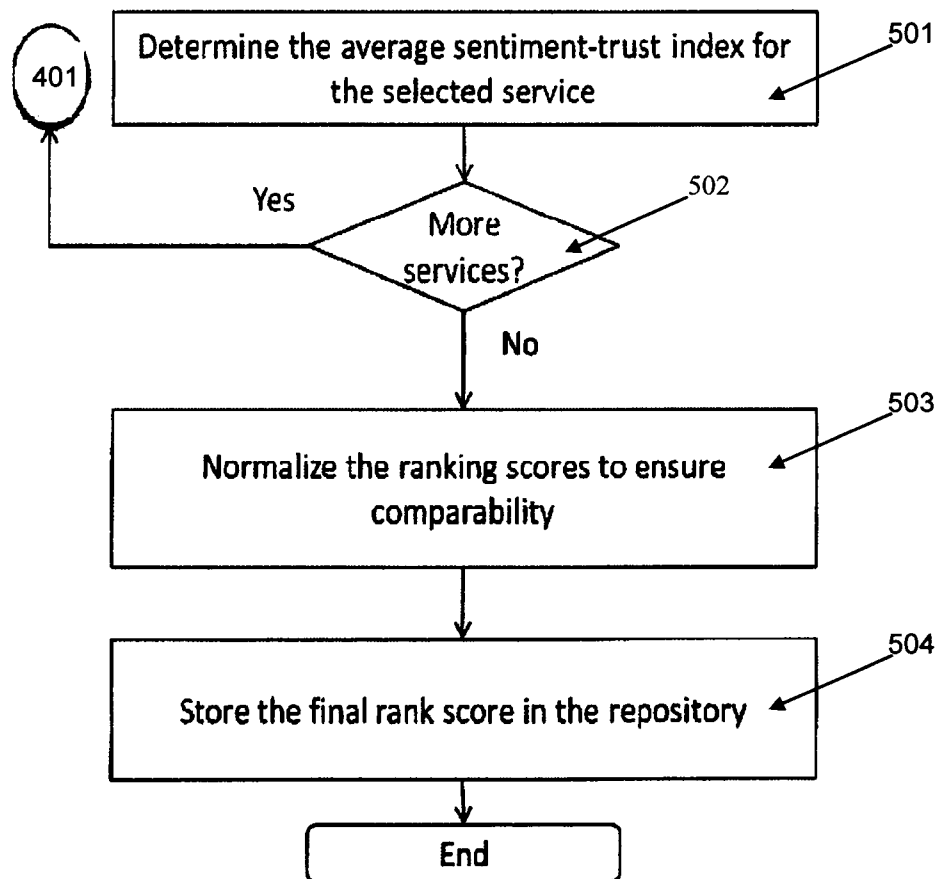


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No

PCT/MY2014/000127

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G06F17/30
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/005064 A1 (SARUKKAI RAMESH R [US]) 3 January 2008 (2008-01-03) abstract; figures 3,9A-9B paragraphs [0032], [0052] paragraph [0076] paragraphs [0120], [0170], [0240], [0244] -----	1-8
X	US 7 822 631 B1 (VANDER MEY CHRISTOPHER D [US] ET AL) 26 October 2010 (2010-10-26) abstract; figures 1,2 column 16, line 5 - line 42 -----	1,2,4,5
A		3,6-8



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

24 November 2014

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/MY2014/000127

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 2008005064	A1	03-01-2008	US 2008005064 A1		03-01-2008
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US 7822631	B1	26-10-2010	NONE		
