



US007610282B1

(12) **United States Patent**  
**Datar et al.**

(10) **Patent No.:** **US 7,610,282 B1**  
(45) **Date of Patent:** **Oct. 27, 2009**

(54) **RANK-ADJUSTED CONTENT ITEMS**

(75) Inventors: **Mayur Datar**, Santa Clara, CA (US);  
**Kedar Dhamdhere**, Sunnyvale, CA  
(US); **Ashutosh Garg**, Sunnyvale, CA  
(US)

(73) Assignee: **Google Inc.**, Mountain View, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 230 days.

(21) Appl. No.: **11/694,268**

(22) Filed: **Mar. 30, 2007**

(51) **Int. Cl.**  
**G06F 17/30** (2006.01)

(52) **U.S. Cl.** ..... **707/5; 707/4**

(58) **Field of Classification Search** ..... **707/4-5**  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,124,129 B2 *	10/2006	Bowman et al.	707/5
7,194,454 B2 *	3/2007	Hansen et al.	707/3
7,472,119 B2 *	12/2008	Dai et al.	707/5
2006/0136377 A1 *	6/2006	Patt-Shamir et al.	707/3
2006/0288000 A1 *	12/2006	Gupta	707/5

\* cited by examiner

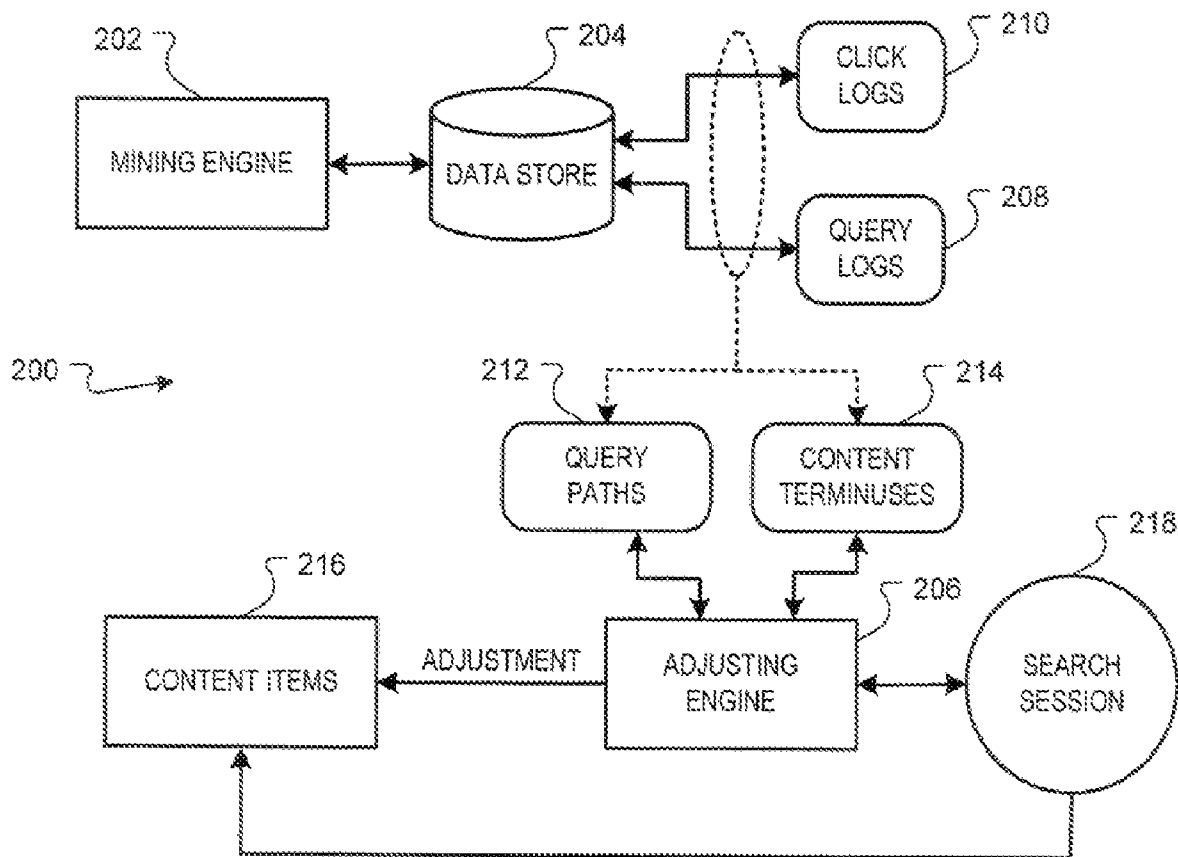
*Primary Examiner*—Debbie M Le

(74) *Attorney, Agent, or Firm*—Fish & Richardson P.C.

(57) **ABSTRACT**

Click logs and query logs are processed to identify statistical search patterns. A search session is compared to the statistical search patterns. Content items responsive to a query of the search session are identified, and a ranking of the content items is adjusted based on the comparison.

**15 Claims, 7 Drawing Sheets**



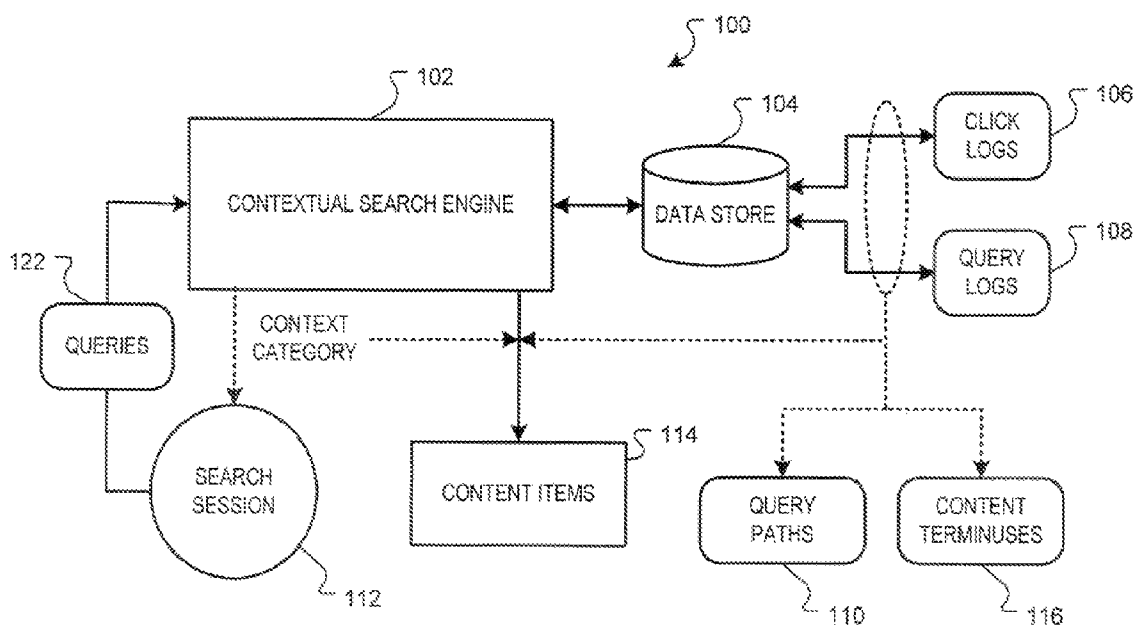


FIG. 1

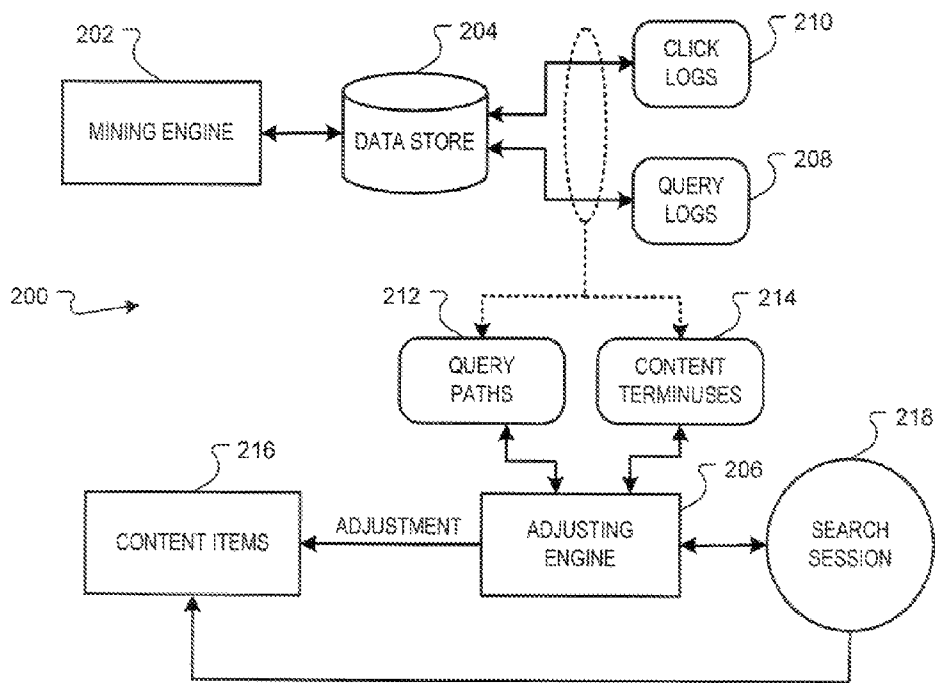


FIG. 2

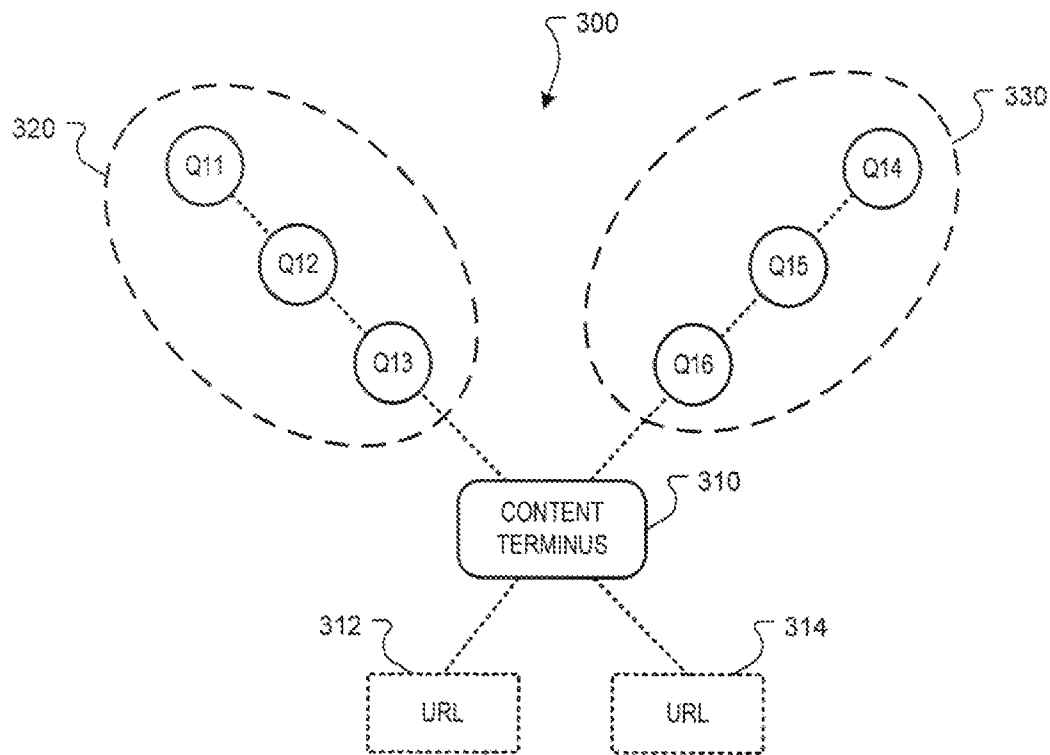


FIG. 3

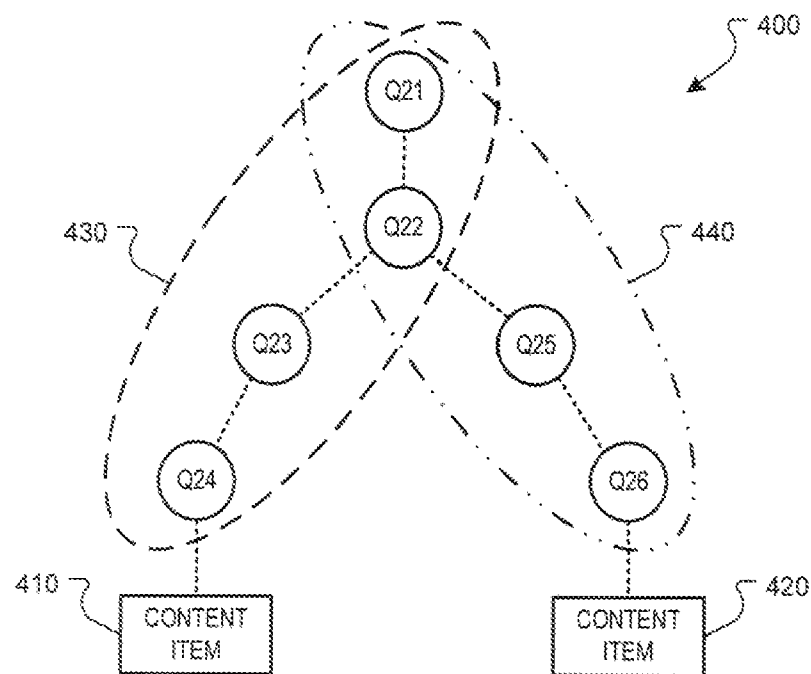


FIG. 4

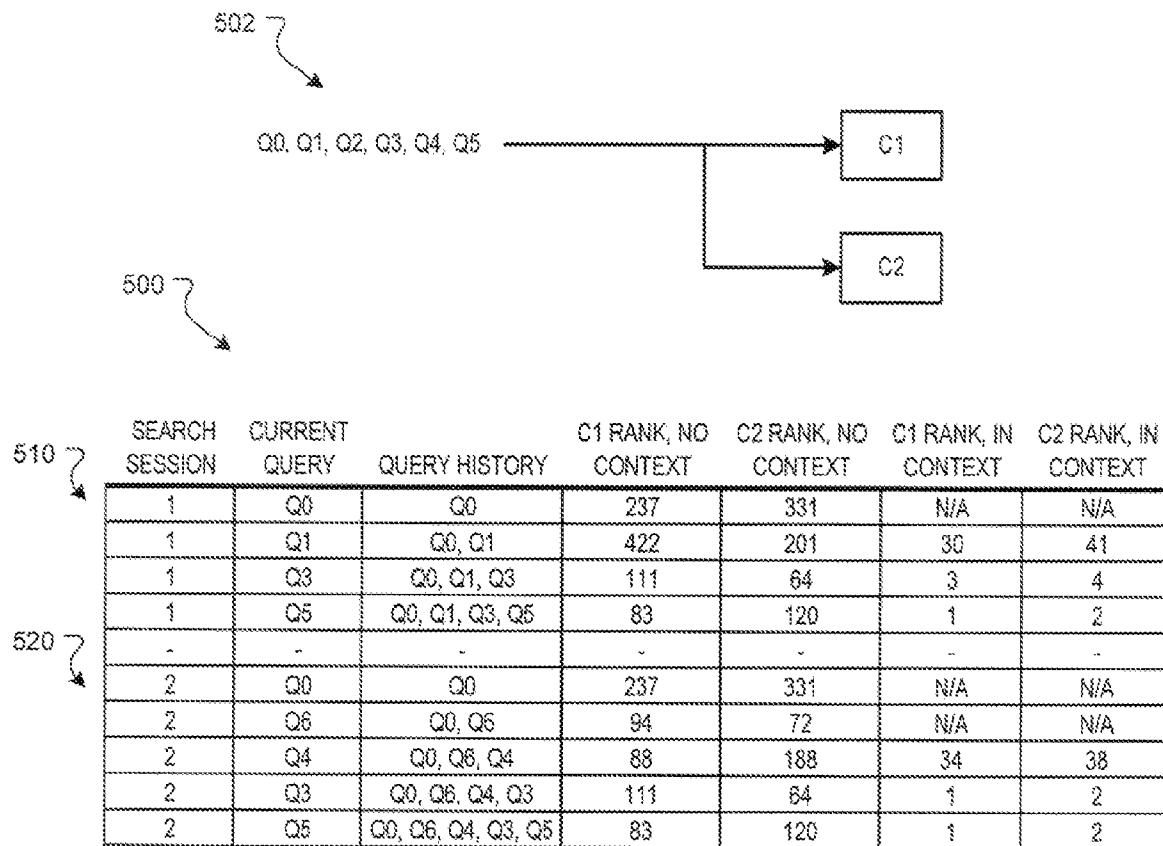


FIG. 5

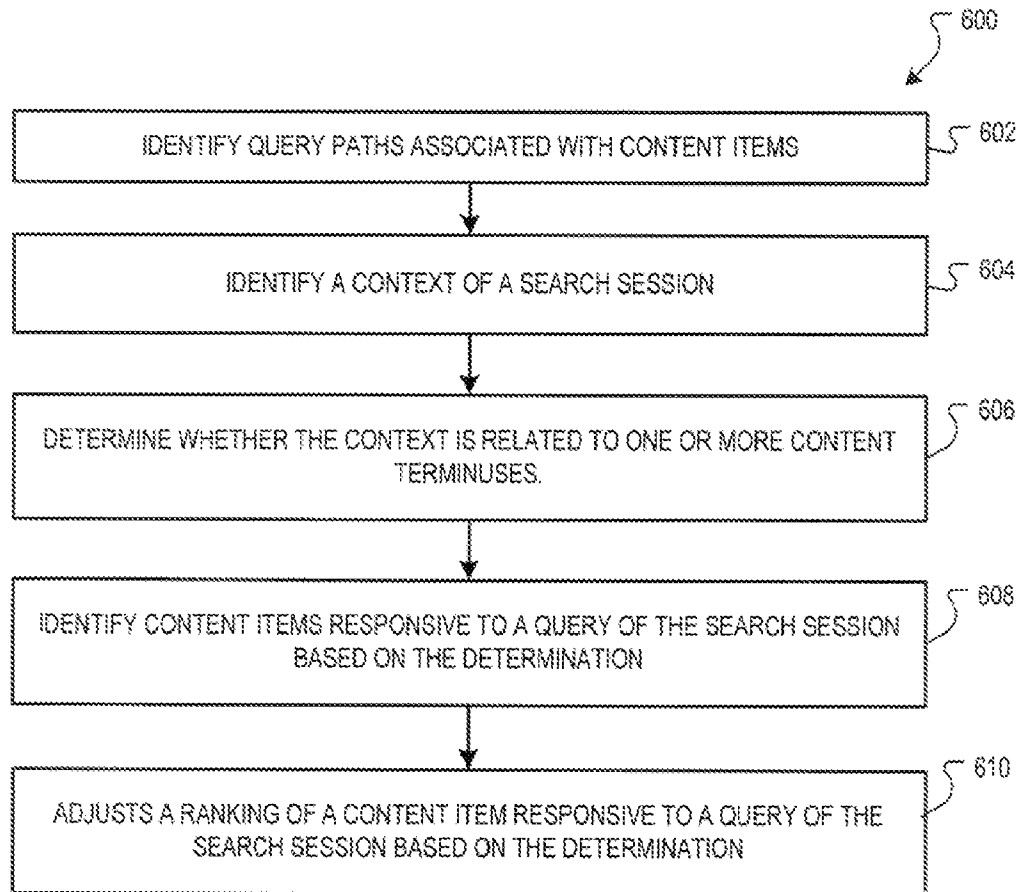


FIG. 6

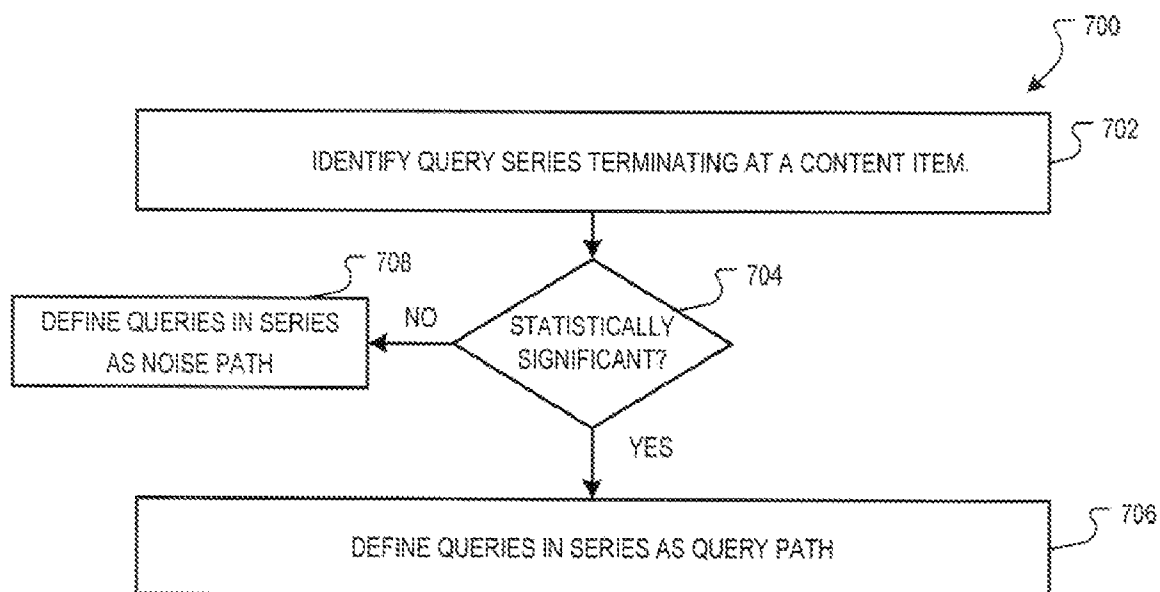


FIG. 7

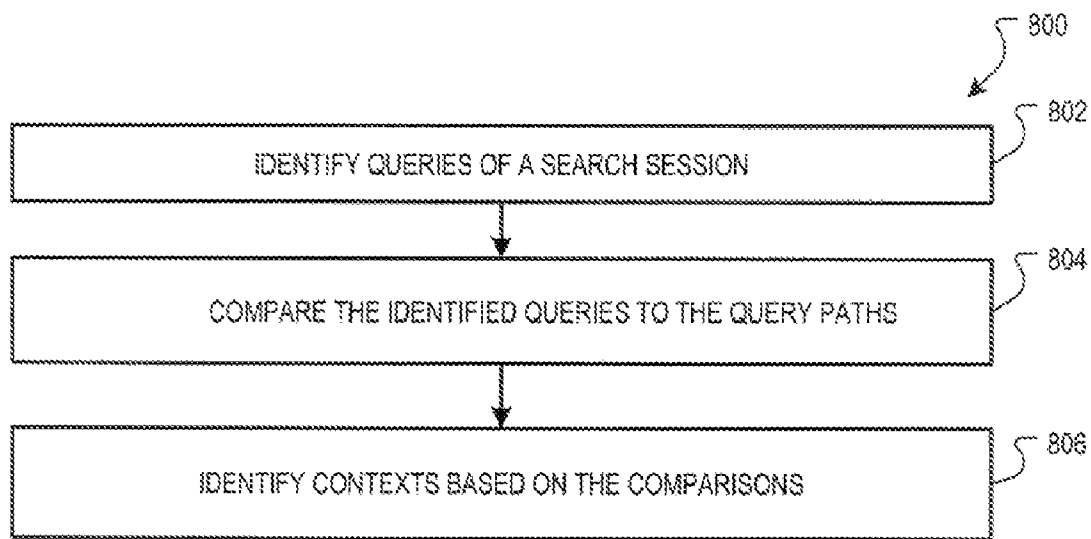


FIG. 8

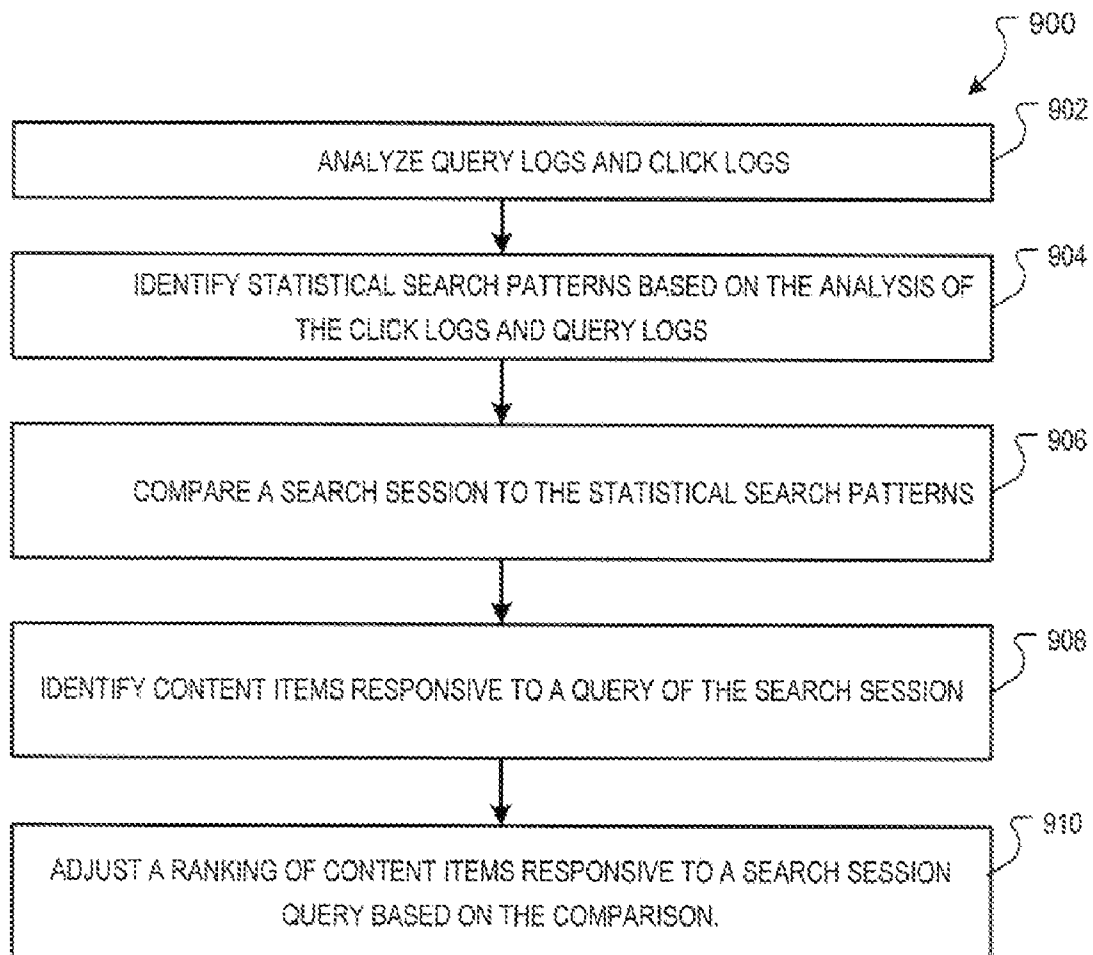


FIG. 9

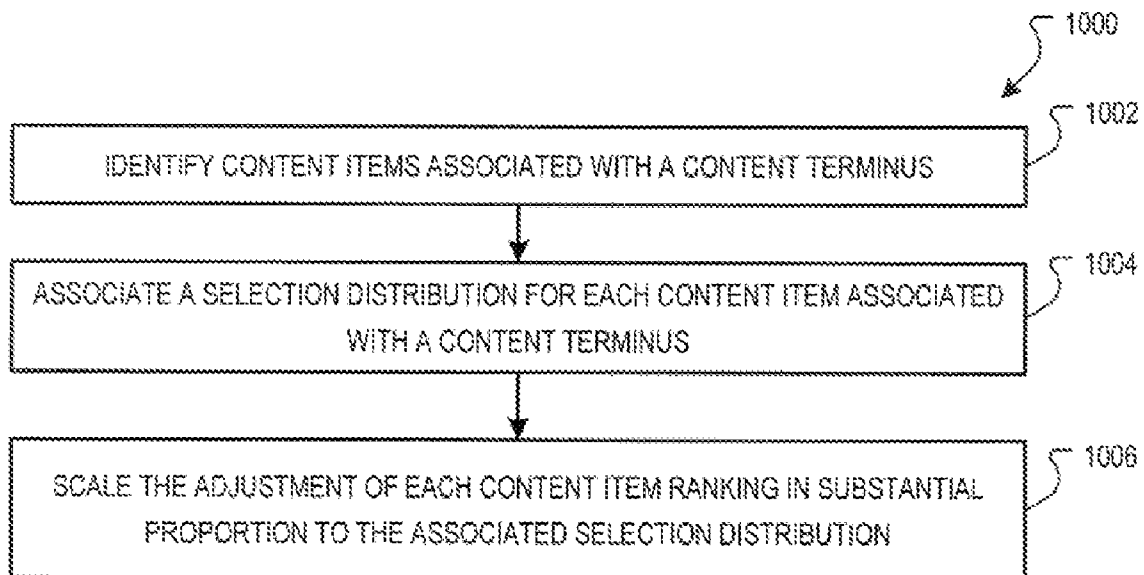


FIG. 10

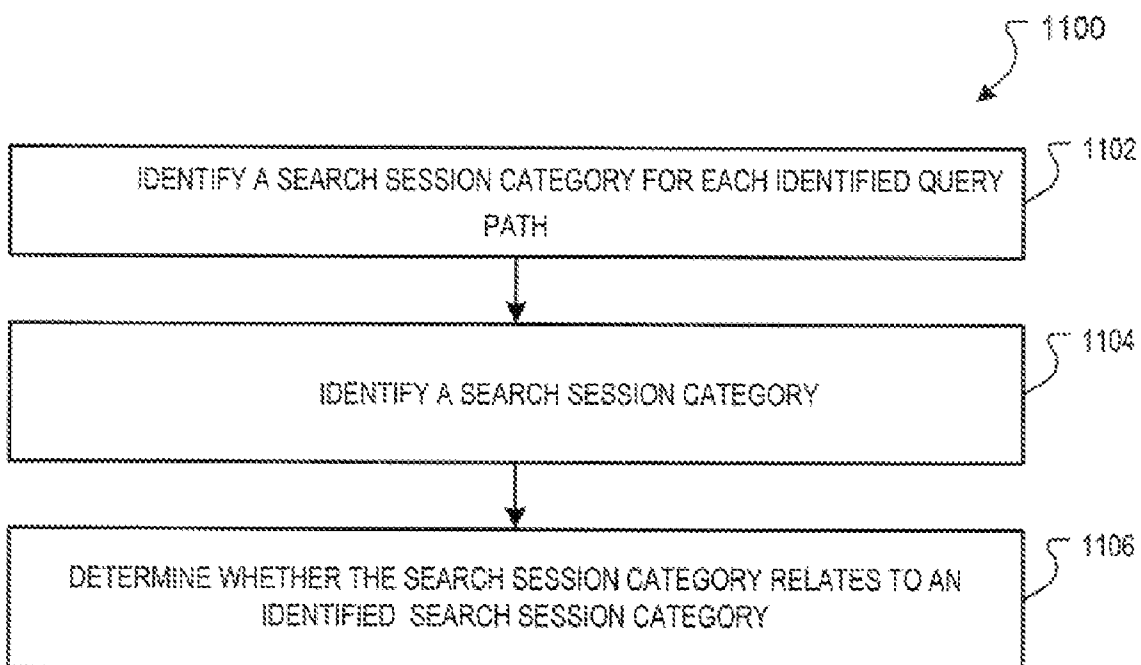


FIG. 11

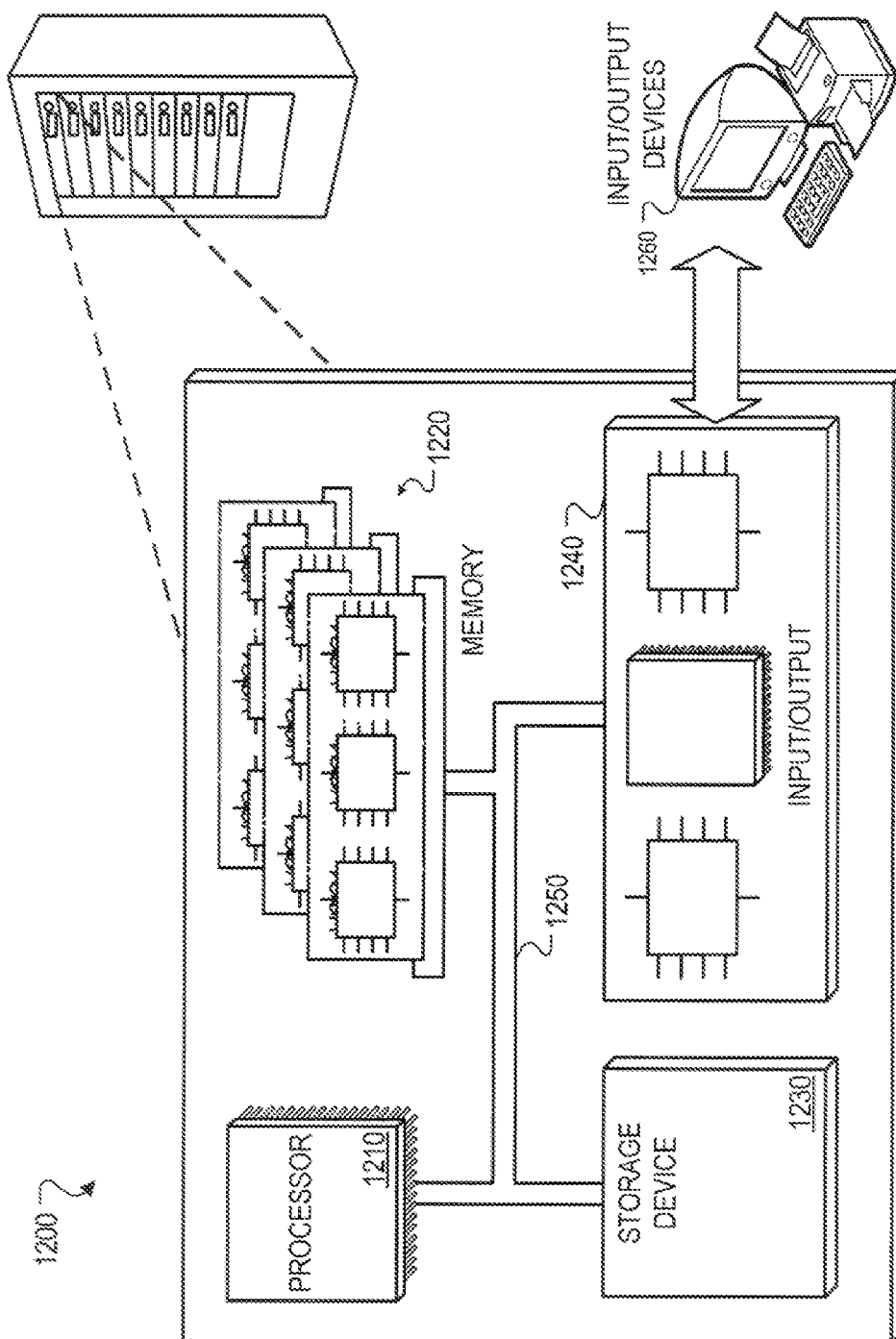


FIG. 12



1

## RANK-ADJUSTED CONTENT ITEMS

## BACKGROUND

This disclosure relates to identifying content items.

Content items, e.g., video and/or audio files, web pages for particular subjects, news articles, etc., can be identified by a search engine in response to a query. The query can include one or more search terms, and the search engine can identify and rank the content items based on the search terms in the query. Typically the content items are displayed according to the rank.

The content items, however, are often identified only in response to a particular query, i.e., the search engine may identify and rank content items to independently for each query. For example, for three different queries, the search engine may return a particular identification and rank of content items for each particular query, regardless of the other queries. In such implementations, a particular content item that may be highly relevant to a user's current interests may not be identified and/or highly ranked and presented to the user until the user has conducted multiple searches. Additionally, other users may experience similar challenges when searching for content.

## SUMMARY

Disclosed herein are systems and methods of identifying content items. In one implementation, click logs and query logs are processed to identify statistical search patterns based on the click logs and query logs. A search session is compared to the statistical search patterns. Content items responsive to a query of the search session are identified, and a ranking of the content items is adjusted based on the comparison.

In another implementation, query paths and content terminuses associated with query paths are identified. Additionally, a context of a search session is identified and a determination of whether the context is related, to one or more of the query paths is made. Content items responsive to a query of the search session are identified based on the determination.

In another implementation, a system includes a mining engine and an adjusting engine. The mining engine mines click logs and query logs to identify query paths and content terminuses associated with the query paths. The adjusting engine adjusts a ranking of content items responsive to a search session query based on the identified query paths and content terminuses.

In one implementation, identification of a context of a search session facilitates the adjusting of a ranking of one or more content items in response to a search session query. The adjustment can, for example, be based on the likelihood that a current user is searching for the rank-adjusted content items because a statistically significant number of prior users that exhibited a similar behavior to the current user selected the rank-adjusted content items.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an example content identification system.

FIG. 2 is a block diagram of another example content identification system.

FIG. 3 is a block diagram of an association of one or more queries and content items.

FIG. 4 is another block diagram of an association of one or more queries and content items.

FIG. 5 is an example query and ranking table.

2

FIG. 6 is a flow diagram of an example process for identifying content items.

FIG. 7 is a flow diagram of an example process for identifying query paths.

FIG. 8 is a flow diagram of an example process for identifying a search session context.

FIG. 9 is a flow diagram of an example process for identifying content items.

FIG. 10 is a flow diagram of an example process for scaling a ranking adjustment.

FIG. 11 is a flow diagram of an example process of identifying content so items based on a search session category.

FIG. 12 is a schematic diagram of an example computer system that can be utilized to implement the systems and methods described herein.

## DETAILED DESCRIPTION

FIG. 1 is a block diagram of an example content identification system **100**. The content identification system **100** can, for example, be implemented in a computer device or one or more computer devices connected through a network, e.g., a local area network (LAN) or a wide area network (WAN), such as the Internet. The one or more computing devices can, for example, include memory devices storing processing instructions and processing devices for executing the processing instructions. An example computing system is shown and described with reference to FIG. 12. Other implementations, however, can also be used.

The content identification system **100** can, for example, include a contextual search engine **102** and a content data store **104**. In one implementation, the content data store **104** can comprise a unitary data store, such as a hard drive. In another implementation, the content data store **104** can comprise a distributed data store, such as a storage system that is distributed over a network. Other implementations, however, can also be used.

The search engine **102** can receive queries for search results and retrieve relevant search results from an index of documents (e.g., from an index of web pages). Search results can include, for example, lists of web page titles, snippets of text extracted from those web pages, and hypertext links to those web pages, and may be grouped into a predetermined number of (e.g., ten) search results. The search results can, for example, be ranked by a quality measure and a relevance measure. For example, a particular web page can have a quality measure derived from the number of other web pages that are linked to the particular web page, and can have an information retrieval score related to the matching the query terms to words in the particular web page. The information retrieval score can be combined with the page rank to give a final rank to the particular web page.

In one implementation, the content data store **104** can, for example, store click logs **106** and query logs **108** that comprise data related to previous search session queries. Different types of query logs **106** and click logs **108** can be identified in one implementation, the query logs **106** can store queries submitted by users, and the click logs **108** can identify content items **114** retrieved in response to the queries.

The contextual search engine **102** can, for example, process the click logs **108** and the query logs **106** to identify query paths **110**. In one implementation, a query path **110** can include, for example, a series of queries in a particular order provided by users. In another implementation, a query path **110** can include, for example, a set of common queries pro-

vided by users that may define a particular order or a permutation of the particular order. Other query paths **110** types can also be used.

In one implementation, the query paths **110** can be defined by the similar or same sets of queries received from a statistically significant number of users that selected a same content item. In another implementation, the query paths **110** can be defined by the similar or same sets of queries received from a statistically significant number of users that selected a content item from a set of identified content items. Other statistical events can be used to define the query paths **110**.

In one implementation, the contextual search engine **102** can, for example, identify the query paths **110** by identifying content terminuses **116**, e.g., the terminus of a query path **110** that corresponds to an eventual selection of a content item **114**, such as web page associated with a URL.

A content terminus **116** can be defined by the click logs **108** and be associated with one or more query paths **110**. In one implementation, a content terminus **116** can, for example, be a content item **114**, e.g., a web page associated with a URL. Accordingly, the associated query paths **110** can define queries that were submitted prior to an eventual selection of the content item **114**.

In another implementation, a content terminus **116** can define an association of one or more query paths **110** with one or more content items **114**, e.g., web pages. For example, the content terminus **116** can be implanted as a node that associates one or more query paths **110** with one or more content items **115**. Accordingly, one or more query paths **110** can be associated with one or more content items **114** through a content terminus **116**.

In one implementation, a search context of a search session **112** can be identified and compared to the query paths **110**. The comparison can, for example, be utilized to adjust a ranking of one or more content items **114** responsive to a search query, such as a search query **122**. For example, a search context can be defined by queries of a particular search session **112** and the contextual search engine **102** can determine whether one or more of the search session queries relate to an identified query path **110**. The search context can thus be determined to correspond to an identified query path **110** that is associated with a content item **114**. Accordingly, the content item **114** associated with the identified query path **110** can be ranked higher in response to a search query, e.g., search query **122**, considered in the search context than when the query is considered absent of any context. The ranking adjustment of the content item **114** according to the search context is based on observation that prior users that exhibited a similar behavior selected the rank-adjusted content item **114**.

For example, if a statistically significant number of users submit at least the set of queries “orange,” “banana,” and “pineapple” during a search session, and then click through to the website defined by a first address, e.g., FRUITURL1, the contextual search engine **102** can identify the first address FRUITURL1 as a content terminus **116** for the query path defined by the queries “orange/banana/pineapple” or a permutation of the queries “orange/banana/pineapple.” Thereafter, the contextual search engine **102** can compare a context of another search session, e.g., a context defined by the so queries “banana,” “apple” and “pineapple” with the query path “orange/banana/pineapple.” Based on the comparison, the contextual search engine **102** can determine that the search session context is related to the query path “orange/banana/pineapple” and adjust the ranking, e.g., increase the ranking, of the content item FRUITURL1 as it is associated with the query path “orange/banana/pineapple.” The ranking adjust-

ment thus reflects that a statistically significant number of prior users that exhibited a similar behavior to the current user performing the search also selected FRUITURL1.

In another implementation, one or more query paths **110** can be associated with the same content terminus **116**. For example, if a statistically significant number of users submit the queries “orange,” “banana,” and “pineapple” during a search session, and then click through to the website defined by a first address, e.g., FRUITURL1, the contextual search engine **102** can identify the first address FRUITURL1 as a content terminus **116** for the query path defined by the queries “orange/banana/pineapple” or a permutation of the queries “orange/banana/pineapple.” Likewise, if a statistically significant number is of users submit the queries “mango,” “kiwi,” and “watermelon” during a search session, and then click through to the website defined by the first address, e.g., FRUITURL1, the contextual search engine **102** can identify the first address FRUITURL1 as a content terminus **116** for the query path defined by the queries “mango/kiwi/watermelon” or a permutation of the queries “mango/kiwi/watermelon.” Accordingly, if the contextual search engine **102** determines that the search session context is related to either of the query paths, then the ranking of the content item FRUITURL1 can be adjusted accordingly.

In another implementation, a content terminus **116** can define a selection of more than one content item, e.g., several web documents. Accordingly, the content items **114** associated with the content terminus **116** can be ranked higher in response to a search query considered in a search context associated with the content terminus **116** than when the query is considered absent of any context. For example, a statistically significant number of users can submit the queries “berries,” “boysenberry,” “blueberry,” “strawberry,” and “raspberry” during a search session, and then click through to the website defined by a first address, e.g., BERRYURL1, while another statistically significant set of users can submit the same queries and click through to a website defined by a second address, e.g., BERRYURL2. Thus the query path defined by the queries “berries/boysenberry/blueberry/strawberry/raspberry” or a permutation of the queries “berries/boysenberry/blueberry/strawberry/raspberry” can be associated with content terminus **116** that is, in turn, associated with the content items BERRYURL1 and BERRYURL2. Accordingly, if the contextual search engine **102** determines that the search session context is related to the query path “berries/boysenberry/blueberry/strawberry/raspberry,” then the ranking of the content item BERRYURL1 and BERRYURL2 can be adjusted accordingly.

In one implementation, the ranking of the content items **114** associated with a content terminus **116** can be adjusted in proportional relation to the likelihood that the content items **114** will be selected. For example, assume 55% of the search sessions having a context associated with the query path “berries/boysenberry/blueberry/strawberry/raspberry” resulted in the selection of the content items BERRYURL1, and 35% of the search sessions having a context associated with the query path “berries/boysenberry/blueberry/strawberry/raspberry” resulted in the selection of the content items BERRYURL2. Based on this selection distribution, the contextual search engine **102** can, for example, rank the content item BERRYURL1 and BERRYURL2 first and second, respectively, in response to any of the queries berries, boysenberry, blueberry, strawberry, and raspberry submitted in a search session having a context that is identified as being related to the query path “berries/boysenberry/blueberry/strawberry/raspberry.”

5

In another implementation, the contextual search engine **102** can identify a category for each of the query paths **110**. For example, for the query path “orange/banana” contextual search engine **102** can identify this query path as a “fruit” category. In one implementation, the contextual search engine **102** can identify a search session category and can adjust content item rankings according to the identified search session category. In another implementation, the ranking adjustment can be based on both the identified context of a search session and the identified category of the search session. In another implementation, the contextual search engine **102** can, for example, eliminate from consideration query paths that do not fall into the identified category.

In another implementation, the contextual search engine **102** can identify a category for each content terminus **116**. For example, for the query path defined by queries “orange/banana/strawberry” and associated with a content terminus, the contextual search engine **102** can identify the category “fruit” for the content terminus. In one implementation, the contextual search engine **102** can identify a search session category and can adjust content item rankings according to the identified search session category. For example, if a search session includes the queries apple, peach, and mango, the search session category may be identified as “fruit,” and content items associated with the content terminus of the fruit category may be adjusted in rank. In this implementation, the search session context may not be readily associated with a query path associated with the content terminus, e.g., there are no common terms among the sets of apple/peach/mango and orange/banana/strawberry, but the content items associated with the search path orange/banana/strawberry may nevertheless be increased in rank based on the identified category.

Other ranking adjustment schemes based on query paths, search contexts, and search categories can also be used. For example, in another implementation, the contextual search engine **102** can decrease a ranking of one or more content items **114**. In one implementation, the ranking of a content item **114** can be decreased if the ranking of the content item **114** is above a threshold but is rarely selected for an identified search context. For example, a particular content item **114** may be highly ranked, e.g., ranked first, for each of the queries “apple,” “orange” and “banana” when the queries are considered in the absence of any context. However, if the content item **114** is rarely selected in response to the queries when the queries are considered in the context of the query path defined by the queries apple/orange/banana, then the ranking of the content item **114** can be reduced, e.g., from a first rank to a second rank, third rank, or an even lower rank.

FIG. 2 is a block diagram of another example content identification system **200**. The content identification system **200**, can, for example, be implemented in a computer device or more than one computer devices connected through a network, e.g., a LAN or a WAN. Example computing devices are shown and described with reference to FIG. 12. Other implementations, however, can also be used.

The content identification system **200** can, for example, include a mining engine **202**, a content data store **204**, and an adjusting engine **206**. In one implementation, the content data store **204** can comprise a unitary data store, such as a hard drive. In another implementation, the content data store **204** can comprise a distributed data store, such as a storage system that is distributed over a network. Other implementations, however, can also be used.

In one implementation the content data store **204** can store click logs **210** and query logs **208**, and the mining engine **202** can mine the query logs **208** and click logs **210** to identify

6

query paths associated with the selections of content items. Different types of query logs **208** and click logs **210** can be identified. In one implementation, the query logs **206** can store queries submitted by users, and the click logs **210** can define content items **216** retrieved in response to the queries.

In one implementation, the mining engine **202** can, for example, identify content terminuses **214** defined by the click logs **210** and identify query paths **212** defined by the query logs **208**. The query paths **212** can, for example, be associated with a content item **216** by a content terminus **214**, e.g., the terminus of a query path that corresponds to an eventual-selection of a content item **216**. In one implementation, the content terminus **214** can be implemented as a node association of one or more query paths **212** with one or more content items **216**, e.g., web pages. In another implementation, the content terminus **214** can be a content item **216**, e.g., a URL associated with a web document. Other implementations can also be used.

In one implementation, the mining engine **202** can, for example, identify a context of a search session. For example, a search context can be defined by multiple queries of a particular search session **218**. The mining engine **202** can, for example, determine whether one or more queries of a search session relate to an identified query path **212**. Accordingly, the content item **216** associated with the identified query path **212** and/or content terminus **214** can be ranked higher in response to a search query considered in the search context than when the query is considered absent of any context.

The content identification system **200** can, for example, implement some or all of the functions of the content identification system **100** of FIG. 1. For example, the mining engine **202** can identify query paths, context terminuses, and categories as described with respect to FIG. 1 above. Likewise, the adjusting engine **206** can increase or decrease the rankings of content items **216** according to an identified search session category, and/or an identified context of a search session. In one implementation, the mining engine **202** and the adjusting engine **206** can be integrated into a search engine. In another implementation, the mining engine **202** and the adjusting engine **206** can be in data communication with a search engine and adjust the search engine results accordingly. Other implementations can also be used, e.g., the adjusting engine **206** can include a search engine.

FIG. 3 is a block diagram of an association **300** of one or more queries **Q11**, **Q12**, **Q13**, **Q14**, **Q15** and **Q16** and a content item **310**. The association **300** illustrates the association of multiple query paths, e.g., query paths **320** and **330**, with a content terminus **310**. In one implementation, the content terminus **310** can, for example, be a content item, such as URL for a publisher web site, an ftp link, a network address, a data file; or some other content or content address.

In another implementation, illustrated by the dashed URLs **312** and **314**, the content terminus **310** can define an association of the query paths **320** and **330** with multiple content items, e.g., the URLs **312** and **314**. For example, statistically significant portions of users that have provided queries in the context of the query paths **320** and **330** may have eventually selected the URLs **312** and **314**. Accordingly, the content terminus **310** is representative of the association of the query paths **320** and **330** with the content items defined by the URLs **312** and **314**.

The queries **Q11**, **Q12** and **Q13**, or permutations thereof, can define a first query path **320**, and the queries **Q14**, **Q15** and **Q16**, or permutations thereof, can define a second query path **330**. A search session having queries in common with the query path **310**, e.g., **Q12** followed by **Q11**, or **Q12** followed

by Q13, or Q11 followed by Q13, for example, can be identified as having a context related to the query path 310.

In one implementation, a search session can be identified, as having a context related to a query path only if all the queries of the search session define an exclusive union with the query path. For example, a search session defined by queries Q11, Q18 and Q13 would not be identified as having a context related to the query path 310; a search session defined only by two or more of the queries Q11, Q12 and Q13, however, would be identified as having a context related to the query path 310. In another implementation, a search session can be identified as having a context related to a query path if some of the queries of the search session define a union with the query path. For example, a search session defined by queries Q11, Q18 and Q12 would be identified as having a context related to the query path 310, despite the fact that the query Q18 is not included in the identified query path 310.

FIG. 4 is another block diagram of an association 400 of one or more queries Q21, Q22, Q23, Q24, Q25 and Q26 and content items 410 and 420. The association 400 illustrates the association of query paths having common queries e.g., first and second query paths 430 and 440 and queries Q21 and Q22. The queries Q21, Q22, Q23 and Q24, or permutations thereof can, for example, define the first query path 430, and the queries Q21, Q22, Q25 and Q26, or permutations thereof can, for example, define the second query path 440.

In one implementation, a search session can be identified as having a context related to a query path only if all of the queries of the search session define an exclusive union with a query path. For example, a search session defined by queries Q21 and Q22 would be identified as having a context related to the query paths 430 and 440; likewise, a search session defined by queries Q21, Q25, and Q22 would be identified as having a context related to the query path 440. In another implementation, a search session can be identified as having a context related to a query path if some of the queries of the search session are common to the query path, e.g., a search session defined by queries Q21, Q23 and Q26 can be identified as having a context related to both of the query paths 410 and 420.

FIG. 5 is an example query and ranking table 500. The query and ranking table 500 illustrates different ranking adjustments for an example query path 502 defined by the queries Q0, Q1, Q2, Q3, Q4 and Q5 associated with two content items C1 and C2.

As shown in the query and ranking table 500, queries Q0, Q1, Q3 and Q5 are received during a first search session 510. For the first query Q0, the content items C1 and C2 are, for example, respectively ranked 237 and 331 in a list of search results for the query Q0 absent any context. Because the query Q0 alone may not identify a particular context, the rankings of the content items C1 and C2 are not adjusted.

For the second query Q1, the content items C1 and C2 are, for example, respectively ranked 237 and 331 in a list of search results for the query Q1 absent any context. However, the queries Q1 and Q0 can, for example, define a context related to the query path 502. Accordingly, the rankings of the content items C1 and C2 can be adjusted, e.g., the content items can be respectively ranked 30 and 41.

For the third query Q3, the content items C1 and C2 are, for example, respectively ranked 111 and 64 in a list of search results for the query Q3 absent any context. However, the queries Q3, Q1 and Q0 can, for example, define the context related to the query path 502. Accordingly the rankings of the content items C1 and C2 can be adjusted, e.g., the content items can be respectively ranked 3 and 4.

For the fourth query Q5, the content items C1 and C2 are, for example, respectively ranked 83 and 120 in a list of search results for the query Q5 absent any context. However, the queries Q5, Q3, Q1 and Q0 can, for example, define the context related to the query path 502. Accordingly, the rankings of the content items C1 and C2 can be adjusted, e.g., the content items can be respectively ranked 1 and 2.

Likewise, queries Q0, Q6, Q4, Q3 and Q5 are received during a second search session 520. For the first query Q0, the content items C1 and C2 are, for example, respectively ranked 237 and 331 in a list of search results for the query Q0 absent any context. Because the query Q0 alone may not identify a particular context, the rankings of the content items C1 and C2 are not adjusted.

For the second query Q6, the content items C1 and C2 are, for example, respectively ranked 94 and 72 in a list of search results for the query Q1 absent any context. Because the queries Q0 and Q6 may not identify a particular context, the rankings of the content items C1 and C2 are not adjusted.

For the third query Q4, the content items C1 and C2 are, for example, respectively ranked 88 and 188 in a list of search results for the query Q4 absent any context. However, the queries Q4 and Q0 can, for example, define the context related to the query path 502. Accordingly, the rankings of the content items C1 and C2 can be adjusted, e.g., the content items can be respectively ranked 34 and 38.

For the fourth query Q3, the content items C1 and C2 are, for example, respectively ranked 111 and 64 in a list of search results for the query Q3 absent any context. However, the queries Q4, Q3 and Q0 can, for example, define the context related to the query path 502. Accordingly, the rankings of the content items C1 and C2 can be adjusted, e.g., the content items can be respectively ranked 1 and 2. Finally, the fifth query Q5 results in a similarly adjusted ranking.

FIG. 6 is a flow diagram of an example process 600 for identifying content items. The process 600 can, for example, be implemented in a system such as the content identification system 100 of FIG. 1 and/or the content identification system 200 of FIG. 2.

Stage 602 identifies query paths associated with content items. For example, the contextual search engine 102 or the mining engine 202 can identify query paths associated with content items.

Stage 604 identifies a context of a search session. For example, the contextual search engine 102 or the mining engine 202 can identify a context of a search session by comparing queries of the search session to identified query paths. In one implementation, query terms of a search session can be compared to the queries defining an identified query path for an exact match. In another implementation, query terms of a search session can be compared to the queries defining an identified query path to determine a degree of similarity, e.g., the term "apple" could be determined to have no similarity to the term "brown bear," while the term "grizzly bear" could be determined to have a high degree of similarity to the term "brown bear."

Stage 606 determines whether the context is related to one or more query paths. For example, the contextual search engine 102 or the mining engine 202 can determine whether the context is related to one or more query paths based on an exclusive union of query terms of the search session with an identified query path, or a union of some of the query terms of the search session with an identified query path, or a percentage of similar query terms, or based on some other determination.

Stage 608 identifies content items responsive to a query of the search session based on the determination. For example,

the contextual search engine **102** or the adjusting engine **206** can identify content items responsive to a query of a search session based on the determination of whether the context is related to one or more query paths, e.g., the relevance of content items responsive to the query in the context of an associated query path may be increased or decreased.

Stage **610** adjusts a ranking of a content item responsive to a query of the search session based on the determination. For example, the contextual search engine **102** or the adjusting engine **206** can adjust a ranking of a content item based on the determination of whether the context is related to one or more query paths.

FIG. **7** is a flow diagram of an example process **700** identifying query paths. The process **700** can, for example, be implemented in a system such as the content identification system **100** of FIG. **1** and/or the content identification system **200** of FIG. **2**.

Stage **702** identifies query series terminating at a content item. For example, the contextual search engine **102** or the mining engine **202** can identify a series of queries that resulted in a selection of a content item based on an analysis of click logs and query logs.

Stage **704** determines whether the series of queries is statistically significant. For example, the contextual search engine **102** or the mining engine **202** can determine whether the series of queries is statistically significant if a threshold percentage of search sessions, e.g., 10%, include the same or similar query series that preceded a selection of the content item.

Upon a positive determination from stage **704**, stage **706** defines the series of queries as a query path. For example, the contextual search engine **102** or the mining engine **202** can define a query path based on the series of queries of a permutation thereof.

Conversely, upon a negative determination from stage **704**, stage **708** defines the series of queries as a noise path, e.g. a statistically insignificant query series. For example, the contextual search engine **102** or the mining engine **202** can define the series of queries as a noise path.

FIG. **8** is a flow diagram of an example process **800** for identifying a search session context. The process **800** can, for example, be implemented in a system such as the content identification system **100** of FIG. **1** and/or the content identification system **200** of FIG. **2**.

Stage **802** identifies queries in a search session. For example, the contextual search engine **102** or the mining engine **202** can identify queries of a search session, e.g., by storing queries received from a client over a network.

Stage **804** compares the identified queries to query paths. For example, the contextual search engine **102** or the mining engine **202** can compare the stored queries to the identified query paths.

Stage **806** identifies contexts based on the comparison. For example, the contextual search engine **102** or the mining engine **202** can determine that the search session can be in the context of one or more query paths based on a non-exclusive union, or an exclusive union, or on some other basis.

FIG. **9** is a flow diagram of an example process **900** for identifying content items. The process **900** can, for example, be implemented in a system such as the content identification system **100** of FIG. **1** and/or the content identification system **200** of FIG. **2**.

Stage **902** analyzes query logs and click logs. For example, the contextual search engine **102** or the mining engine **202** can analyze query logs and click logs.

Stage **904** identifies statistical search patterns based on the analysis of the click logs and query logs. For example, the

contextual search engine **102** or the mining engine **202** can identify statistically significant search patterns, e.g., query paths, based on the analysis of the query logs and click logs.

Stage **906** compares a search session to the statistical search patterns.

For example, the contextual search engine **102** or the mining engine **202** can compare a search session to the statistical search patterns, Stage **908** identifies content items responsive to a query of the search session. For example, the contextual search engine **102** or the adjusting engine **206** can identify content items responsive to a query of the search session.

Stage **910** adjusts a ranking of content items responsive to a search session query based on the comparison. For example, the contextual search engine **102** or the adjusting engine **206** can adjust a ranking of content items responsive to a search session query based on the comparison.

FIG. **10** is a flow diagram of an example process **1000** for scaling a ranking adjustment. The process **1000** can, for example, be implemented in a system such as the content identification system **100** of FIG. **1** and/or the content identification system **200** of FIG. **2**.

Stage **1002** identifies content items associated with a content terminus. For example, the contextual search engine **102** or the mining engine **202** can identify content items associated with a content terminus.

Stage **1004** associates a selection distribution for each content item associated with a content terminus. For example, the contextual search engine **102** or the mining engine **202** can associate a selection distribution for each content item associated with a content terminus.

Stage **1006** scales the adjustment of each content item ranking, in one implementation, in substantial proportion to the associated selection distribution. For example, the contextual search engine **102** or the mining engine **202** can scale the adjustment of each content item ranking in substantial proportion to the associated selection distribution, e.g., a content item with a selection distribution of 40% may be scaled more that a content item was a selection distribution of 5%.

FIG. **11** is a flow diagram of an example process **1100** of identifying content items based on a search session category. The process **1100** can, for example, be implemented in a system such as the content identification system **100** of FIG. **1** and/or the content identification system **200** of FIG. **2**.

Stage **1102** identifies a search session category for each identified query path. For example, the contextual search engine **102** or the mining engine **202** can identify a search session category for each of the query paths, e.g., by evaluating the query keywords and content associated with a content terminus or content item. For example, a query path may have an identified category of "extreme sports" if the queries and associated content include subjects such as "base jumping," "rock climbing," etc.

Stage **1104** identifies a current search session category. For example, the contextual search engine **102** or the mining engine **202** can identify a search session category of a current search session by comparing queries of the current search session to the queries of an identified query path; if the queries of the current search session are common to the queries of an identified query path, then the search session category can be identified as the same category of the identified query path. In another implementation, the search terms of the query of the current search session can be processed to identify a category. Other identification techniques can also be used.

Stage **1106** determines whether the current search session category relates to an identified search session category. For example, the contextual search engine **102** or the mining

11

engine **202** can determine whether the current search session category relates to an identified previous search session category, e.g., either by an exact relationship or a similar relationship. For example, the category of “sports” may be determined to be of a similar relationship to “extreme sports.”

In one implementation, adjustments of content item rankings can be scaled according to the identified relation. For example, if the current search session category relates exactly to a category of an identified query path, content items associated with the identified query path can be adjusted to a maximum degree, e.g., a rank may be increased by an order of magnitude, or by a certain value, or to a value that ensures that the content item will be displayed on a first display page to a user. Conversely, if the current search session category is only similarly related to a category of an identified query path, content items associated with the identified query path can be adjusted to a lesser, e.g., minimum, degree. Other adjustment schemes can also be used.

FIG. **12** is block diagram of an example computer system **1200**. The system **1200** includes a processor **1212**, a memory **1220**, a storage device **1230**, and an input/output device **1240**. Each of the components **1212**, **1220**, **1230**, and **1240** can, for example, be interconnected using a system bus **1250**. The processor **1212** is capable of processing instructions for execution within the system **1200**. In one implementation, the processor **1212** is a single-threaded processor. In another implementation, the processor **1212** is a multi-threaded processor. The processor **1212** is capable of processing instructions stored in the memory **1220** or on the storage device **1230**.

The memory **1220** stores information within the system **1200**. In one implementation, the memory **1220** is a computer-readable medium. In one implementation, the memory **1220** is a volatile memory unit. In another implementation, the memory **1220** is a non-volatile memory unit.

The storage device **1230** is capable of providing mass storage for the system **1200**. In one implementation, the storage device **1230** is a computer-readable medium. In various different implementations, the storage device **1230** can, for example, include a hard disk device, an optical disk device, or some other large capacity storage device.

The input/output device **1240** provides input/output operations for the system **1200**. In one implementation, the input/output device **1240** can include one or more of a network interface devices, e.g., an Ethernet card, a serial communication device, e.g., and RS-232 port, and/or a wireless interface device, e.g., and 802.11 card. In another implementation, the input/output device can include driver devices configured to receive input data and send output data to other input/output devices, e.g., keyboard, printer and display devices **1260**.

Queries can, for example, be received from client devices that can be implemented on computer systems similar to the computer system **1200** of FIG. **12**. Other implementations, however, can also be used, such as mobile computing devices, mobile communication devices, set-top box television client devices, etc.

The apparatus, methods, flow diagrams, and structure block diagrams described in this patent document may be implemented in computer processing systems including program code comprising program instructions that are executable by the computer processing system. Other implementations may also be used. Additionally, the flow diagrams and structure block diagrams described in this patent document, which describe particular methods and/or corresponding acts in support of steps and corresponding functions in support of

12

disclosed structural means, may also be utilized to implement corresponding software structures and algorithms, and equivalents thereof.

This written description sets forth the best mode of the invention and provides examples to describe the invention and to enable a person of ordinary skill in the art to make and use the invention. This written description does not limit the invention to the precise terms set forth. Thus, while the invention has been described in detail with reference to the examples set forth above, those of ordinary skill in the art may effect alterations, modifications and variations to the examples without departing from the scope of the invention.

What is claimed is:

**1.** A computer-implemented method, comprising:

selecting, by a computer, query paths, each query path being a plurality of queries sequenced in an order in which the queries were provided for a previous search session;

identifying, by the computer, content terminuses, each content terminus defining a terminus of a query path and corresponding to a selection of a content item in response to a query in the query path;

identifying, by the computer, a context of a current search session, wherein the context is defined by a plurality of search session queries of the current search session;

determining, by the computer, that the context is related to a selected query path of the selected query paths only if two or more of the queries of the selected query path are similar to two or more of the search session queries of the current search session;

identifying, by the computer, two or more content items responsive to a query of the current search session based on the determination, the two or more content items being associated with a content terminus;

for each of the two or more content items, determining a corresponding likelihood that the content item will be selected given the content terminus and respective query path; and

adjusting a ranking of each of the two or more content items in substantially proportional relation to the corresponding likelihood.

**2.** The method of claim **1**, wherein:

identifying content terminuses comprises:

identifying content terminuses defined by click logs identifying a selection of a content item.

**3.** The method of claim **1**, wherein:

determining that the context is related to a selected query path comprises:

identifying a union of the two or more of the queries of the selected query path and the two or more of the search session queries of the current search session.

**4.** The method of claim **3**, comprising:

determining that the context is related to the selected query path if the identified union is an exclusive union.

**5.** A computer-implemented method, comprising:

analyzing, by a computer, click logs and query logs;

selecting, by the computer, statistical search patterns associated with content items based on the analysis of the click logs and query logs, wherein each statistical search pattern is defined by a plurality of queries sequenced in an order in which the queries were provided for a previous search session;

comparing, by the computer, a plurality of queries received for a current search session to the selected statistical search patterns;

determining, by the computer, that the current search session is related to a selected statistical search pattern only

## 13

if two or more of the queries of the selected statistical search pattern are similar to two or more of the queries of the current search session;

identifying, by the computer, two or more content items responsive to a query of the current search session based on the determination, the two or more content items being associated with a statistical search pattern;

for each of the two or more content items, determining a corresponding likelihood that the content item will be selected based on the statistical search pattern; and

adjusting, by the computer, a ranking of each of the two or more content items in substantially proportional relation to the corresponding likelihood.

6. The method of claim 5, wherein:

the click logs define content items responsive to previous search session queries.

7. The method of claim 6, wherein:

the query logs comprise previous search session queries.

8. The method of claim 7, wherein selecting statistical search patterns comprises:

identifying content terminuses defined by the click logs; and

identifying query paths terminating at the content terminuses.

9. The method of claim 8, further comprising:

identifying a search session category for each of the query paths.

10. The method of claim 9, further comprising:

identifying a current search session category.

11. The method claim 10, further comprising:

determining whether the current search session category relates to one of the identified search session categories.

12. The method of claim 10, further comprising:

identifying a content category for each of the content terminuses; and

determining whether the current search session category relates to an identified content category.

13. The method of claim 5, wherein the content items comprise webpages.

14. A system, comprising:

a data processor;

a computer memory device;

mining engine stored in the computer memory device and upon execution by the data processor mines click logs and query logs and selects query paths and content terminuses associated with the query paths, each query path being a plurality of queries sequenced in an order in which the queries were provided in a previous search session, and each content terminus being a terminus of a query path and corresponding to a selection of a content item in response to a query in the query path; and

## 14

a contextual search engine stored in the computer memory device and upon execution by the data processor:

identifies a context in a current search session, the context defined by a plurality of queries of the current search session;

determines that the context is related to a content terminus only if two or more of the queries of the query path associated with the content terminus are similar to two or more of the queries of the current search session;

identifies two or more content items responsive to a query of the current search session based on the determination, the two or more content items being associated with a content terminus;

for each of the two or more content items, determine a corresponding likelihood that the content item will be selected given the content terminus and respective query path; and

adjusts a ranking of each of the two or more content items in substantially proportional relation to the corresponding likelihood.

15. A system, comprising:

means for selecting content terminuses associated with content items, each content terminus defining a terminus of a query path, and each query path being a plurality of queries sequenced in an order in which the queries were provided in a previous search session and each content terminus corresponding to a selection of a content item in response to a query in the query path;

means for identifying a context in a current search session, wherein the context is defined by a plurality of queries of the current search session;

means for determining that the context is related to a content terminus only if two or more of the queries of the query path associated with the content terminus are similar to two or more queries of the current search session; and

means for identifying two or more content items responsive to a query of the current search session based on the determination, the two or more content items being associated with a content terminus;

means for determining for each of the two or more content items a corresponding likelihood that the content item will be selected given the content terminus and respective query path; and

means for adjusting a ranking of each of the two or more content items in substantially proportional relation to the corresponding likelihood.

\* \* \* \* \*