(54) Title: TEMPORAL UPDATES OF RELEVANCY RATING OF RETRIEVED INFORMATION IN AN INFORMATION SEARCH SYSTEM

(57) Abstract: The information retrieval system in accordance with the principles of the present invention assigns a relevance rating to each of the index entries without requiring an explicit input from the user. When the user selects and retrieves an informational item through a list of index entries presented as a result of a search, the relevance rating of the selected informational item is increased by a predetermined amount, and is further adjusted based on any actions the user takes subsequent to the initial selection. Ratings of the informational items in the database are determined from implicit suggestions from the usage of the retrieval system rather than from an explicit user input. In another aspect of the present invention, the ratings are allowed to decay over time to minimize the tendencies for historical usage biased rating, and to provide more temporally accurate ratings.
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TEMPORAL UPDATES OF RELEVANCY RATING OF RETRIEVED
INFORMATION IN AN INFORMATION SEARCH SYSTEM

Related Application
The present application is related to an application for US Letter patent, entitled “Implicit Rating of Retrieval Information in an Information Search System”, application No. 09/549,669, and filed on April 14, 2000. Additionally, the present application claims priority of U.S. patent application No. 09/549,566 filed on April 14, 2000.

Technical Field
The present invention generally relates to information search and retrieval systems. More particularly the present invention relates to implicitly establishing a relative ranking among information objects retrieved as a result of an information search in an information search and retrieval system.

Background Art
A database is useful only if a desired item can be efficiently found and retrieved therefrom. To locate and retrieve a desired information item in an information database, a search of the database, e.g., based on a keyword or a text string, may be required. The search typically involves finding entries matching the keyword (or string) in an index created from parsing the information items into searchable words and the location in which the word appears in the database. For example, the Internet, or the world wide web (WWW) may be considered as a very large database of information items, in the form of web pages, distributed over a very wide network. Currently available search engines, e.g., the YAHOO™, EXCITE™, and the like, maintain an index of the entire content of the WWW parsed into searchable words and corresponding locations, e.g., the Uniform Resource Locators (URL).

At the conclusion of a search, all matching entries are returned to the user who selects therefrom the one particularly desired information item. Often, however, as the size of a database becomes very large (e.g., the number of web pages in the WWW is currently in the hundreds of millions, and growing fast), a search may return more matching entries than a typical user can ever review in a reasonable time. Thus, even if the search was effective in finding every matching entry, a
user must still sift through an excessive number of returned entry to find the one desired information
item. This problem -- referred to as the “information overload” problem-- diminishes the usefulness
of the database.

Conventional search mechanisms, e.g., a web search engine, attempt to address the above
information overload problem by presenting the matching entries in a more useful form thereby making
it easier for the user to select therefrom. To this end, typically, each of the matching entries is ranked
in terms of its relevance or usefulness. The matching entries are sorted according to, and presented
to the user in the order of, the usefulness ranking. Thus, the user is first presented with information
items that are purported to be the most useful and relevant. Obviously, the usefulness of the above
relevancy rating would be largely dependent on how accurately the ratings can be made.

Conventional methods of relevancy rating rely on explicit feedback from users of the
information items, i.e., by requesting the user to explicitly answer at least one question regarding the
usefulness or the relevance of the retrieved information. For example, a user may be asked to answer
either “yes” or “no” to a question “Was the information helpful?”. Alternately, the user may be asked,
e.g., to choose from “very useful”, “somewhat useful”, “not useful”, and the like. Thus, the accuracy
of conventional relevancy ratings depends largely on the explicit inputs from the users of the information
items.

Unfortunately, in practice, only a small number (e.g., less than 10 percent) of users even bother
to respond to the rating requests, and conventional relevancy ratings are thus often not accurate
predictions of the usefulness or the relevance of an information item. Accordingly, in a conventional
informational database search, the order in which the retrieved information items are sorted and
presented to the user is often nonsensical, and still requires the user to sift through an excessive number
of items, and thus fails to effectively address the information overload problem.

Moreover, usefulness or relevance of an informational item may change over time as, for
example, the information contained within the item may become outdated. However, once a relatively
high relevancy rating is attributed to an informational item, the rated informational item may continue to
appear in the earlier portion of the search result presented to the user. That is, a conventional rating
method biases the database system to present retrieved information items in the order of a high overall
historical rating, but without regard to the datedness of informational items or temporal preference
Thus, what is needed is an efficient system for and method of rating the usefulness or the
relevance of a retrieved informational item without requiring an explicit user feedback.
What is also needed is an efficient system and method for determining a temporally accurate
usefulness or relevance rating of a retrieved informational item.

Summary of Invention

In accordance with the principles of the present invention, a method of, and an apparatus for,
temporally updating relevancy ratings of a plurality of informational items in a information retrieval
system comprises detecting an access of at least one of the plurality of informational items, the at least
one of the plurality of informational items having a most recently accessed time, the most recently
accessed time indicating time at which the at least one of the plurality of informational items was lastly
accessed, determining an elapsed time since the most recently accessed time, comparing the elapsed
time with a predetermined stale access time threshold value, and adjusting a relevancy rating of the at
least one of the plurality of informational items if the elapsed time exceeds the predetermined stale
access time threshold value.

In addition, in accordance with the principles of the present invention, a computer readable
storage medium having stored thereon a computer program for implementing a method of temporally
updating relevancy ratings of a plurality of informational items in a information retrieval system, the
computer program comprises a set of instructions for detecting an access of at least one of the plurality
of informational items, the at least one of the plurality of informational items having a most recently
accessed time, the most recently accessed time indicating time at which the at least one of the plurality
of informational items was lastly accessed, determining an elapsed time since the most recently accessed
time, comparing the elapsed time with a predetermined stale access time threshold value, and adjusting
a relevancy rating of the at least one of the plurality of informational items if the elapsed time exceeds
the predetermined stale access time threshold value.
Description of Drawings

Features and advantages of the present invention will become apparent to those skilled in the art from the following description with reference to the drawings, in which:

FIG. 1 is an exemplary block diagram of the information retrieval system in accordance with the principles of the present invention;

FIG. 2 is an exemplary table showing the relevant portions of the index shown in Fig. 1;

FIG. 3A shows an exemplary embodiment of the user interface search screen in accordance with the principles of the present invention.

FIG. 3B shows an exemplary embodiment of the user interface search result screen in accordance with the principles of the present invention.

FIG. 4 is a flow diagram showing an exemplary embodiment of the relevance rating method in accordance with the principles of the present invention; and

FIG. 5 is a flow diagram showing an exemplary embodiment of the temporally accurate relevance rating method in accordance with the principles of the present invention.

Detailed Description of Preferred Embodiments

For simplicity and illustrative purposes, the principles of the present invention are described by referring mainly to an exemplar embodiment, particularly, with references to the Internet and the world wide web (WWW) as the exemplary databases of informational items. However, one of ordinary skill in the art would readily recognize that the same principles are equally applicable to, and can be implemented in, other informational database, and that any such variation would be within such modifications that do not depart from the true spirit and scope of the present invention.

In accordance with the principles of the present invention, an information retrieval system allows a user to search a database of informational items for a desired informational item, and presents the search result in the form of matching index entries in the order of relevance. The information retrieval system in accordance with the principles of the present invention assigns a relevance rating to each of the index entries without requiring an explicit input from the user with respect to the usefulness or the relevance of the retrieved information corresponding to the respective index entries. When the user
selects and retrieves an informational item through a list of index entries presented by the retrieval system as a result of a search, the relevance rating of the selected informational item is increased by a predetermined amount.

The relevance rating of the selected informational item is further adjusted based on any actions the user takes subsequent to the initial selection of the informational item if the subsequent act indicates that the relevance of the selected informational item may be less than what is reflected by the rating increase by the predetermined amount. Ratings of the informational items in the database are determined from implicit suggestions from the usage of the retrieval system and the database by the user rather than from an explicit user input.

In another aspect of the present invention, the ratings are allowed to decay over time to minimize the tendencies for historical usage biased rating, and to provide more temporally accurate ratings. The most recently accessed time of each of the informational items in the database is compared to a predetermined stale access time threshold, and if the most recently accessed time is older than the threshold, than the rating of the corresponding informational item is decreased by a predetermined amount to reflect the dated nature of the information contained within the item.

In particular, Fig. 1 shows an illustrative embodiment of the information retrieval system 100 in accordance with the principles of the present invention, which may comprise, in relevant part, *inter alia*, an information requester 101, a search engine 102 and an information server 104. The information retrieval system 100 may be any system in which a plurality of informational items are available to be searched and retrieved. For example, the entire information retrieval system 100 may be housed within a single computer system, where the information server 104 may comprise a database containing a plurality of informational items stored in a mass storage device, e.g., a hard disk or the like, and where the information requester 101 may be a user interface through which a user may initiate a search and retrieval session with the search engine 102, which in turn may be an application program running on the computer. In this example, the communication interfaces 105 and 106 may be, e.g., bus(s) within the computer system.

Alternatively, the information retrieval system 100 may even comprise a single computer program, in which each of the information server 104, information requester 101 and the search engine
102 may comprise a sub-component of the single computer program. In this case, communications
interfaces 105 and 106 may themselves be computer routines acting as, e.g., program interfaces.
In a yet another alternative embodiment, the information retrieval system 100 may comprise a
plurality of computers connected via a computer network. For example, the communication interfaces
105 and 106 may be a wide area network (WAN), e.g., the Internet, the world wide web (WWW),
Public Switched Telephone Network (PSTN), or the like, through which each of the information
requester 101, the search engine 102 and the information server 104 communicate. The information
requester 101 may be, e.g., a personal computer connected to the Internet, e.g., via a modem or the
like. The information server 104 may comprise a plurality of computers, e.g., web servers, distributed
over the WAN 105, 106, e.g., the Internet. The search engine 102 may comprise any currently
available and known search engines, e.g., the YAHOO™, EXCITE™, and the like, and may maintain
an index 103 of the entire content of the WWW parsed into searchable words and corresponding
locations as shown in Fig.2. An example of a known search engine may also be found from, e.g., US
Patent No. 6,02,409 issued February 1, 2000 to Michael Burrows, the entirety of which is hereby
incorporated by reference herein.

Fig. 2 shows the relevant portions 200 of the index 103. The index 103 in accordance with
the principles of the present invention comprises, inter alia, an information item field 201 that uniquely
identifies an information items, e.g., INFO#1 to INFO#n, a location Field (LOC) 202 containing the
location pointers, e.g., the URL in the case of WWW pages, for the information items, a relevancy
rating (R<sub>R</sub>) field 203 contains the relevancy rating of the information items that indicates the relative
usefulness of each of the informational items as related to each other, and a most recent access time
(t<sub>MRA</sub>) field 204 that contains the time stamp of the last time the respective informational item was
accessed. The search engine 102 may periodically monitor the information server 104 via the
communication interface 106 for any newly added informational items to be added the index 103.

In operation, when the information requester 101 requires an informational item, it initiates an
information retrieval session by sending a search request to the search engine 102 via the
communication interface 105. For example, the search request may be generated when a user of a
client computer in a WAN, e.g., the Internet, enters a keyword WORD1 in the keyword entry field
302 of a user interface search screen 301 shown in Fig. 3A, and "clicks" on the search button 303. Upon receiving the search request, the search engine searches the index 103 for all entries that contain the keyword WORD1 in the index term field 201. The search engine 102 returns, via the communication interface 105, all matching entries to be displayed to the information requester 101.

Fig. 3B shows an exemplary display format 304 of the returned matching entries. As shown, identifications 306 of, e.g., first few words or sentences, preferably with hyperlinks to, the matching informational items are displayed in the descending order of their respective informational importance 305. The informational importance is determined based on a combination of the degree that the search term WORD1 302 matched the information item and the relevancy rating 203 of that information item. The information requester 101 may request more matching entries in addition to the ones shown in the initial display screen by clicking on the "more" button 307.

Fig. 4 shows an exemplary embodiment of the relevancy rating method in accordance with the principles of the present invention. In step 401, the present inventive information retrieval system 100 detects a selection, from the above described matching entry display screen, of an information item by the user, e.g., the INFO#1 306 having a present relevancy rating of R1. When the user selects an information item, e.g., by clicking on the provided hyperlink, a retrieval request is sent to the search engine 102 via the communication interface 105. Upon receiving the retrieval request, the information retrieval system 100 adjusts the rating of the selected information item. For example, a positive user feedback is assumed from the fact that the user made the selection, and thus the relevancy rating for the selected information item may be increased by a predetermined amount (RATE#1), e.g., two (2). The predetermined amount of increase represents the weight of the user selection to be attributed with respect to relevancy rating, and can be determined (and adjusted time to time) empirically by the search engine 102 from observing the performance behavior of the information retrieval system 100, or in the alternative, may be specified by the information requester 101 during the information retrieval session.

In step 403, a determination is made whether the user has taken an action subsequent to the initial selection detected during the step 401. If the user has not taken any action subsequent to the initial selection, then it is assumed that the initial adjustment of the relevancy rating (made in step 402
is correct, and the process flow proceeds to step 406 during which the adjusted relevancy rating is
stored to update the index 103.

If, on the other hand, a subsequent action by the user is detected by the search engine 102
(e.g., when a request signal is received from the information requester 101 via the communication
interface 105), the search engine 102 examines, in step 404, the request signal to determine the nature
of the subsequent user action. From the nature of the subsequent user action, one can draw reasonable
conclusions with regard to the relevancy and/or usefulness of the selected informational item.

It is assumed that by initial selection of an informational item, the user is providing positive
feedback about that selected informational item. However, if the user subsequently selects additional
 informational items, submits a question, searches for additional informational items, and/or initiates a
entirely new search, it can be concluded that the usefulness of the initially selected informational item
may be less than originally assumed. Accordingly, the relevancy rating of the initially selected
informational item may be adjusted downward by a second predetermined amount, RATE#2, in light
of any of the above subsequent user action.

Finally, in step 406, the adjusted relevancy ratings of selected informational items are stored
to update the index 103.

The following examples are provided to further illustrate the operation of the inventive relevancy
rating method of Fig.4. Assume, for example, that three adjustment factors, RATE#1, RATE#2 and
RATE#3 are provided, where RATE#1 > RATE#2 and RATE#1 > RATE#3.

Example 1

In step 401, when a user selection of an informational item, e.g., INFO#1 having a current
relevancy rating of R1 (Fig 3B), is detected, in step 402, the relevancy rating of INFO#1 is increased
by RATE#1, e.g., two (2), to arrive at the adjusted relevancy rating of 38 for INFO#1. If the user
takes no other action, the adjusted relevancy rating, i.e., 38, is stored in the index 103 in step 406.
However, when retrieval request for INFO#2 is subsequently received (steps 404 and 405), the
relevancy rating of INFO#1 is further adjusted, i.e., decreased by RATE#2, e.g., one (1), to arrive a
a further adjusted relevancy rating for INFO#1, i.e., 37. Thus, the final relevancy rating used to update
the index 103 is 37.
The relevancy rating of the subsequently selected informational item, INFO#2, may be increased by RATE#1, to arrive at an adjusted relevancy rating for INFO#2, e.g., 77.

If the user continues on to select another informational item, e.g., INFO#3, the relevancy rating of INFO#3 is increased by RATE#1 while the relevancy rating of INFO#2 is decreased by RATE#2. The relevancy rating of INFO#1 would remain unchanged at + RATE#1 - RATE#2, i.e., 37.

Example 2

In step 401, when a user selection of an informational item, e.g., INFO#1, is detected, the relevancy rating of INFO#1 is increased by RATE#1 in step 402, to arrive at an adjusted relevancy rating for INFO#1. If the user takes no other action, the adjusted relevancy rating is stored in the index 103 in step 406.

However, when the information requester 101 subsequently submits, via the communication interface 105, a question with respect to the informational item being sought, the relevancy rating of INFO#1 is further adjusted, i.e., decreased by RATE#2, and the resulting adjusted relevancy rating is stored in the index 103, since the information item INFO#1 did not end the search.

Example 3

In step 401, when a user selection of an informational item, e.g., INFO#1, is detected, the relevancy rating of INFO#1 is increased by RATE#1 in step 402, to arrive at the adjusted relevancy rating for INFO#1. If the user takes no other action, the adjusted relevancy rating is stored in the index 103 in step 406.

However, when the information requester subsequently initiates an additional search, e.g., send a search request over the communication interface 105, and if newly matched informational items, INFO#2 and INFO#3 were found as a result of the new search, the relevancy rating of INFO#1 is further adjusted, i.e., decreased by RATE#2. The relevancy ratings of both INFO#2 and INFO#3 are increased by RATE#3. The respective adjusted relevancy ratings are stored to update the index 103.

Example 4
In this example, the inventive relevancy ranking method is utilized in presenting an ordered list of frequently asked questions (FAQs) on the World Wide Web, e.g., from a customer service web site. For simplicity, the initial relevancy ratings associated with each respective FAQ item in the service web site is assumed to have an initial value of zero (0). However, it should be readily apparent to one skilled in the art that the initial values of the relevancy ratings do not have to be initialized to zero, but are merely being assumed to provide an easier understanding of this example.

When a customer first visits the service web site, the customer is presented with a sorted list of FAQ titles. When the customer selects one of the FAQ titles to view in detail the respective FAQ item associated thereto, e.g., (FAQ#1), the relevancy rating associated with this selected FAQ item is increased by RATE#1 (e.g., 2 points), resulting in the new relevancy rating value of two (2). If this FAQ item satisfactorily answered the customer’s question, the customer may choose to end the session at this point. However, if the customer continues on, e.g., by returning to the list of sorted FAQ titles, and selecting a second FAQ title to view the associated FAQ item (e.g., FAQ#2) in detail, the relevancy rating associated with the FAQ#2 is increased by RATE#1 (e.g., 2 points), while the relevancy rating associated with the FAQ#1 is decreased by RATE#2 (e.g., 1 point). The relevancy ratings of the FAQ items, FAQ#1 and FAQ#2, are now 1 and 2, respectively.

When, e.g., the customer once again returns to the sorted list of FAQ titles, and chooses yet a third FAQ title to view in detail the associated third FAQ item (FAQ#3). The relevancy rating for this FAQ#3 is increased by RATE#1 (e.g., 2 points), the relevancy rating for the secondly selected FAQ item (FAQ#2) is decreased by RATE#2 (e.g., 1 point), and the relevancy rating for the firstly selected FAQ item (FAQ#1) is not updated further. After this selection the resulting relevancy ratings are 1, 1, and 2 for the FAQ#1, FAQ#2, and FAQ#3, respectively.

Now, assume further that the customer was still unable to have the question answered satisfactorily. At this point the customer may enter a search query in an attempt to find an answer to the question. Assume the search returns three FAQ items, FAQ#4, FAQ#5, and FAQ#6. For all those FAQ items that successfully matched the query and thus are returned for the customer’s selection, the respective associated relevancy rating for each matching FAQ item is increased by RATE#3 (e.g., 1
point), while the relevancy rating for the thirdly selected FAQ item (FAQ#3) is decremented by 1 point (RATE#2).

The resulting relevancy ratings for each of FAQ#1, FAQ#2, FAQ#3, FAQ#4, FAQ#5 and FAQ#6 are now all set at 1. At this point the customer decides one of the returned FAQ items (FAQ#4, FAQ#5 and FAQ#6), may contain the answer for the question, and selects to view the details of a fourth FAQ item (FAQ#4). The relevancy rating for this FAQ (FAQ#4) is increased by RATE#1 (e.g., 2 points). Since the previously viewed FAQ, e.g., the thirdly selected FAQ item (FAQ#3), has already been decremented by 1 point (RATE#2) during the search request, the relevancy rating is not further adjusted. The counter for the latest selected FAQ item (FAQ#4) is now set to 3, while relevancy ratings for the other FAQ items, i.e., FAQ#1, FAQ#2, FAQ#3, FAQ#5 and FAQ#6, remain at 1.

At this point the customer may decide that it is time to stop trying to find the answer from among the existing FAQ items, and instead ask his question directly to a customer service representative via a Web form, e.g., an e-mail. Upon submission, the last FAQ item that the customer viewed (FAQ#4) is decremented by 1 (RATE#2) to the final count of 2, and relevancy ratings for the other FAQ items involved during the session, i.e., FAQ#1, FAQ#2, FAQ#3, FAQ#5 and FAQ#6, remain unchanged at 1 point.

Thus, at the end of the customer's session, the relevancy ratings for the FAQ items with which the customer interacted would have experienced the following manipulations:

FAQ#1: initial value + RATE#1 - RATE#2 = 0 + 2 - 1 = 1;
FAQ#2: initial value + RATE#1 - RATE#2 = 0 + 2 - 1 = 1;
FAQ#3: initial value + RATE#1 - RATE#2 = 0 + 2 - 1 = 1;
FAQ#4: initial value + RATE#3 + RATE#1 - RATE#2 = 0 + 1 + 2 - 1 = 2;
FAQ#5: initial value + RATE#3 = 0 + 1 = 1; and
FAQ#6: initial value + RATE#3 = 0 + 1 = 1.

As can be appreciated, the inventive relevancy rating system described above, determines the relevancy rating of informational items, without requiring an explicit rating by a user by providing a weighted adjustments of the ratings based on the usage of the informational items by the users. The
inventive relevancy rating system can be used to augment conventionally known rating systems, or could
supplant conventional explicit rating methods when the conventional method is unavailable and/or in
appropriate.

In another aspect of the present invention, the relevancy ratings are allowed to decay over time
to minimize the tendencies for historical usage biased rating, and to provide a more temporally accurate
ratings. The most recently accessed time of each of the informational items in the database is compared
to a predetermined stale access time threshold, and if the most recently accessed time is older than the
threshold, then the rating of the corresponding informational item is decreased to reflect the dated
nature.

In particular, Fig. 5 shows an illustrative embodiment of the temporal adjustment for the
relevancy ratings. According to this embodiment, in step 501, a stale access time threshold value (t_{th})
is determined. The t_{th} represents a predetermined length of time duration between consecutive
accesses of an informational item. Expiration of the t_{th} requires an adjustment of the relevancy rating
of that informational item.

In step 502, for each of the matching entries of the index 103 after a search, a determination
whether the elapsed time since the last time of access of the respective informational item, i.e., the
current time t minus t_{MRA} 204 (t- t_{MRA}), exceeds the t_{th}. If the threshold is exceeded, it is assumed
that, for the purpose of relevancy rating, that the information is stale, and thus the relevancy rating of
the informational item is adjusted (or “aged”) by a predetermined temporal adjustment factor RATE_{i}
in step 503. If on the other hand, in a preferred embodiment of the present invention, the threshold
has not been exceeded, then, in step 504, the t_{MRA} 204 of the informational item is preferably set to
equal the current time to avoid excessive aging of an information item.

Finally, in step 505, the index 103 is updated to reflect any changes to the relevancy rating
and/or the t_{MRA} 204.

Both the stale access time threshold value (t_{th}) and the temporal adjustment factor RATE_{i} can
be chosen based on the desired temporal sensitivity of the relevancy ratings. For example, the
threshold value may be set to be an arbitrarily large time duration, e.g., 1000 years, for the minimal
temporal sensitivity. The threshold value may, on the other hand, be set to a much smaller time
duration, e.g., one day or even one hour, for maximum temporal sensitivity, and to place a strong bias
for those informational items that have been recently accessed. Similarly, e.g., setting the RATEt to 100
percent will effectively erase all historical ratings older than the specified tscr. Setting the RATEt to zero
percent will result in the minimal temporal sensitivity of the relevancy ratings, i.e., no ratings being aged.

The threshold value and the adjustment factor may be determined empirically to tune the
information retrieval system for optimal performance, and may be set by the system administrator of
the retrieval system, or in the alternative, the user, i.e., the information requestor 101, may be allowed
to specify per search request basis, e.g., providing an input capability for the respective values in the
search screen shown in Fig. 3A.

As can be appreciated, the inventive relevancy rating aging system described above, allows the
rating to decay over time to minimize the tendencies for historical usage biased rating, and to provide
a more temporally accurate ratings.

While the invention has been described with reference to the exemplary embodiments thereof,
those skilled in the art will be able to make various modifications to the described embodiments of the
invention without departing from the true spirit and scope of the invention. The terms and descriptions
used herein are set forth by way of illustration only and are not meant as limitations. In particular,
although the method of the present invention has been described by examples, the steps of the method
may be performed in a different order than illustrated or simultaneously. Those skilled in the art will
recognize that these and other variations are possible within the spirit and scope of the invention as
defined in the following claims and their equivalents.
What is claimed is:

1. A method of temporally updating relevancy ratings of a plurality of informational items in a information retrieval system, comprising:
   detecting an access of at least one of said plurality of informational items, said at least one of said plurality of informational items having a most recently accessed time, said most recently accessed time indicating time at which said at least one of said plurality of informational items was lastly accessed;
   determining an elapsed time since said most recently accessed time;
   comparing said elapsed time with a predetermined stale access time threshold value; and
   adjusting a relevancy rating of said at least one of said plurality of informational items if said elapsed time exceeds said predetermined stale access time threshold value.

2. The method of temporally updating relevancy ratings in accordance with claim 1, further comprising:
   updating said most recently accessed time to be equal to a time of said detected present access of said at least one of said plurality of informational items.

3. The method of temporally updating relevancy ratings in accordance with claim 1, further comprising:
   storing said adjusted relevancy rating for said at least one of said plurality of informational items.

4. The method of temporally updating relevancy ratings in accordance with claim 2, further comprising:
   storing said updated most recently accessed time of said at least one of said plurality of informational items.

5. The method of temporally updating relevancy ratings in accordance with claim 1, wherein said step of adjusting said relevancy rating comprises:
   decreasing said relevancy rating by a predetermined temporal adjustment factor.
6. The method of temporally updating relevancy ratings in accordance with claim 1, wherein:
said stale access time threshold value is determined based on a desired temporal sensitivity of
said relevancy ratings.

7. The method of temporally updating relevancy ratings in accordance with claim 5, wherein:
said temporal adjustment factor is determined based on a desired temporal sensitivity of said
relevancy ratings.

8. The method of temporally updating relevancy ratings in accordance with claim 6, wherein:
said stale access time threshold value is determined empirically.

9. The method of temporally updating relevancy ratings in accordance with claim 7, wherein:
said temporal adjustment factor is determined empirically.

10. The method of temporally updating relevancy ratings in accordance with claim 1, further
comprising:
allowing a user of said information retrieval system to directly input said stale access time
threshold value.

11. The method of temporally updating relevancy ratings in accordance with claim 5, further
comprising:
allowing a user of said information retrieval system to directly input said temporal adjustment
factor.
12. An apparatus for temporally updating relevancy ratings of a plurality of informational items in a information retrieval system, comprising:

means for detecting an access of at least one of said plurality of informational items, said at least one of said plurality of informational items having a most recently accessed time, said most recently accessed time indicating time at which said at least one of said plurality of informational items was lastly accessed;

means for determining an elapsed time since said most recently accessed time;

means for comparing said elapsed time with a predetermined stale access time threshold value;

and

means for adjusting a relevancy rating of said at least one of said plurality of informational items if said elapsed time exceeds said predetermined stale access time threshold value.

13. The apparatus for temporally updating relevancy ratings according to claim 12, further comprising:

means for updating said most recently accessed time to be equal to a time of said detected present access of said at least one of said plurality of informational items.

14. The apparatus for temporally updating relevancy ratings according to claim 12, further comprising:

means for storing said adjusted relevancy rating for said at least one of said plurality of informational items.

15. The apparatus for temporally updating relevancy ratings according to claim 13, further comprising:

means for storing said updated most recently accessed time of said at least one of said plurality of informational items.
16. The apparatus for temporally updating relevancy ratings according to claim 13, wherein:
said means for adjusting said relevancy rating is adapted to decrease said relevancy rating by
a predetermined temporal adjustment factor.

17. The apparatus for temporally updating relevancy ratings according to claim 12, wherein:
said stale access time threshold value is determined based on a desired temporal sensitivity of
said relevancy ratings.

18. The apparatus for temporally updating relevancy ratings according to claim 16, wherein:
said temporal adjustment factor is determined based on a desired temporal sensitivity of said
relevancy ratings.

19. The apparatus for temporally updating relevancy ratings according to claim 17, wherein:
said stale access time threshold value is determined empirically.

20. The apparatus for temporally updating relevancy ratings according to claim 18, wherein:
said temporal adjustment factor is determined empirically.

21. The apparatus for temporally updating relevancy ratings according to claim 15, further
comprising:
an input interface adapted to receive said stale access time threshold value from a user of said
information retrieval system.

22. The apparatus for temporally updating relevancy ratings according to claim 16, further
comprising:
an input interface adapted to receive said temporal adjustment factor from a user of said
information retrieval system.
23. A computer readable storage medium having stored thereon a computer program for 
implementing a method of temporally updating relevancy ratings of a plurality of informational items in 
a information retrieval system, said computer program comprising a set of instructions for: 
detecting an access of at least one of said plurality of informational items, said at least one of 
said plurality of informational items having a most recently accessed time, said most recently accessed 
time indicating time at which said at least one of said plurality of informational items was lastly accessed; 
determining an elapsed time since said most recently accessed time; 
comparing said elapsed time with a predetermined stale access time threshold value; and 
adjusting a relevancy rating of said at least one of said plurality of informational items if said 
elapsed time exceeds said predetermined stale access time threshold value.

24. The computer readable storage medium according to claim 23, wherein said computer 
program further comprising one or more instructions for: 
updating said most recently accessed time to be equal to a time of said detected present access 
of said at least one of said plurality of informational items.

25. The computer readable storage medium according to claim 23, wherein said computer 
program further comprising one or more instructions for: 
storing said adjusted relevancy rating for said at least one of said plurality of informational items.

26. The computer readable storage medium according to claim 24, wherein said computer 
program further comprising one or more instructions for: 
storing said updated most recently accessed time of said at least one of said plurality of 
informational items.

27. The computer readable storage medium according to claim 23, wherein: 
said instructions for adjusting said relevancy rating are adapted to decrease said relevancy 
rating by a predetermined temporal adjustment factor.
28. The computer readable storage medium according to claim 23, wherein:
said stale access time threshold value is determined based on a desired temporal sensitivity of
said relevancy ratings.

29. The computer readable storage medium according to claim 23, wherein:
said temporal adjustment factor is determined based on a desired temporal sensitivity of said
relevancy ratings.

30. The computer readable storage medium according to claim 27, wherein:
said stale access time threshold value is determined empirically.

31. The computer readable storage medium according to claim 29, wherein:
said temporal adjustment factor is determined empirically.

32. The computer readable storage medium according to claim 23, wherein said computer
program further comprising one or more instructions for:
allowing a user of said information retrieval system to directly input said stale access time
threshold value.

33. The computer readable storage medium according to claim 23, wherein said computer
program further comprising one or more instructions for:
allowing a user of said information retrieval system to directly input said temporal adjustment
factor.
<table>
<thead>
<tr>
<th>INFORMATION ITEM</th>
<th>LOCATION</th>
<th>RELEVANCY RATING</th>
<th>ACCESS TIME</th>
</tr>
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<tbody>
<tr>
<td>ITEM1</td>
<td>LOCATION1</td>
<td>36</td>
<td>TIME1</td>
</tr>
<tr>
<td>ITEM2</td>
<td>LOCATION2</td>
<td>75</td>
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<tr>
<td>ITEMN</td>
<td>LOCATIONN</td>
<td>R_{R,N}</td>
<td>TIME5</td>
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FIG. 3 A

ENTER KEYWORD TO SEARCH

WORD

SEARCH

FIG. 3 B

TOP 10 MATCHES FOR "WORD"

1. INFO #2 (RATING = 89%)
2. INFO #3 (RATING = 63%)
3. INFO #1 (RATING = 2%)

:::

MORE
DETECT USER SELECTION OF AN INFORMATION ITEM ~ 401

ADJUST RATING OF THE SELECTED INFORMATION ITEM ~ 402

SUBSEQUENT USER ACTION DETECTED? ~ 403

NO

YES

DETERMINE NATURE OF SUBSEQUENT USER ACTION ~ 404

FURTHER ADJUST THE RATING OF THE SELECTED INFORMATION ITEM AND ANY OTHER NEWLY SELECTED INFORMATION ITEMS ~ 405

UPDATE INDEX ~ 406

END ~ 407

FIG. 4
SET STALE ACCESS TIME THRESHOLD, t_{sth}  \sim 501

FOR EACH MATCHING ENTRY IN A SEARCH, t-t_{mra}>t_{sth}  \sim 502

NO

YES

ADJUST RATING BY RATE_t  \sim 503

SET t_{mra}=t  \sim 504

UPDATE INDEX  \sim 505

END  \sim 506

FIG.5
INTERNATIONAL SEARCH REPORT

Inventorial Application No
PCT/US 01/12147

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/30

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)
IPC 7 G06F

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

Electronic database consulted during the international search (name of database and, where practical, search terms used)
WPI Data, EPO-Internal, PAJ, INSPEC, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>WO 99 48028 A (GLOBALBRAIN NET INC) 23 September 1999 (1999-09-23) abstract; figure 3</td>
<td>1,12,23</td>
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<tr>
<td>A</td>
<td>EP 0 551 696 A (IBM) 21 July 1993 (1993-07-21) abstract; figure 3</td>
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<td>P,X</td>
<td>WO 01 16807 A (POWERCAST MEDIA INC) 8 March 2001 (2001-03-08) abstract; figures 5,7 page 12, line 15 - page 13, line 13</td>
<td>1,5-12, 17,19, 23,25, 27-33</td>
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</table>

Further documents are listed in the continuation of box C. Patient family members are listed in annex.

* Special categories of cited documents:
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  *O* document referring to an oral disclosure, use, exhibition or other means
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  *A* document member of the same patent family

Date of the actual completion of the international search: 4 October 2001
Date of mailing of the international search report: 11/10/2001

Name and mailing address of the ISA
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Authorized officer
Deane, E
## INTERNATIONAL SEARCH REPORT

### Information on patent family members

<table>
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