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(54) Title: QUERY RANKING MODELS

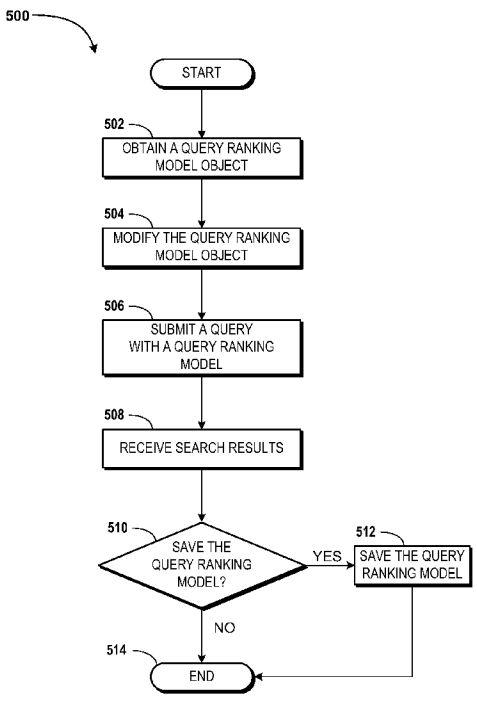

FIG. 5

(57) Abstract: Concepts and technologies are described herein for query ranking models. In accordance with the concepts and technologies disclosed herein, a search engine can be configured to expose a query ranking model object corresponding to a ranking function used by the search engine. A query application can be configured to obtain the query ranking model object and generate a query ranking model based upon the query ranking model object. The query ranking model can include one or more features and respective weights. The query application can generate a query and include data with the query identifying the query ranking model that is to be used to rank search results generated by the search engine. The query application also can be configured to manage query ranking models to allow creation, modification, and/or deletion of query ranking models as well as weights of features of the query ranking models.

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QUERY RANKING MODELS

BACKGROUND

[0001] The proliferation of data creation and storage has resulted in an increased reliance upon various search technologies for identifying and accessing data. Generally speaking, documents or records accessible at a particular location may be indexed by a search engine and data relating to the indexed information can be stored at a database or other data structure accessible to various systems or devices. Thus, when a search query is submitted to a search engine, the search engine can execute the query against the search index, determine if records or documents matching the search query are present in the search index, order the identified records or documents in accordance with a ranking function, and return search results.

[0002] The ranking of search results is often based upon popularity of the respective search results and/or a respective determined relevancy to the submitted query. Thus, for example, if a search term appears in a document, the document can be determined to be relevant to the search query. Similarly, clicks on particular results can be logged and used to affect ranking of a document or record corresponding to the particular result in future result sets.

[0003] In some instances, however, documents or records identified as being popular and/or relevant may or may not be of interest to a particular entity. As such, ranking of the documents or records in accordance with popularity-based and/or relevance-based considerations may not be helpful to some searchers. Similarly, some documents or records are ranked higher in result sets based upon sponsorship or advertising fees. Thus, highly ranked documents or records may be of little to no interest to a searcher.

[0004] It is with respect to these and other considerations that the disclosure made herein is presented.

SUMMARY

[0005] Concepts and technologies are described herein for query ranking models. In accordance with the concepts and technologies disclosed herein, a search engine can be configured to expose a ranking function used to rank or order search results. The ranking function can be exposed as an object such as a query ranking model object. If an entity accessed the search engine, the query ranking model object can be exposed to the entity, transmitted to the entity, and/or downloaded by the entity. In some embodiments, a computing device accessed the search engine via a web browser or other application.

[0006] The computing device can execute a query application and/or can access query application functionality provided by the search engine. The query application can be configured to receive or otherwise obtain the query ranking model object and generate a query ranking model based upon the query ranking model object. The query ranking model can include one or more features. The "features" can include various aspects or considerations of ranking search results that are to be considered by the search engine when ranking the search results. According to various embodiments, the query ranking model can include data specifying weights assigned to the various features of the query ranking model. The computing device can be configured to generate and/or store any number of query ranking models.

[0007] The computing device can generate a query and include data with the query identifying the query ranking model that is to be used to rank search results generated by the search engine. In some embodiments, the computing device can be configured to submit the query ranking model as an object that can be submitted with the query. Alternatively, the query ranking model can be identified by a flag or other data included in the query and stored elsewhere such as at the search engine, at a social networking server, with an online profile, and/or elsewhere. As such, a particular query ranking model can be specified for a particular query, if desired.

[0008] The computing device also can be configured to manage query ranking models. The computing device can be configured to allow creation, modification, and/or deletion of query ranking models. The weights of features of the query ranking models can be adjusted. Additionally, or alternatively, the features themselves can be adjusted and/or features can be added to and/or removed from the query ranking models. Changes to the query ranking models can be saved and or used for single searches, if desired. In some implementations, query ranking models can be associated with particular devices and/or users of a search engine or other search services or applications. As such, each user or device can use a personalized query ranking model, if desired.

[0009] It should be appreciated that the above-described subject matter may be implemented as a computer-controlled apparatus, a computer process, a computing system, or as an article of manufacture such as a computer-readable storage medium. These and various other features will be apparent from a reading of the following Detailed Description and a review of the associated drawings.

[0010] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended

to identify key features or essential features of the claimed subject matter, nor is it intended that this Summary be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIGURE **1** is a system diagram illustrating an illustrative operating environment for the various embodiments disclosed herein.

[0012] FIGURE **2** is a line diagram schematically showing additional aspects of a query ranking model, according to an illustrative embodiment.

[0013] FIGURE **3** is a user interface diagram showing aspects of a user interface for performing a search using a query ranking model, according to an illustrative embodiment.

[0014] FIGURE **4** is a user interface diagram showing aspects of a user interface for presenting and modifying query ranking models, according to an illustrative embodiment.

[0015] FIGURE **5** is a flow diagram showing aspects of a method for performing a search using a query ranking model, according to an illustrative embodiment.

[0016] FIGURE **6** is a flow diagram showing aspects of a method for modifying a query ranking model, according to an illustrative embodiment.

[0017] FIGURE **7** is a computer architecture diagram illustrating an illustrative computer hardware and software architecture for a computing system capable of implementing aspects of the embodiments presented herein.

[0018] FIGURE **8** is a diagram illustrating a distributed computing environment capable of implementing aspects of the embodiments presented herein.

[0019] FIGURE **9** is a computer architecture diagram illustrating a computing device architecture capable of implementing aspects of the embodiments presented herein.

DETAILED DESCRIPTION

[0020] The following detailed description is directed to concepts and technologies for query ranking models. According to the concepts and technologies described herein, a search engine can be configured to expose ranking function as an object such as a query ranking model object. A query application can be configured to obtain the query ranking model object and generate a query ranking model based upon the query ranking model object. The query ranking model can include one or more features, as well as weights assigned to the features. Thus, the query ranking model can include an indication of what

aspects of documents or records are to be considered during ranking of search results, as well as relative weights of the aspects.

[0021] The query application can generate a query. The query can include data identifying the query ranking model that is to be used to rank search results generated by the search engine in response to the query. Search results can be received by a computing device, for example, a computing device configured to execute the query application. The search results can be ordered and/or ranked in accordance with the query ranking model submitted with the query and/or identified by the data included in the query. The query application also can be configured to manage query ranking models to allow creation, modification, and/or deletion of query ranking models. Additionally, or alternatively, weights associated with one or more features of the query ranking models can be modified by the query application, and updated or new query ranking models can be saved and used for present or future queries.

[0022] While the subject matter described herein is presented in the general context of program modules that execute in conjunction with the execution of an operating system and application programs on a computer system, those skilled in the art will recognize that other implementations may be performed in combination with other types of program modules. Generally, program modules include routines, programs, components, data structures, and other types of structures that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the subject matter described herein may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, minicomputers, mainframe computers, and the like.

[0023] In the following detailed description, references are made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration specific embodiments or examples. Referring now to the drawings, in which like numerals represent like elements throughout the several figures, aspects of a computing system, computer-readable storage medium, and computer-implemented methodology for query ranking models will be presented.

[0024] Referring now to FIGURE **1**, aspects of one operating environment **100** for the various embodiments presented herein will be described. The operating environment **100** shown in FIGURE **1** includes a computing device **102**. According to various embodiments, the functionality of the computing device **102** can be provided by a personal computer ("PC") such as a desktop, tablet, or laptop computer system. The functionality of the

computing device **102** also can be provided by other types of computing systems including, but not limited to, server computers, handheld computers, netbook computers, embedded computer systems, personal digital assistants, mobile telephones, smart phones, or other devices or systems capable of executing the various software elements described herein in detail. For purposes of describing the concepts and technologies disclosed herein, the computing device **102** is described herein as a personal computing device such as a PC, smartphone, or tablet computer. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0025] According to some embodiments, the computing device **102** is configured to operate in communication with, or as part of, a communications network ("network") **104**. In some other embodiments, the computing device **102** does not operate in communication with the network **104**. The computing device **102** can be configured to execute an operating system **106** and one or more application programs, modules, software elements, or other computer-executable or computer readable instructions such as, for example, a query application **108**.

[0026] The operating system **106** is a computer program for controlling the operation of the computing device **102**. The query application **108** can include an executable program configured to execute on top of the operating system **106** to provide the functionality described herein for creating, modifying, and/or using query ranking models. Although the query application **108** is illustrated as executing at the computing device **102**, it should be understood that the query application **108** may be embodied as an application or module executing on a device remote from the computing device **102** such as a web server, a search engine, or the like. Thus, the functionality of the query application **108** described herein can be provided by a server computer or web server that is executed by an application program executing on the computing device **102** such as a web browser or other application program. Therefore, it should be understood that the illustrated embodiment is illustrative, and should not be construed as being limiting in any way.

[0027] The query application **108** can be configured to obtain a query ranking model object **110**. The query ranking model object **110** can include an object exposed by various applications, services, and/or devices. In some contemplated embodiments, a search engine **112** can be configured to expose the query ranking model object **110** to searchers and/or other entities. Thus, the search engine **112** can be configured to allow searchers or other entities to determine how results generated by the search engine are to be ranked and/or ordered. In some embodiments, as will be described in more detail below, the query

application **108** can be configured to obtain the query ranking model object **110**, to modify one or more aspects of the query ranking model object **110**, and/or to generate a query ranking model **114**.

[0028] The query ranking model **114** generated by the query application **108** can be submitted to the search engine **112** and used to rank and/or order results identified by the search engine **112** in response to searches performed on behalf of the computing device **102**. In some embodiments, the computing device **102** can be configured to submit the query ranking model **114** with a query **116**. In some other embodiments, the computing device **102** can be configured to generate and/or modify query ranking models **114** at the search engine **112** and/or other devices such as social networking services (not illustrated), online profile services, or the like. Thus, the computing device **102** can be configured to submit data identifying the query ranking model **114** to be used to rank and/or order results instead of actually submitting the query ranking model **114** with the query **116**. Therefore, while the illustrated embodiments are described as including the query ranking model **114** with query **116**, it should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0029] As mentioned above, the query application **108** can be configured to modify the query ranking model object **110** to generate the query ranking model **114**. In particular, the query application **108** can be configured to obtain the query ranking model object **110** from the search engine **112** and/or elsewhere, and to identify one or more "features" that are included in the query ranking model object **110**. As used herein, the term "features" can be used to refer to variables, constants, relationships, and/or other aspects of results generated by the search engine **112** that are to be used in ranking results identified by the search engine **112** in response to queries such as the query **116**. Additional aspects of the features, as well as some examples of the features, are illustrated and described in more detail below with reference to FIGURE **2**.

[0030] The query ranking model object **110** can identify one or more features included and/or considered as part of the query ranking model object **110**, as well as respective weights assigned to each of the included features. The weights can include percentages that define a relative importance of the particular feature in determining a rank or order of a particular hit to be included as part of a result set. In some embodiments, the features can be weighted positively and/or negatively to increase or decrease, respectively, a relative rank of a hit based upon matches between the hit and the features included in the query

ranking model object **110**. Features also can be weighted to zero to remove consideration of that feature when ranking and/or ordering results in a result set.

[0031] According to various embodiments, the query application **108** can be configured to obtain the query ranking model object **110** from the search engine **112** or other location, and to allow users or other entities to modify weights assigned to the various features included in the query ranking model object **110**. Additionally, or alternatively, users or other entities can add or remove features included in the query ranking model object **110**. The weights and feature additions or other modifications can be captured by the query application **108** and used to generate the query ranking model **114**.

[0032] According to various embodiments, the query ranking model **114** can be submitted with the query **116** and disposed of immediately thereafter. In some other embodiments, the query ranking model **114** can be stored at the computing device **102**, stored at the search engine **112** as associated with a particular profile or device such as the computing device **102**, and/or can be stored at other devices or services. In some implementations, the query ranking model **114** can be associated with various devices and/or users of the search engine **112** and/or other search services or applications, and as such, each user or device can use a personalized query ranking model **114**. In some embodiments, query ranking models **114** can be stored at social networking services or other services as associated with a particular user, profile, or device and used at various times and/or for various purposes.

[0033] The query application **108** can be configured to generate the query **116** and submit the query **116** to the search engine **112**. As is generally understood, the computing device **102** can render a search page or search portal using a web browser or other application program, and the query **116** can be submitted to the search engine **112** via the search page or search portal. In response to receiving the query **116**, the search engine **112** can perform a search of a search index or other dataset stored at the search engine **112** and/or in communication with the search engine **112**. In the illustrated embodiment, the search engine **112** is illustrated as accessing a data store **118** that stores data against which the query **116** is run. It should be understood that the query **116** described herein can include, but is not limited to, web search strings, database queries, enterprise application search queries, or the like. As such, the data store **118** can include or can store a search index, a site index, a document repository, computing device directories, databases, other information, or the like.

[0034] The search engine **112** can generate a result set based upon the query **116**. In some embodiments, the search engine **112** generates one or more search results **120**. The search results **120** can be returned to a searching entity such as the computing device **102**. The

search results **120** can be provided to the computing device **102** as a result set, as a result page generated by the search engine **112**, and/or in other formats. According to various embodiments, the search results **120** can be ordered and/or ranked in accordance with the query ranking model **114** generated by the computing device **102** as explained herein. As such, the concepts and technologies disclosed herein can be used to obtain, rank, and/or order search results **120** in accordance with a particular query ranking model **114**. Additional aspects of the concepts and technologies disclosed herein for query ranking models **114** are illustrated and described below, particularly with reference to FIGURES **2-6**.

[0035] The concepts and technologies disclosed herein also can be used to provide management of one or more query ranking models **114**. In particular, users or other entities can access one or more query ranking models **114**, select one or more query ranking models **114** for use with a particular query **116**, and/or access functionality of the query application **108** for modifying or creating query ranking models **114**. According to various embodiments, the query application **108** can provide a user interface for managing one or more query ranking models **114**. For example, a user interface for adjusting weights of one or more features of the query ranking models **114** can be provided by the query application **108**.

[0036] Similarly, users or other entities can create new query ranking models **114** via one or more user interfaces ("UIs"). Features can be added to and/or removed from query ranking models **114**, relative weights can be adjusted, and/or modified and/or new query ranking models **114** can be saved and/or used for searches. Various aspects of illustrative UIs for interacting with the query application **108** are illustrated and described in more detail below, particularly with reference to FIGURES **3-4**.

[0037] FIGURE **1** illustrates one computing device **102**, one network **104**, one search engine **112**, and one data store **118**. It should be understood, however, that some implementations of the operating environment **100** include multiple computing devices **102**, multiple networks **104**, zero or multiple search engines **114**, zero or multiple data stores **118**, and/or additional or alternative hardware elements. Thus, the illustrated embodiments should be understood as being illustrative, and should not be construed as being limiting in any way.

[0038] Turning now to FIGURE **2**, additional aspects of the query ranking models **114** will be described in detail, according to some illustrative embodiments. As explained above with reference to FIGURE **1**, the query application **108** can be configured to modify a query

ranking model object **110** to generate the query ranking model **114**. According to various, such as the embodiment illustrated in FIGURE **2**, the query ranking model **114** includes a number of features **200A-N** (hereinafter collectively and/or generically referred to as "features **200**") that can added to the query ranking model **114**, removed from the query ranking model **114**, and/or weighted with respect to one another.

[0039] As noted above, the features **200** can correspond to various parameters, constants, variables, and/or other aspects of functions, algorithms, or the like, that are used or applied by the search engine **112** to rank or order search results **120**. According to various embodiments, the query ranking models **114** can include one or more features **200**, each of which can be weighted according to preferences or settings associated with a user or other entity. Thus, it should be understood that by application of the query ranking models **114** when executing a particular query **116**, the contents of the search results **120** can be changed and/or reordered with respect to one another. In particular, two query ranking models **114** used in accordance with a single query **116** may produce different results and/or different orders of results.

[0040] According to various embodiments, the features **200** can include various aspects or properties of documents, records, devices, or other searched entities or items. Examples of contemplated features **200** include, but are not limited to, freshness of document or record such as a creation or modification data; an average review or relevancy of a particular document or record; an absolute or relative popularity of a particular document or record; averages and/or absolute numbers of likes or dislikes with respect to a particular document or record; determined relevance of a particular document or record to an entered or received query **116**; a geographic location of a resource or source associated with a particular document or record; a network location of a particular document or record; a particular word within a particular document or record, as well as an indication of how early or late the word appears in the document or record; a history of visited pages associated with a particular document or record; combinations thereof, or the like.

[0041] As such, it can be appreciated that a particular query ranking model **114** can include various features **200** that can be weighted with respect to one another to modify orders and/or ranks of search results **120** provided by the search engine **112**. Although not visible in FIGURE **2**, it should be understood that a particular query ranking model **114** also can include a formula defining how the features **200** associated with the query ranking model **114** are applied to documents or records identified by the search engine **112**. As such, the query application **108** can be configured to modify weights of features **200**, as well

as formulas defining how the features are or are not applied during ranking or ordering of the search results **120**. An example embodiment of a UI for modifying a query ranking model **114** is illustrated and described below with reference to FIGURE **4**.

[0042] Turning now to FIGURE **3**, a UI diagram showing various aspects of a user interface for performing a search query using a query ranking model will be described according to an illustrative embodiment. FIGURE **3** shows an illustrative screen display **300** generated by a device such as the computing device **102**, for example, by execution of the query application **108** described herein. It should be appreciated that the UI diagram illustrated in FIGURE **3**is illustrative of one contemplated embodiment, and therefore should not be construed as being limited in any way.

[0043] The screen display **300** can include various menus and/or menu options. It can be appreciated from the embodiment illustrated in FIGURE **3** that the screen display **300** can include an application window generated by a web browser or other software. As such, as mentioned above, it can be appreciated that the functionality of the query application **108** described herein can be provided by a service, web page, or other resource accessed by various applications executed by the computing device **102** in addition to, or instead of, a natively executed or web-based application. The screen display **300** can include a search query input area **302**. As generally is understood, the search query input area **302** can include a text input field and a UI control for submitting the query. Because these and other elements for performing searches are generally understood, the search query input area **302** is not further described herein.

[0044] The screen display **300** also can include a query ranking model menu **304**. The query ranking model menu **304** can include a UI control **306** for selecting whether or not a query ranking model **114** is to be used to rank search results **120** obtained by the computing device **102**. In some embodiments, the query ranking model menu **304** can be hidden and/or expanded in response to detecting selecting and/or deselecting the UI control **306**. In the illustrated embodiment, the UI control **306** has been selected, indicating that the query ranking model **114** is to be submitted with a query **116** such as a search string entered into the search query input area **302**. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0045] The query ranking model menu **304** can include one or more UI controls **308** for selecting a particular query ranking model **114**. As explained above, users or other entities can create multiple query ranking models **114** for various purposes. In the illustrated embodiment, a user or other entity has selected the UI control **308** for indicating that a query

ranking model **114** for web searches is to be used. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0046] The query ranking model menu **304** also can include a UI control for managing query ranking models **114**. Via selection of the UI control **310**, a user or other entity can create, modify, delete, and/or otherwise manage one or more query ranking models **114**. In response to detecting selection of the UI control **310**, the computing device **102** and/or a remotely executed application providing the functionality described herein with respect to the query application **108** can present a query ranking model management screen. An example embodiment of a query ranking model management screen is illustrated and described below with reference to FIGURE **4**.

[0047] Turning now to FIGURE **4**, a UI diagram showing various aspects of a user interface for presenting and modifying query ranking models will be described according to an illustrative embodiment. FIGURE **4** shows an illustrative screen display **400** generated by a device such as the computing device **102**, for example, by execution of the query application **108** described herein. It should be appreciated that the UI diagram illustrated in FIGURE **4** is illustrative of one contemplated embodiment, and therefore should not be construed as being limited in any way.

[0048] The screen display **400** can include various menus and/or menu options as mentioned above with reference to FIGURE **3**. Similarly, it can be appreciated from the embodiment illustrated in FIGURE **4** that the screen display **400** also can be provided by an application program such as a web browser, or the like in addition to, or instead of, a natively executed or web-based query application **108**. The screen display **400** can include a query ranking model management screen **402** as mentioned above. It should be understood that the query ranking model management screen **402** can be, but is not necessarily, presented in response to detecting selection of the UI control **310** illustrated and described above with reference to FIGURE **3**.

[0049] The query ranking model management screen **402** can include various displays and/or controls for creating, modifying, deleting, and/or otherwise managing query ranking models **114**. A particular query ranking model **114** that can be managed can be indicated by an indicator **404A-B** (hereinafter collectively and/or generically referred to as "indicators **404**"). The indicators **404** can provide an indication of a particular query ranking model **114** that can be managed via the query ranking model management screen **402**. It should be understood that the illustrated indicators **404** are illustrative, and should not be construed as being limiting in any way.

[0050] The query ranking model management screen **402** also can include one or more control decks **406A-B** (hereinafter collectively and/or generically referred to as "control decks **406**"). The control decks **406** can include various UI controls for modifying the query ranking models **114**. In the illustrated embodiment, the control decks **406** include one or more slider controls **408** for weighting the various features **200** included in a particular query ranking model **114**. The control decks **406** also can include feature labels **410** for indicating a particular feature **200** that is weighted via manipulation of a respective slider control **408**. It should be understood that that the illustrated feature labels **410** are illustrative only, and that the feature labels **410** can include detailed descriptions of the particular feature **200** controlled by the respective slider control **408**.

[0051] Additionally, while manual manipulation of the slider controls **408** has been described herein, it should be understood that various applications, services, or the like can be configured to modify query ranking models **114**. In one particular embodiment, the query application **108** or other application programs can be configured to access social networking services, online profiles, or the like, to modify weights associated with the various features **200** of a particular query ranking model **114**. Thus, for example, the query application **108** or other program can determine probable preferences associated with the various features **200** based upon external considerations such as a social networking profile, an online profile, or the like, and modify the query ranking model **114** based upon these and/or other considerations. Thus, the query application **108** can be configured to provide personalized search results based upon profiles or other information associated with a particular entity such as a searcher. Because other information can be used to modify the query ranking models **114** without user manipulation of the UIs described herein, it should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

[0052] The control decks **406** also can include UI controls **412** for adding features **200** to the query ranking models **114**. While not visible in the embodiment illustrated in FIGURE **4**, it should be understood that that UI controls for deleting features **200** from the query ranking models **114** also can be included, if desired. Alternatively, a user or other entity can adjust a weight associated with a particular feature **200** to "0," thereby removing the feature **200** from consideration when applying the query ranking model **114**.

[0053] As shown in FIGURE **4**, each feature **200** of a query ranking model **114** can be weighted positively and/or negatively. Thus, the features **200** can be weighted to shift particular search result hits up or down in rankings based upon the various features **200**. In

some embodiments, only positive weightings are allowed or supported, and in some other embodiments, only negative weightings are allowed. As such, it should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0054] The query ranking model management screen **402** also can include a UI control **414** for adding query ranking models **114**. Via selection of the UI control **414**, a user or other entity can create a new query ranking model **114**. Although not shown in FIGURE **4**, UI controls for deleting query ranking models **114** can also be presented on the screen display **400**, if desired. It should be appreciated that via manipulation of the UI controls **412**, the slider controls **408**, and/or other functionality associated with the controls decks **406**, a user or other entity can modify one or more of the query ranking models **114**. According to various embodiments, changes made to the query ranking models **114** via the screen display **400** can be saved by the computing device **102**, used for a particular search, and/or discarded, if desired.

[0055] Turning now to FIGURE **5**, aspects of a method **500** for performing a s search using a query ranking model will be described in detail. It should be understood that the operations of the methods disclosed herein are not necessarily presented in any particular order and that performance of some or all of the operations in an alternative order(s) is possible and is contemplated. The operations have been presented in the demonstrated order for ease of description and illustration. Operations may be added, omitted, and/or performed simultaneously, without departing from the scope of the appended claims.

[0056] It also should be understood that the illustrated methods disclosed herein can be ended at any time and need not be performed in their respective entireties. Some or all operations of the methods disclosed herein, and/or substantially equivalent operations, can be performed by execution of computer-readable instructions included on a computer-storage media, as defined herein. The term "computer-readable instructions," and variants thereof, as used in the description and claims, is used expansively herein to include routines, applications, application modules, program modules, programs, components, data structures, algorithms, and the like. Computer-readable instructions can be implemented on various system configurations, including single-processor or multiprocessor systems, minicomputers, mainframe computers, personal computers, hand-held computing devices, microprocessor-based, programmable consumer electronics, combinations thereof, and the like.

[0057] Thus, it should be appreciated that the logical operations described herein are implemented (1) as a sequence of computer implemented acts or program modules running

on a computing system and/or (5) as interconnected machine logic circuits or circuit modules within the computing system. The implementation is a matter of choice dependent on the performance and other requirements of the computing system. Accordingly, the logical operations described herein are referred to variously as states, operations, structural devices, acts, or modules. These operations, structural devices, acts, and modules may be implemented in software, in firmware, in special purpose digital logic, and any combination thereof.

[0058] For purposes of illustrating and describing the concepts of the present disclosure, the methods disclosed herein are described as being performed by the computing device **102** via execution of computer executable instructions such as, for example, the query application **108**. It should be understood that these embodiments are illustrative, and should not be viewed as being limiting in any way. In particular, devices other than and/or in addition to the computing device **102** can provide the functionality described herein via execution of computer executable instructions other than and/or in addition to the query application **108**.

[0059] The method **500** begins at operation **502**, wherein the computing device **102** obtains a query ranking model object **110**. According to various embodiments, the search engine **112** can be configured to expose the query ranking model object **110** to the computing device **102** and/or other devices accessing the search engine **112**. As such, it should be understood that the computing device **102** can receive the query ranking model object **110** in response to accessing the search engine **112**, in response to requesting the query ranking model object **110**, and/or at other times.

[0060] From operation **502**, the method **500** proceeds to operation **504**, wherein the computing device **102** modifies the query ranking model object **110** to generate a query ranking model **114**. As explained above, and as illustrated and described above with reference to FIGURE **4**, the computing device **102** can be configured to present a UI for adding, modifying, and/or deleting features **200** from a query ranking model object **110** to generate the query ranking model **114**. As such, operation **504** can include presentation of the screen display **400** and/or other UIs, as well as obtaining input and/or capturing interactions with the screen display **400** and/or other UIs.

[0061] From operation **504**, the method **500** proceeds to operation **506**, wherein the computing device **102** submits a query such as the query **116** to the search engine **112**. As illustrated and described above with reference to FIGURE **1**, the query **116** submitted by the computing device **102** can include the query ranking model **114**. In some embodiments,

the query ranking model **114** is submitted with the query **116**. In some other embodiments, the query ranking model **114** is stored at the search engine **112**, and the query **116** can include a flag or other data identifying the query ranking model **114** to be used in ranking search results **120** generated by the search engine **112** in response to the query **116**. Thus, it should be understood that operation **506** encompasses submitting the query **116** and identifying and/or including a query ranking model **114** to be used in ranking the search results **120**.

[0062] From operation **506**, the method **500** proceeds to operation **508**, wherein the computing device **102** receives the search results **120**. As explained herein, the search results **120** received by the computing device **102** can be ranked in accordance with the query ranking model **114**. Thus, the concepts and technologies disclosed herein can allow users or other entities to modify ranking models used to order and/or rank the search results **120** when submitting a query **116**, and the search results **120** can be ranked in accordance with the user's or other entity's preferences.

[0063] From operation **508**, the method **500** proceeds to operation **510**, wherein the computing device **102** determines if the query ranking model **114** submitted with and/or identified in the query **116** in operation **506** is to be saved. The query ranking models **114** can be saved at the computing device **102** and/or elsewhere. In particular, in some embodiments the query ranking models **114** can be saved at the computing device **102** as, for example, preferences, configurations, or settings associated with the query application **108**, a web browser, a profile, or the like. In some other embodiments, the query ranking model **114** can be saved as part of an online profile associated with a user. For example, the query ranking models **114** can be saved as part of a social networking profile of a social networking service, as part of a search profile associated with the search engine **112**, as a user profile associated with an enterprise data delivery service, or the like. Because the query ranking models **114** can be saved at other devices and/or locations, it should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

[0064] If the computing device **102** determines, in operation **510**, that the query ranking model **114** is to be saved, the method **500** can proceed to operation **512**. In operation **512**, the computing device **102** can save the query ranking model **114**. The saved query ranking model **114** can be associated with a particular entity such as, for example, the computing device **102**, a user of the computing device **102**, a social networking profile, an online profile, or the like. As such, the query ranking model **114** can be saved and associated with

a particular entity for future retrieval and use, if desired. As explained above, the query ranking model **114** can be saved at one or more local and/or remote devices. From operation **512**, and/or from operation **510** if the computing device **102** determines that the query ranking model **114** is not to be saved, the method **500** proceeds to operation **514**. The method **500** ends at operation **514**.

[0065] Turning now to FIGURE **6**, aspects of a method **600** for modifying a query ranking model will be described in detail. It should be understood that the functionality described herein with reference to FIGURE **6** can, but is not necessarily, provided by the computing device **102** in response to a user accessing a query ranking model management screen such as the query ranking model management screen **402** illustrated and described above with reference to FIGURE **4**.

[0066] The method **600** begins at operation **602**, wherein the computing device **102** obtains a query ranking model **114**. In some embodiments, the query ranking model **114** can be obtained in response to detecting a selection of a particular query ranking model **114** from a list of query ranking models **114** and/or in response to selection of an option to modify a query ranking model **114** where only one query ranking model **114** is stored. In operation **602**, the computing device **102** can obtain information describing the query ranking model **114** such as, for example, a definition of the query ranking model **114** such as a formula identifying one or more features **200** included in the query ranking model **114** as well as the respective weights thereof. Because obtaining the query ranking model **114** can include obtaining additional and/or alternative data, it should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0067] From operation **602**, the method **600** proceeds to operation **604**, wherein the computing device **102** can adjust feature weights (weights of one or more features **200**) of the query ranking model **114**. It should be understood that the computing device **102** can be configured to present a UI for adjusting the feature weights. In some embodiments, for example, the computing device **102** can be configured to present the query ranking model management screen **402** illustrated and described above with reference to FIGURE **4**. In some other embodiments, the computing device **102** can obtain input from users or other entities for adjusting the feature weights of the query ranking model **114**. As such, operation **604** can include detecting modification of at least one weight of at least one feature **200**. Because the method **600** can be ended at any time, it should be understood that that the computing device **102** can terminate the method **600** without modifying the query ranking

model **114**. As such, it should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0068] From operation **604**, the method **600** proceeds to operation **606**, wherein the computing device **102** can determine if the features **200** of the query ranking model **114** are to be modified. Thus, the computing device **102** can determine, for example, if a feature **200** is to be added to the query ranking model **114** and/or if a feature **200** of the query ranking model **114** is to be removed from the query ranking model **114**. It should be understood that the determination of whether features **200** are to be added or deleted from the query ranking model **114** can be made by detecting selection of one or more UI controls for adding features **200** and/or deleting features **200** from the query ranking model **114** as illustrated and described above with reference to FIGURE **4**. Because the determination of operation **606** can be made in additional and/or alternative ways, it should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way.

[0069] If the computing device **102** determines in operation **606** that the features **200** are to be modified, the method **600** can proceed to operation **608**. In operation **608**, the computing device **102** can add one or more features to the query ranking model **114**, remove one or more features **200** from the query ranking model **114**, and/or a combination thereof. From operation **608**, the method **600** can return to operation **604**, wherein the computing device **102** can again adjust feature weights of the query ranking model **114**. As such, it can be appreciated that features **200** of the query ranking model **114** can be reweighted by the computing device **102** in response to adding or removing features **200** to/from the query ranking models **114**. Operations **604-608** can be repeated until the computing device **102** determines, in any iteration of operation **606**, that the features **200** of the query ranking model **114** are not be modified.

[0070] If the computing device **102** determines in operation **606** that the features **200** are not to be modified, the method **600** can proceed to operation **610**. In operation **610**, the computing device **102** can save the query ranking model **114**. The query ranking model **114** can be saved in a memory, in a mass storage device, and/or at another data storage location associated with the computing device **102**. Additionally, or alternatively, the query ranking model **114** can be saved at a remote storage device such as the data store **118**, a data storage associated with the search engine **112**, a social networking server (not illustrated), and/or at other devices or services. As explained above, the query ranking model **114** can be persisted in memory until the query **116** is submitted, if desired, after which the query ranking model

114 can be discarded. Alternatively, query ranking models **114** can be stored indefinitely. From operation **610**, the method **600** proceeds to operation **612**. The method **600** ends at operation **612**.

[0071] FIGURE **7** illustrates an illustrative computer architecture **700** for a device capable of executing the software components described herein for query ranking models. Thus, the computer architecture **700** illustrated in FIGURE **7** illustrates an architecture for a server computer, mobile phone, a PDA, a smart phone, a desktop computer, a netbook computer, a tablet computer, and/or a laptop computer. The computer architecture **700** may be utilized to execute any aspects of the software components presented herein.

[0072] The computer architecture **700** illustrated in FIGURE **7** includes a central processing unit **702** ("CPU"), a system memory **704**, including a random access memory **706** ("RAM") and a read-only memory ("ROM") **708**, and a system bus **710** that couples the memory **704** to the CPU **702**. A basic input/output system containing the basic routines that help to transfer information between elements within the computer architecture **700**, such as during startup, is stored in the ROM **708**. The computer architecture **700** further includes a mass storage device **712** for storing the operating system **106** and one or more application programs including, but not limited to, the query application **108**. Although not shown in FIGURE **7**, the mass storage device **712** also can be configured to store the query ranking model object **110**, one or more query ranking models **114**, search results **120**, and/or other data, if desired.

[0073] The mass storage device **712** is connected to the CPU **702** through a mass storage controller (not shown) connected to the bus **710**. The mass storage device **712** and its associated computer-readable media provide non-volatile storage for the computer architecture **700**. Although the description of computer-readable media contained herein refers to a mass storage device, such as a hard disk or CD-ROM drive, it should be appreciated by those skilled in the art that computer-readable media can be any available computer storage media or communication media that can be accessed by the computer architecture **700**.

[0074] Communication media includes computer readable instructions, data structures, program modules, or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics changed or set in a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and

wireless media such as acoustic, RF, infrared and other wireless media. Combinations of the any of the above should also be included within the scope of computer-readable media.

[0075] By way of example, and not limitation, computer storage media may include volatile and non-volatile, removable and non-removable media implemented in any method or technology for storage of information such as computer-readable instructions, data structures, program modules or other data. For example, computer media includes, but is not limited to, RAM, ROM, EPROM, EEPROM, flash memory or other solid state memory technology, CD-ROM, digital versatile disks ("DVD"), HD-DVD, BLU-RAY, or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the computer architecture **700**. For purposes the claims, the phrase "computer storage medium" and variations thereof, does not include waves, signals, and/or other transitory and/or intangible communication media, per se.

[0076] According to various embodiments, the computer architecture **700** may operate in a networked environment using logical connections to remote computers through a network such as the network **104**. The computer architecture **700** may connect to the network **104** through a network interface unit **714** connected to the bus **710**. It should be appreciated that the network interface unit **714** also may be utilized to connect to other types of networks and remote computer systems, for example, the search engine **212**, a social networking server (not illustrated), the data store **118**, or the like. The computer architecture **700** also may include an input/output controller **716** for receiving and processing input from a number of other devices, including a keyboard, mouse, or electronic stylus (not shown in FIGURE **7**). Similarly, the input/output controller **716** may provide output to a display screen, a printer, or other type of output device (also not shown in FIGURE **7**).

[0077] It should be appreciated that the software components described herein may, when loaded into the CPU **702** and executed, transform the CPU **702** and the overall computer architecture **700** from a general-purpose computing system into a special-purpose computing system customized to facilitate the functionality presented herein. The CPU **702** may be constructed from any number of transistors or other discrete circuit elements, which may individually or collectively assume any number of states. More specifically, the CPU **702** may operate as a finite-state machine, in response to executable instructions contained within the software modules disclosed herein. These computer-executable instructions may transform the CPU **702** by specifying how the CPU **702** transitions between states, thereby transforming the transistors or other discrete hardware elements constituting the CPU **702**.

[0078] Encoding the software modules presented herein also may transform the physical structure of the computer-readable media presented herein. The specific transformation of physical structure may depend on various factors, in different implementations of this description. Examples of such factors may include, but are not limited to, the technology used to implement the computer-readable media, whether the computer-readable media is characterized as primary or secondary storage, and the like. For example, if the computer-readable media is implemented as semiconductor-based memory, the software disclosed herein may be encoded on the computer-readable media by transforming the physical state of the semiconductor memory. For example, the software may transform the state of transistors, capacitors, or other discrete circuit elements constituting the semiconductor memory. The software also may transform the physical state of such components in order to store data thereupon.

[0079] As another example, the computer-readable media disclosed herein may be implemented using magnetic or optical technology. In such implementations, the software presented herein may transform the physical state of magnetic or optical media, when the software is encoded therein. These transformations may include altering the magnetic characteristics of particular locations within given magnetic media. These transformations also may include altering the physical features or characteristics of particular locations within given optical media, to change the optical characteristics of those locations. Other transformations of physical media are possible without departing from the scope and spirit of the present description, with the foregoing examples provided only to facilitate this discussion.

[0080] In light of the above, it should be appreciated that many types of physical transformations take place in the computer architecture **700** in order to store and execute the software components presented herein. It also should be appreciated that the computer architecture **700** may include other types of computing devices, including hand-held computers, embedded computer systems, personal digital assistants, and other types of computing devices known to those skilled in the art. It is also contemplated that the computer architecture **700** may not include all of the components shown in FIGURE **7**, may include other components that are not explicitly shown in FIGURE **7**, or may utilize an architecture completely different than that shown in FIGURE **7**.

[0081] FIGURE **8** illustrates an illustrative distributed computing environment **800** capable of executing the software components described herein for query ranking models. Thus, the distributed computing environment **800** illustrated in FIGURE **8** can be used to

provide the functionality described herein with respect to the computing device **102** and/or the search engine **112**. The distributed computing environment **800** thus may be utilized to execute any aspects of the software components presented herein.

[0082] According to various implementations, the distributed computing environment **800** includes a computing environment **802** operating on, in communication with, or as part of the network **804**. The network **804** also can include various access networks. According to various implementations, the functionality of the network **804** can be provided by the network **104** illustrated in FIGURE **1**. One or more client devices **806A-806N** (hereinafter referred to collectively and/or generically as "clients **806**") can communicate with the computing environment **802** via the network **804** and/or other connections (not illustrated in FIGURE **8**). In the illustrated embodiment, the clients **806** include a computing device **806A** such as a laptop computer, a desktop computer, or other computing device; a slate or tablet computing device ("tablet computing device") **806B**; a mobile computing device **806C** such as a mobile telephone, a smart phone, or other mobile computing device; a server computer **806D**; and/or other devices **806N**. It should be understood that any number of clients **806** can communicate with the computing environment **802**. Two example computing architectures for the clients **806** are illustrated and described herein with reference to FIGURES **7** and **9**. It should be understood that the illustrated clients **806** and computing architectures illustrated and described herein are illustrative, and should not be construed as being limited in any way.

[0083] In the illustrated embodiment, the computing environment **802** includes application servers **808**, data storage **810**, and one or more network interfaces **812**. According to various implementations, the functionality of the application servers **808** can be provided by one or more server computers that are executing as part of, or in communication with, the network **804**. The application servers **808** can host various services, virtual machines, portals, and/or other resources. In the illustrated embodiment, the application servers **808** host one or more virtual machines **814** for hosting applications or other functionality. According to various implementations, the virtual machines **814** host one or more applications and/or software modules for providing the functionality described herein for query ranking models. It should be understood that this embodiment is illustrative, and should not be construed as being limiting in any way. The application servers **808** also host or provide access to one or more Web portals, link pages, Web sites, and/or other information ("Web portals") **816**.

[0084] According to various implementations, the application servers **808** also include one or more mailbox services **818** and one or more messaging services **820**. The mailbox services **818** can include electronic mail ("email") services. The mailbox services **818** also can include various personal information management ("PIM") services including, but not limited to, calendar services, contact management services, collaboration services, and/or other services. The messaging services **820** can include, but are not limited to, instant messaging services, chat services, forum services, and/or other communication services.

[0085] The application servers **808** also can include one or more social networking services **822**. The social networking services **822** can include various social networking services including, but not limited to, services for sharing or posting status updates, instant messages, links, photos, videos, and/or other information; services for commenting or displaying interest in articles, products, blogs, or other resources; and/or other services. In some embodiments, the social networking services **822** are provided by or include the FACEBOOK social networking service, the LINKEDIN professional networking service, the MYSPACE social networking service, the FOURSQUARE geographic networking service, the YAMMER office colleague networking service, and the like. In other embodiments, the social networking services **822** are provided by other services, sites, and/or providers that may or may not explicitly be known as social networking providers. For example, some web sites allow users to interact with one another via email, chat services, and/or other means during various activities and/or contexts such as reading published articles, commenting on goods or services, publishing, collaboration, gaming, and the like. Examples of such services include, but are not limited to, the WINDOWS LIVE service and the XBOX LIVE service from Microsoft Corporation in Redmond, Washington. Other services are possible and are contemplated.

[0086] The social networking services **822** also can include commenting, blogging, and/or microblogging services. Examples of such services include, but are not limited to, the YELP commenting service, the KUDZU review service, the OFFICETALK enterprise microblogging service, the TWITTER messaging service, the GOOGLE BUZZ service, and/or other services. It should be appreciated that the above lists of services are not exhaustive and that numerous additional and/or alternative social networking services **822** are not mentioned herein for the sake of brevity. As such, the above embodiments are illustrative, and should not be construed as being limited in any way.

[0087] As shown in FIGURE **8**, the application servers **808** also can host other services, applications, portals, and/or other resources ("other resources") **824**. The other resources

824 can include, but are not limited to, the search engine **112** and/or the query application **108** described herein. It thus can be appreciated that the computing environment **802** can provide integration of the concepts and technologies disclosed herein provided herein for query ranking models **114** with various mailbox, messaging, social networking, and/or other services or resources. For example, the concepts and technologies disclosed herein can be used to store the query ranking models **114** at social networking services, to share the query ranking models **114** with mail or message recipients, save the query ranking models **114** at search services, or the like. It should be understood that these embodiments are illustrative, and should not be construed as being limiting in any way.

[0088] As mentioned above, the computing environment **802** can include the data storage **810**. According to various implementations, the functionality of the data storage **810** is provided by one or more databases operating on, or in communication with, the network **804**. The functionality of the data storage **810** also can be provided by one or more server computers configured to host data for the computing environment **802**. The data storage **810** can include, host, or provide one or more real or virtual datastores **826A-826N** (hereinafter referred to collectively and/or generically as "datastores **826**"). The datastores **826** are configured to host data used or created by the application servers **808**and/or other data. Although not illustrated in FIGURE **8**, the datastores **826** also can host or store the query ranking model object **110**, query ranking models **114**, search results **120**, and/or other data, if desired.

[0089] The computing environment **802** can communicate with, or be accessed by, the network interfaces **812**. The network interfaces **812** can include various types of network hardware and software for supporting communications between two or more computing devices including, but not limited to, the clients **806** and the application servers **808**. It should be appreciated that the network interfaces **812** also may be utilized to connect to other types of networks and/or computer systems.

[0090] It should be understood that the distributed computing environment **800** described herein can provide any aspects of the software elements described herein with any number of virtual computing resources and/or other distributed computing functionality that can be configured to execute any aspects of the software components disclosed herein. According to various implementations of the concepts and technologies disclosed herein, the distributed computing environment **800** provides the software functionality described herein as a service to the clients **806**. It should be understood that the clients **806** can include real or virtual machines including, but not limited to, server computers, web servers, personal

computers, mobile computing devices, smart phones, and/or other devices. As such, various embodiments of the concepts and technologies disclosed herein enable any device configured to access the distributed computing environment **800** to utilize the functionality described herein for query ranking models.

[0091] Turning now to FIGURE **9**, an illustrative computing device architecture **900** for a computing device that is capable of executing various software components described herein for query ranking models. The computing device architecture **900** is applicable to computing devices that facilitate mobile computing due, in part, to form factor, wireless connectivity, and/or battery-powered operation. In some embodiments, the computing devices include, but are not limited to, mobile telephones, tablet devices, slate devices, portable video game devices, and the like. Moreover, the computing device architecture **900** is applicable to any of the clients **906** shown in FIGURE **8**. Furthermore, aspects of the computing device architecture **900** may be applicable to traditional desktop computers, portable computers (e.g., laptops, notebooks, ultra-portables, and netbooks), server computers, and other computer systems, such as described herein with reference to FIGURE **7**. For example, the single touch and multi-touch aspects disclosed herein below may be applied to desktop computers that utilize a touchscreen or some other touch-enabled device, such as a touch-enabled track pad or touch-enabled mouse.

[0092] The computing device architecture **900** illustrated in FIGURE **9** includes a processor **902**, memory components **904**, network connectivity components **906**, sensor components **908**, input/output components **910**, and power components **912**. In the illustrated embodiment, the processor **902** is in communication with the memory components **904**, the network connectivity components **906**, the sensor components **908**, the input/output ("I/O") components **910**, and the power components **912**. Although no connections are shown between the individuals components illustrated in FIGURE **9**, the components can interact to carry out device functions. In some embodiments, the components are arranged so as to communicate via one or more busses (not shown).

[0093] The processor **902** includes a central processing unit ("CPU") configured to process data, execute computer-executable instructions of one or more application programs, and communicate with other components of the computing device architecture **900** in order to perform various functionality described herein. The processor **902** may be utilized to execute aspects of the software components presented herein and, particularly, those that utilize, at least in part, a touch-enabled input.

[0094] In some embodiments, the processor **902** includes a graphics processing unit ("GPU") configured to accelerate operations performed by the CPU, including, but not limited to, operations performed by executing general-purpose scientific and engineering computing applications, as well as graphics-intensive computing applications such as high resolution video (e.g., 720p, 1080p, and greater), video games, three-dimensional ("3D") modeling applications, and the like. In some embodiments, the processor **902** is configured to communicate with a discrete GPU (not shown). In any case, the CPU and GPU may be configured in accordance with a co-processing CPU/GPU computing model, wherein the sequential part of an application executes on the CPU and the computationally-intensive part is accelerated by the GPU.

[0095] In some embodiments, the processor **902** is, or is included in, a system-on-chip ("SoC") along with one or more of the other components described herein below. For example, the SoC may include the processor **902**, a GPU, one or more of the network connectivity components **906**, and one or more of the sensor components **908**. In some embodiments, the processor **902** is fabricated, in part, utilizing a package-on-package ("PoP") integrated circuit packaging technique. Moreover, the processor **902**may be a single core or multi-core processor.

[0096] The processor **902** may be created in accordance with an ARM architecture, available for license from ARM HOLDINGS of Cambridge, United Kingdom. Alternatively, the processor **902** may be created in accordance with an x**86** architecture, such as is available from INTEL CORPORATION of Mountain View, California and others. In some embodiments, the processor **902** is a SNAPDRAGON SoC, available from QUALCOMM of San Diego, California, a TEGRA SoC, available from NVIDIA of Santa Clara, California, a HUMMINGBIRD SoC, available from SAMSUNG of Seoul, South Korea, an Open Multimedia Application Platform ("OMAP") SoC, available from TEXAS INSTRUMENTS of Dallas, Texas, a customized version of any of the above SoCs, or a proprietary SoC.

[0097] The memory components **904** include a random access memory ("RAM") **914**, a read-only memory ("ROM") **916**, an integrated storage memory ("integrated storage") **918**, and a removable storage memory ("removable storage") **920**. In some embodiments, the RAM **914** or a portion thereof, the ROM **916** or a portion thereof, and/or some combination the RAM **914** and the ROM **916** is integrated in the processor **902**. In some embodiments, the ROM **916** is configured to store a firmware, an operating system or a portion thereof

(e.g., operating system kernel), and/or a bootloader to load an operating system kernel from the integrated storage **918** or the removable storage **920**.

[0098] The integrated storage **918** can include a solid-state memory, a hard disk, or a combination of solid-state memory and a hard disk. The integrated storage **918** may be soldered or otherwise connected to a logic board upon which the processor **902** and other components described herein also may be connected. As such, the integrated storage **918** is integrated in the computing device. The integrated storage **918** is configured to store an operating system or portions thereof, application programs, data, and other software components described herein.

[0099] The removable storage **920** can include a solid-state memory, a hard disk, or a combination of solid-state memory and a hard disk. In some embodiments, the removable storage **920** is provided in lieu of the integrated storage **918**. In other embodiments, the removable storage **920** is provided as additional optional storage. In some embodiments, the removable storage **920** is logically combined with the integrated storage **918** such that the total available storage is made available and shown to a user as a total combined capacity of the integrated storage **918** and the removable storage **920**.

[00100] The removable storage **920** is configured to be inserted into a removable storage memory slot (not shown) or other mechanism by which the removable storage **920** is inserted and secured to facilitate a connection over which the removable storage **920** can communicate with other components of the computing device, such as the processor **902**. The removable storage **920** may be embodied in various memory card formats including, but not limited to, PC card, CompactFlash card, memory stick, secure digital ("SD"), miniSD, microSD, universal integrated circuit card ("UICC") (e.g., a subscriber identity module ("SIM") or universal SIM ("USIM")), a proprietary format, or the like.

[00101] It can be understood that one or more of the memory components **904** can store an operating system. According to various embodiments, the operating system includes, but is not limited to, SYMBIAN OS from SYMBIAN LIMITED, WINDOWS MOBILE OS from Microsoft Corporation of Redmond, Washington, WINDOWS PHONE OS from Microsoft Corporation, WINDOWS from Microsoft Corporation, PALM WEBOS from Hewlett-Packard Company of Palo Alto, California, BLACKBERRY OS from Research In Motion Limited of Waterloo, Ontario, Canada, IOS from Apple Inc. of Cupertino, California, and ANDROID OS from Google Inc. of Mountain View, California. Other operating systems are contemplated.

[00102] The network connectivity components **906** include a wireless wide area network component ("WWAN component") **922**, a wireless local area network component ("WLAN component") **924**, and a wireless personal area network component ("WPAN component") **926**. The network connectivity components **906** facilitate communications to and from a network **928**, which may be a WWAN, a WLAN, or a WPAN. Although a single network **928** is illustrated, the network connectivity components **906** may facilitate simultaneous communication with multiple networks. For example, the network connectivity components **906** may facilitate simultaneous communications with multiple networks via one or more of a WWAN, a WLAN, or a WPAN.

[00103] In some embodiments, the network **928** can be provided by one or more of the networks **104**, **804**. In some embodiments, the network **928** can include one or more of the networks **104**,**804**. In other embodiments, the network **928** can provide access to one or more of the networks **104**, **804**.

[00104] The network **928** may be a WWAN, such as a mobile telecommunications network utilizing one or more mobile telecommunications technologies to provide voice and/or data services to a computing device utilizing the computing device architecture **900** via the WWAN component **922**. The mobile telecommunications technologies can include, but are not limited to, Global System for Mobile communications ("GSM"), Code Division Multiple Access ("CDMA") ONE, CDMA**2000**, Universal Mobile Telecommunications System ("UMTS"), Long Term Evolution ("LTE"), and Worldwide Interoperability for Microwave Access ("WiMAX"). Moreover, the network **928** may utilize various channel access methods (which may or may not be used by the aforementioned standards) including, but not limited to, Time Division Multiple Access ("TDMA"), Frequency Division Multiple Access ("FDMA"), CDMA,wideband CDMA ("W-CDMA"), Orthogonal Frequency Division Multiplexing ("OFDM"), Space Division Multiple Access ("SDMA"), and the like. Data communications may be provided using General Packet Radio Service ("GPRS"), Enhanced Data rates for Global Evolution ("EDGE"), the High-Speed Packet Access ("HSPA") protocol family including High-Speed Downlink Packet Access ("HSDPA"), Enhanced Uplink ("EUL") or otherwise termed High-Speed Uplink Packet Access ("HSUPA"), Evolved HSPA ("HSPA+"), LTE, and various other current and future wireless data access standards. The network **928** may be configured to provide voice and/or data communications with any combination of the above technologies. The network **928** may be configured to or adapted to provide voice and/or data communications in accordance with future generation technologies.

[00105] In some embodiments, the WWAN component **922** is configured to provide dual-multi-mode connectivity to the network **928**. For example, the WWAN component **922** may be configured to provide connectivity to the network **928**, wherein the network **928** provides service via GSM and UMTS technologies, or via some other combination of technologies. Alternatively, multiple WWAN components **922** may be utilized to perform such functionality, and/or provide additional functionality to support other non-compatible technologies (i.e., incapable of being supported by a single WWAN component). The WWAN component **922** may facilitate similar connectivity to multiple networks (e.g., a UMTS network and an LTE network).

[00106] The network **928** may be a WLAN operating in accordance with one or more Institute of Electrical and Electronic Engineers ("IEEE") 802.11 standards, such as IEEE 802.11a, 802.11b, 802.11g, 802.11n, and/or future 802.11 standard (referred to herein collectively as WI-FI). Draft 802.11 standards are also contemplated. In some embodiments, the WLAN is implemented utilizing one or more wireless WI-FI access points. In some embodiments, one or more of the wireless WI-FI access points are another computing device with connectivity to a WWAN that are functioning as a WI-FI hotspot. The WLAN component **924** is configured to connect to the network **928** via the WI-FI access points. Such connections may be secured via various encryption technologies including, but not limited, WI-FI Protected Access ("WPA"), WPA2, Wired Equivalent Privacy ("WEP"), and the like.

[00107] The network **928** may be a WPAN operating in accordance with Infrared Data Association ("IrDA"), BLUETOOTH, wireless Universal Serial Bus ("USB"), Z-Wave, ZIGBEE, or some other short-range wireless technology. In some embodiments, the WPAN component **926** is configured to facilitate communications with other devices, such as peripherals, computers, or other computing devices via the WPAN.

[00108] The sensor components **908** include a magnetometer **930**, an ambient light sensor **932**, a proximity sensor **934**, an accelerometer **936**, a gyroscope **938**, and a Global Positioning System sensor ("GPS sensor") **940**. It is contemplated that other sensors, such as, but not limited to, temperature sensors or shock detection sensors, also may be incorporated in the computing device architecture **900**.

[00109] The magnetometer **930** is configured to measure the strength and direction of a magnetic field. In some embodiments the magnetometer **930** provides measurements to a compass application program stored within one of the memory components **904** in order to provide a user with accurate directions in a frame of reference including the cardinal

directions, north, south, east, and west. Similar measurements may be provided to a navigation application program that includes a compass component. Other uses of measurements obtained by the magnetometer **930** are contemplated.

[00110] The ambient light sensor **932** is configured to measure ambient light. In some embodiments, the ambient light sensor **932** provides measurements to an application program stored within one the memory components **904** in order to automatically adjust the brightness of a display (described below) to compensate for low-light and high-light environments. Other uses of measurements obtained by the ambient light sensor **932** are contemplated.

[00111] The proximity sensor **934** is configured to detect the presence of an object or thing in proximity to the computing device without direct contact. In some embodiments, the proximity sensor **934** detects the presence of a user's body (e.g., the user's face) and provides this information to an application program stored within one of the memory components **904** that utilizes the proximity information to enable or disable some functionality of the computing device. For example, a telephone application program may automatically disable a touchscreen (described below) in response to receiving the proximity information so that the user's face does not inadvertently end a call or enable/disable other functionality within the telephone application program during the call. Other uses of proximity as detected by the proximity sensor **934** are contemplated.

[00112] The accelerometer **936** is configured to measure proper acceleration. In some embodiments, output from the accelerometer **936** is used by an application program as an input mechanism to control some functionality of the application program. For example, the application program may be a video game in which a character, a portion thereof, or an object is moved or otherwise manipulated in response to input received via the accelerometer **936**. In some embodiments, output from the accelerometer **936** is provided to an application program for use in switching between landscape and portrait modes, calculating coordinate acceleration, or detecting a fall. Other uses of the accelerometer **936** are contemplated.

[00113] The gyroscope **938** is configured to measure and maintain orientation. In some embodiments, output from the gyroscope **938** is used by an application program as an input mechanism to control some functionality of the application program. For example, the gyroscope **938** can be used for accurate recognition of movement within a 3D environment of a video game application or some other application. In some embodiments, an application program utilizes output from the gyroscope **938** and the accelerometer **936** to enhance

control of some functionality of the application program. Other uses of the gyroscope **938** are contemplated.

[00114] The GPS sensor **940** is configured to receive signals from GPS satellites for use in calculating a location. The location calculated by the GPS sensor **940** may be used by any application program that requires or benefits from location information. For example, the location calculated by the GPS sensor **940** may be used with a navigation application program to provide directions from the location to a destination or directions from the destination to the location. Moreover, the GPS sensor **940** may be used to provide location information to an external location-based service, such as E911 service. The GPS sensor **940** may obtain location information generated via WI-FI, WIMAX, and/or cellular triangulation techniques utilizing one or more of the network connectivity components **906** to aid the GPS sensor **940** in obtaining a location fix. The GPS sensor **940** may also be used in Assisted GPS ("A-GPS") systems.

[00115] The I/O components **910** include a display **942**, a touchscreen **944**, a data I/O interface component ("data I/O")**946**, an audio I/O interface component ("audio I/O") **948**, a video I/O interface component ("video I/O") **950**, and a camera **952**. In some embodiments, the display **942** and the touchscreen **944** are combined. In some embodiments two or more of the data I/O component **946**, the audio I/O component **948**, and the video I/O component **950** are combined. The I/O components **910** may include discrete processors configured to support the various interface described below, or may include processing functionality built-in to the processor **902**.

[00116] The display **942** is an output device configured to present information in a visual form. In particular, the display **942** may present graphical user interface ("GUI") elements, text, images, video, notifications, virtual buttons, virtual keyboards, messaging data, Internet content, device status, time, date, calendar data, preferences, map information, location information, and any other information that is capable of being presented in a visual form. In some embodiments, the display **942** is a liquid crystal display ("LCD") utilizing any active or passive matrix technology and any backlighting technology (if used). In some embodiments, the display **942** is an organic light emitting diode ("OLED") display. Other display types are contemplated.

[00117] The touchscreen **944** is an input device configured to detect the presence and location of a touch. The touchscreen **944** may be a resistive touchscreen, a capacitive touchscreen, a surface acoustic wave touchscreen, an infrared touchscreen, an optical imaging touchscreen, a dispersive signal touchscreen, an acoustic pulse recognition

touchscreen, or may utilize any other touchscreen technology. In some embodiments, the touchscreen **944** is incorporated on top of the display **942** as a transparent layer to enable a user to use one or more touches to interact with objects or other information presented on the display **942**. In other embodiments, the touchscreen **944** is a touch pad incorporated on a surface of the computing device that does not include the display **942**. For example, the computing device may have a touchscreen incorporated on top of the display **942** and a touch pad on a surface opposite the display **942**.

[00118] In some embodiments, the touchscreen **944** is a single-touch touchscreen. In other embodiments, the touchscreen **944** is a multi-touch touchscreen. In some embodiments, the touchscreen **944** is configured to detect discrete touches, single touch gestures, and/or multi-touch gestures. These are collectively referred to herein as gestures for convenience. Several gestures will now be described. It should be understood that these gestures are illustrative and are not intended to limit the scope of the appended claims. Moreover, the described gestures, additional gestures, and/or alternative gestures may be implemented in software for use with the touchscreen **944**. As such, a developer may create gestures that are specific to a particular application program.

[00119] In some embodiments, the touchscreen **944** supports a tap gesture in which a user taps the touchscreen **944**once on an item presented on the display **942**. The tap gesture may be used for various reasons including, but not limited to, opening or launching whatever the user taps. In some embodiments, the touchscreen **944** supports a double tap gesture in which a user taps the touchscreen **944** twice on an item presented on the display **942**. The double tap gesture may be used for various reasons including, but not limited to, zooming in or zooming out in stages. In some embodiments, the touchscreen **944** supports a tap and hold gesture in which a user taps the touchscreen **944** and maintains contact for at least a pre-defined time. The tap and hold gesture may be used for various reasons including, but not limited to, opening a context-specific menu.

[00120] In some embodiments, the touchscreen **944** supports a pan gesture in which a user places a finger on the touchscreen **944** and maintains contact with the touchscreen **944** while moving the finger on the touchscreen **944**. The pan gesture may be used for various reasons including, but not limited to, moving through screens, images, or menus at a controlled rate. Multiple finger pan gestures are also contemplated. In some embodiments, the touchscreen **944** supports a flick gesture in which a user swipes a finger in the direction the user wants the screen to move. The flick gesture may be used for various reasons including, but not limited to, scrolling horizontally or vertically through menus or pages. In some

embodiments, the touchscreen **944** supports a pinch and stretch gesture in which a user makes a pinching motion with two fingers (e.g., thumb and forefinger) on the touchscreen **944** or moves the two fingers apart. The pinch and stretch gesture may be used for various reasons including, but not limited to, zooming gradually in or out of a website, map, or picture.

[00121] Although the above gestures have been described with reference to the use one or more fingers for performing the gestures, other appendages such as toes or objects such as styluses may be used to interact with the touchscreen **944**. As such, the above gestures should be understood as being illustrative and should not be construed as being limiting in any way.

[00122] The data I/O interface component **946** is configured to facilitate input of data to the computing device and output of data from the computing device. In some embodiments, the data I/O interface component **946** includes a connector configured to provide wired connectivity between the computing device and a computer system, for example, for synchronization operation purposes. The connector may be a proprietary connector or a standardized connector such as USB, micro-USB, mini-USB, or the like. In some embodiments, the connector is a dock connector for docking the computing device with another device such as a docking station, audio device (e.g., a digital music player), or video device.

[00123] The audio I/O interface component **948** is configured to provide audio input and/or output capabilities to the computing device. In some embodiments, the audio I/O interface component **946** includes a microphone configured to collect audio signals. In some embodiments, the audio I/O interface component **946** includes a headphone jack configured to provide connectivity for headphones or other external speakers. In some embodiments, the audio interface component **948** includes a speaker for the output of audio signals. In some embodiments, the audio I/O interface component **946** includes an optical audio cable out.

[00124] The video I/O interface component **950** is configured to provide video input and/or output capabilities to the computing device. In some embodiments, the video I/O interface component **950** includes a video connector configured to receive video as input from another device (e.g., a video media player such as a DVD or BLURAY player) or send video as output to another device (e.g., a monitor, a television, or some other external display). In some embodiments, the video I/O interface component **950** includes a High-Definition Multimedia Interface ("HDMI"), mini-HDMI, micro-HDMI, DisplayPort, or proprietary

connector to input/output video content. In some embodiments, the video I/O interface component **950** or portions thereof is combined with the audio I/O interface component **948** or portions thereof.

[00125] The camera **952** can be configured to capture still images and/or video. The camera **952** may utilize a charge coupled device ("CCD") or a complementary metal oxide semiconductor ("CMOS") image sensor to capture images. In some embodiments, the camera **952** includes a flash to aid in taking pictures in low-light environments. Settings for the camera **952** may be implemented as hardware or software buttons.

[00126] Although not illustrated, one or more hardware buttons may also be included in the computing device architecture **900**. The hardware buttons may be used for controlling some operational aspect of the computing device. The hardware buttons may be dedicated buttons or multi-use buttons. The hardware buttons may be mechanical or sensor-based.

[00127] The illustrated power components **912** include one or more batteries **954**, which can be connected to a battery gauge **956**. The batteries **954** may be rechargeable or disposable. Rechargeable battery types include, but are not limited to, lithium polymer, lithium ion, nickel cadmium, and nickel metal hydride. Each of the batteries **954** may be made of one or more cells.

[00128] The battery gauge **956** can be configured to measure battery parameters such as current, voltage, and temperature. In some embodiments, the battery gauge **956** is configured to measure the effect of a battery's discharge rate, temperature, age and other factors to predict remaining life within a certain percentage of error. In some embodiments, the battery gauge **956** provides measurements to an application program that is configured to utilize the measurements to present useful power management data to a user. Power management data may include one or more of a percentage of battery used, a percentage of battery remaining, a battery condition, a remaining time, a remaining capacity (e.g., in watt hours), a current draw, and a voltage.

[00129] The power components **912** may also include a power connector, which may be combined with one or more of the aforementioned I/O components **910**. The power components **912** may interface with an external power system or charging equipment via a power I/O component **944**.

[00130] Based on the foregoing, it should be appreciated that technologies for query ranking models have been disclosed herein. Although the subject matter presented herein has been described in language specific to computer structural features, methodological and transformative acts, specific computing machinery, and computer readable media, it is to be

understood that the invention defined in the appended claims is not necessarily limited to the specific features, acts, or media described herein. Rather, the specific features, acts and mediums are disclosed as example forms of implementing the claims.

[00131] The subject matter described above is provided by way of illustration only and should not be construed as limiting. Various modifications and changes may be made to the subject matter described herein without following the example embodiments and applications illustrated and described, and without departing from the true spirit and scope of the present invention, which is set forth in the following claims.

CLAIMS

1. A computer-implemented method for requesting a search using a query ranking model, the computer-implemented method comprising performing computer-implemented operations for:

obtaining, at a computer executing a query application, a query ranking model object defining a ranking model used by a search engine;

generating, based upon the query ranking model object, a query ranking model comprising at least one feature corresponding to an aspect to be considered during ranking of search results by the search engine;

submitting a query for execution by the search engine, the query identifying the query ranking model to be used by the search engine; and

receiving the search results from the search engine, the search results being ordered in accordance with the query ranking model.

2. The method of claim 1, wherein identifying the query ranking model further comprises submitting the query ranking model as an object with the query.

3. The method of claim 1, further comprising modifying the query ranking model by

identifying the at least one feature,

adjusting a weight of the at least one feature, and

saving the query ranking model as modified by adjusting the weight.

4. The method of claim 3, wherein the at least one feature comprises a plurality of features, and wherein modifying the query ranking model further comprises

adjusting at least one weight associated with the plurality of features,

determining if the plurality of features are to be modified, and

saving the query ranking model as modified by adjusting the at least one weight.

5. The method of claim 4, wherein determining if the plurality of features are to be modified comprises at least one of

determining if a new feature is to be added to the query ranking model, or

determining if at least one of the plurality of features is to be removed from the query ranking model.

6. The method of claim 4, wherein adjusting the at least one weight comprises

presenting a user interface comprising at least one control for adjusting the at least one weight, and

receiving input corresponding to a change to the at least one weight.

7. A computer storage medium having computer readable instructions stored thereupon that, when executed by a computer, cause the computer to:

obtain a query ranking model object defining a ranking model used by a search engine, the query ranking model object being exposed as an object by the search engine;

generate, based upon the query ranking model object, a query ranking model comprising a feature considered during ranking of search results by the search engine;

submit a query to the search engine, the query comprising data identifying the query ranking model for use by the search engine when executing the query; and

receive the search results from the search engine, the search results being ordered in accordance with the query ranking model.

8. The computer storage medium of claim 7, wherein generating the query ranking model further comprises adjusting a weight of the feature of the query ranking model object.

9. The computer storage medium of claim 7, further comprising computer readable instructions that, when executed by the computer, cause the computer to modify the query ranking model, wherein modifying the query ranking model comprises

adjusting a weight associated with the feature by presenting a user interface comprising at least one control for adjusting the weight, and receiving input corresponding to a change to the weight,

determining a new feature is to be added to the query ranking model,

determining if the feature is to be removed from the query ranking model, and

saving the query ranking model as modified by adjusting the weight.

10. A computer storage medium having computer readable instructions stored thereupon that, when executed by a computer, cause the computer to:

receive data indicating that a query ranking model is to be used when executing a query;

in response to receiving the data, obtain a query ranking model object defining a ranking model used by a search engine, the query ranking model object being exposed as an object by the search engine;

generate, based upon the query ranking model object, the query ranking model, the query ranking model comprising features considered during ranking of search results by the search engine;

submit the query to the search engine with data identifying the query ranking model; and

receive the search results from the search engine, the search results being ordered in accordance with the query ranking model.

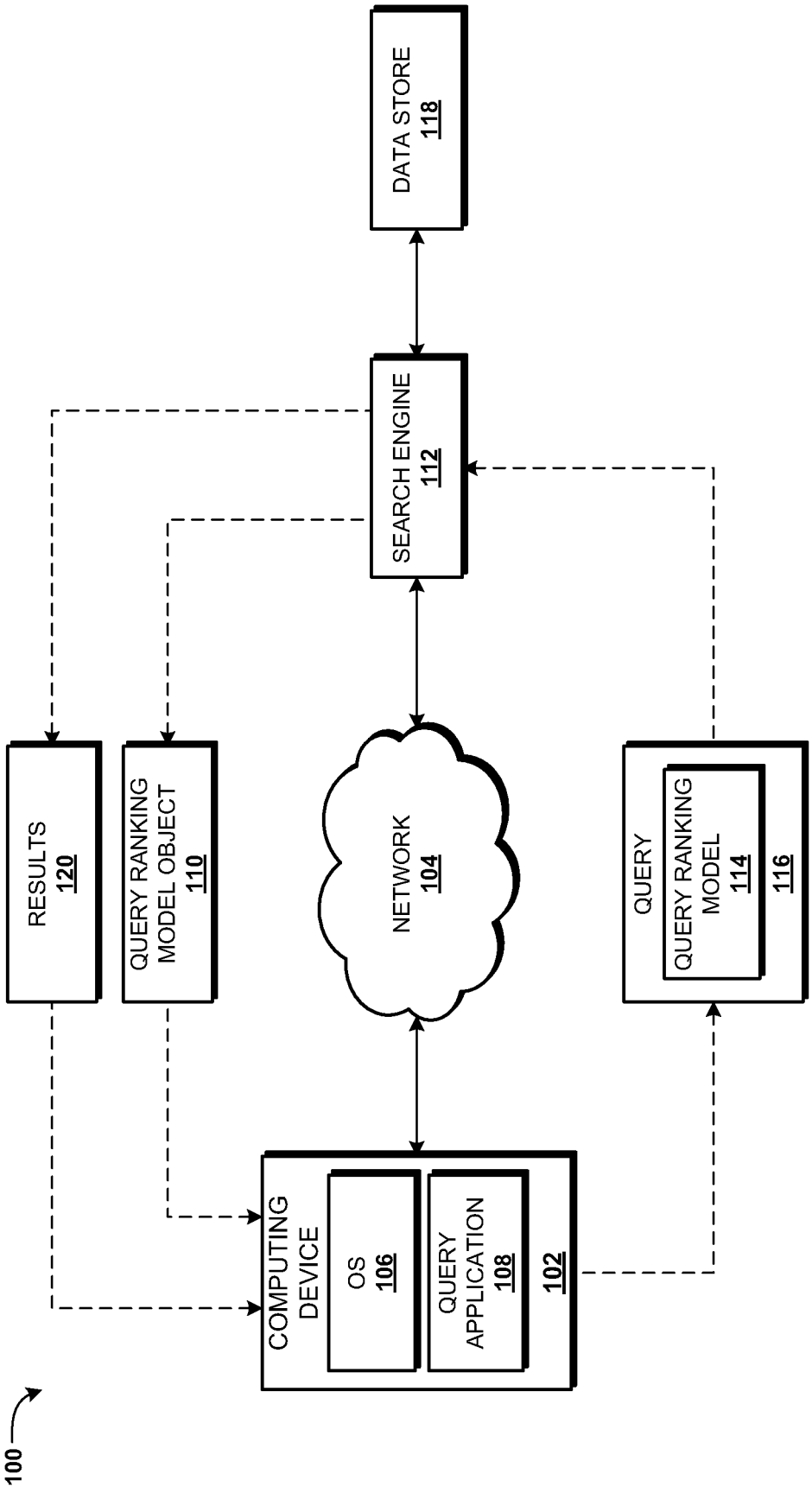
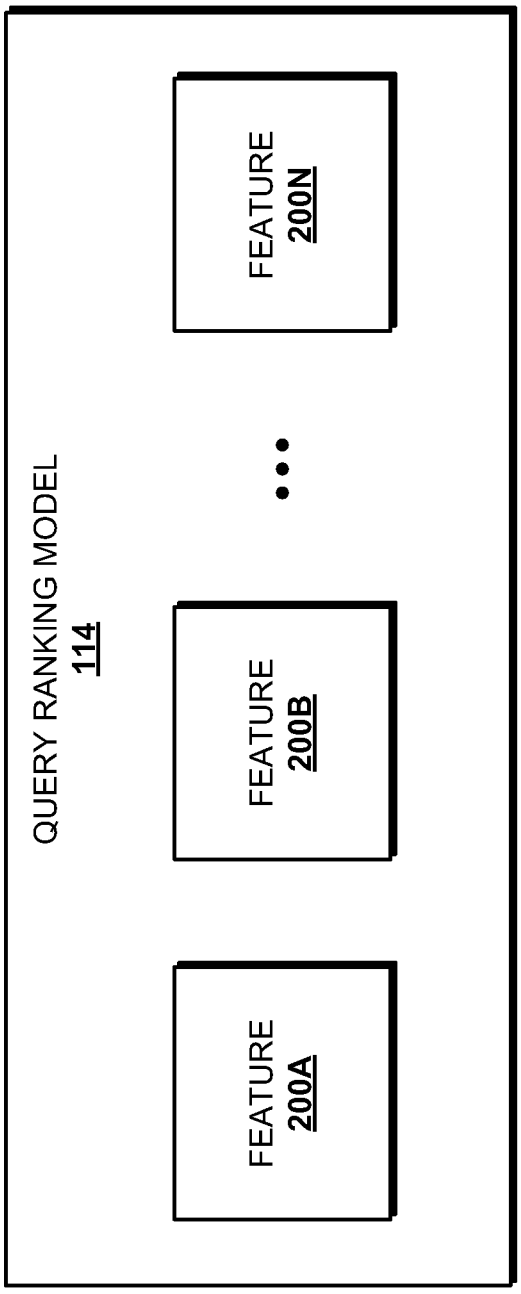

DATA STORE
118
SEARCH ENGINE
112
RESULTS
120
QUERY RANKING
MODEL OBJECT
110
NETWORK
104
QUERY
QUERY RANKING
MODEL
114
116
COMPUTING
DEVICE
OS
106
QUERY
APPLICATION
108
102
100

FIG. 1


QUERY RANKING MODEL
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FEATURE
200A
FEATURE
200B
FEATURE
200N

FIG. 2

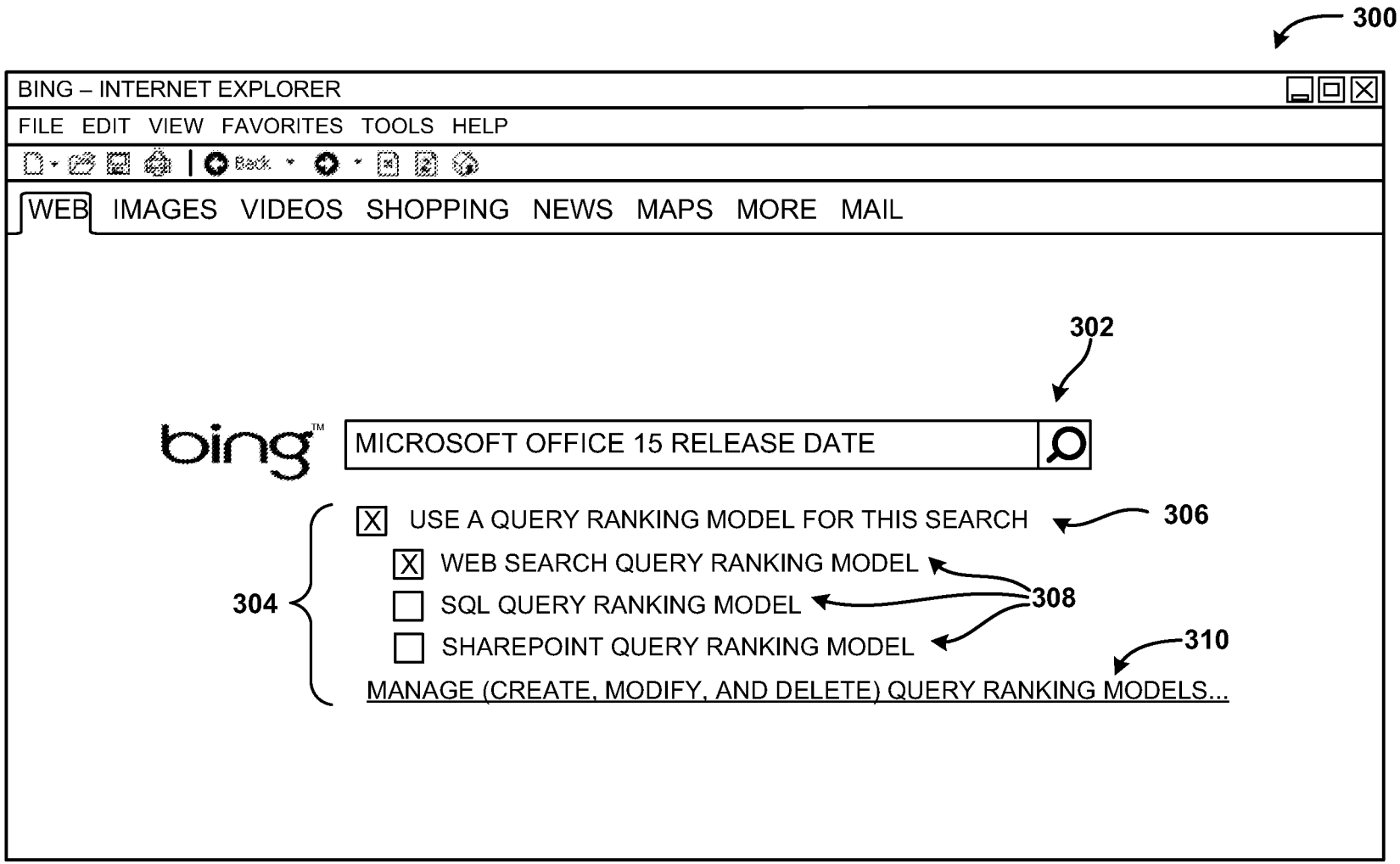
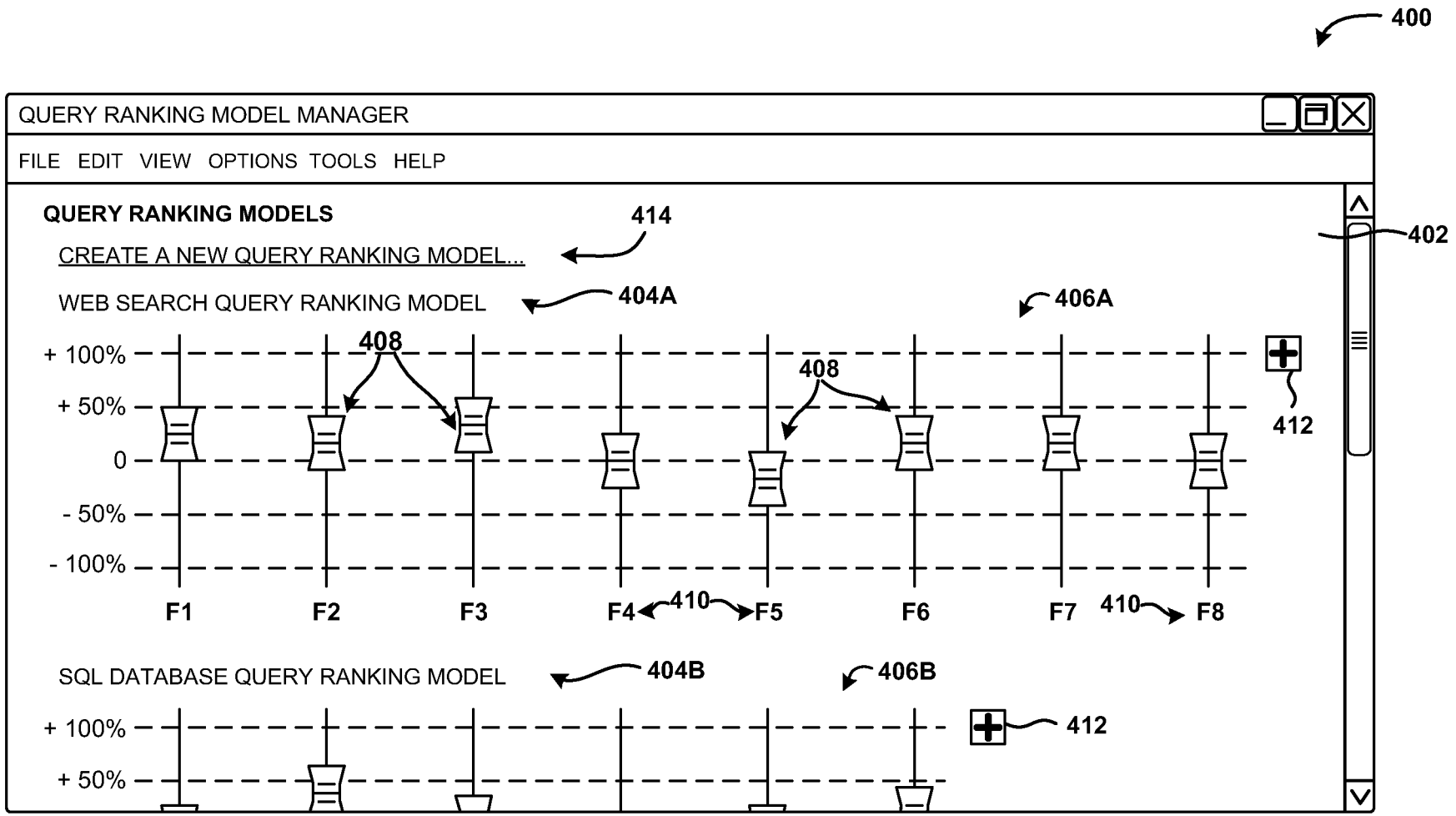

300
BING – INTERNET EXPLORER
FILE EDIT VIEW FAVORITES TOOLS HELP
WEB IMAGES VIDEOS SHOPPING NEWS MAPS MORE MAIL
302
bing™
MICROSOFT OFFICE 15 RELEASE DATE
304
[X] USE A QUERY RANKING MODEL FOR THIS SEARCH
306
[X] WEB SEARCH QUERY RANKING MODEL
[ ] SQL QUERY RANKING MODEL
[ ] SHAREPOINT QUERY RANKING MODEL
308
310
MANAGE (CREATE, MODIFY, AND DELETE) QUERY RANKING MODELS...

FIG. 3


400
QUERY RANKING MODEL MANAGER
FILE EDIT VIEW OPTIONS TOOLS HELP
QUERY RANKING MODELS
414
CREATE A NEW QUERY RANKING MODEL...
402
WEB SEARCH QUERY RANKING MODEL
404A
406A
408
408
+ 100%
+ 50%
0
- 50%
- 100%
412
F1
F2
F3
F4
410
F5
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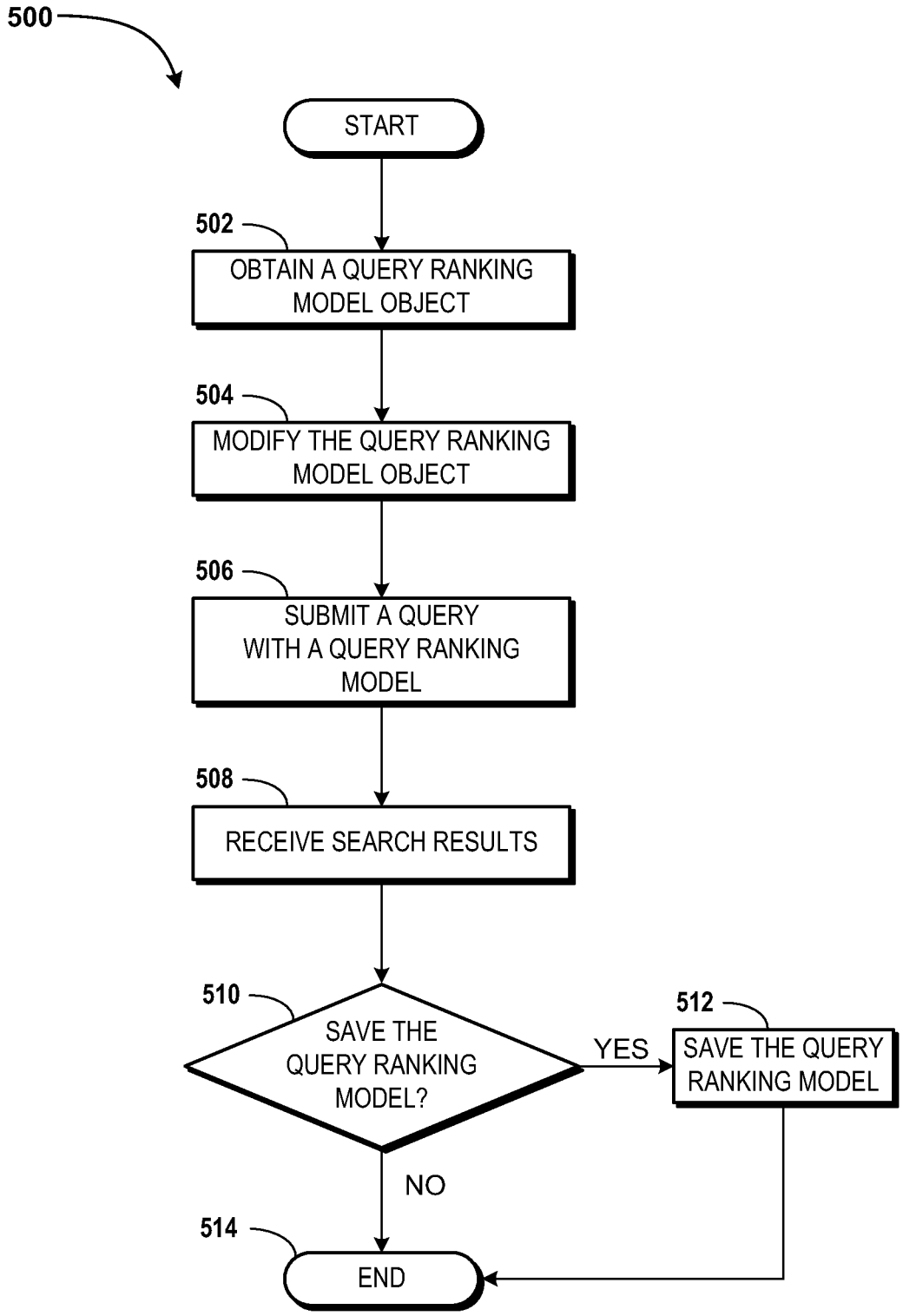
410
F8
SQL DATABASE QUERY RANKING MODEL
404B
406B
+ 100%
+ 50%
412

FIG. 4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START
502
OBTAIN A QUERY RANKING MODEL OBJECT
504
MODIFY THE QUERY RANKING MODEL OBJECT
506
SUBMIT A QUERY WITH A QUERY RANKING MODEL
508
RECEIVE SEARCH RESULTS
510
SAVE THE QUERY RANKING MODEL?
YES
512
SAVE THE QUERY RANKING MODEL
NO
514
END

FIG. 5

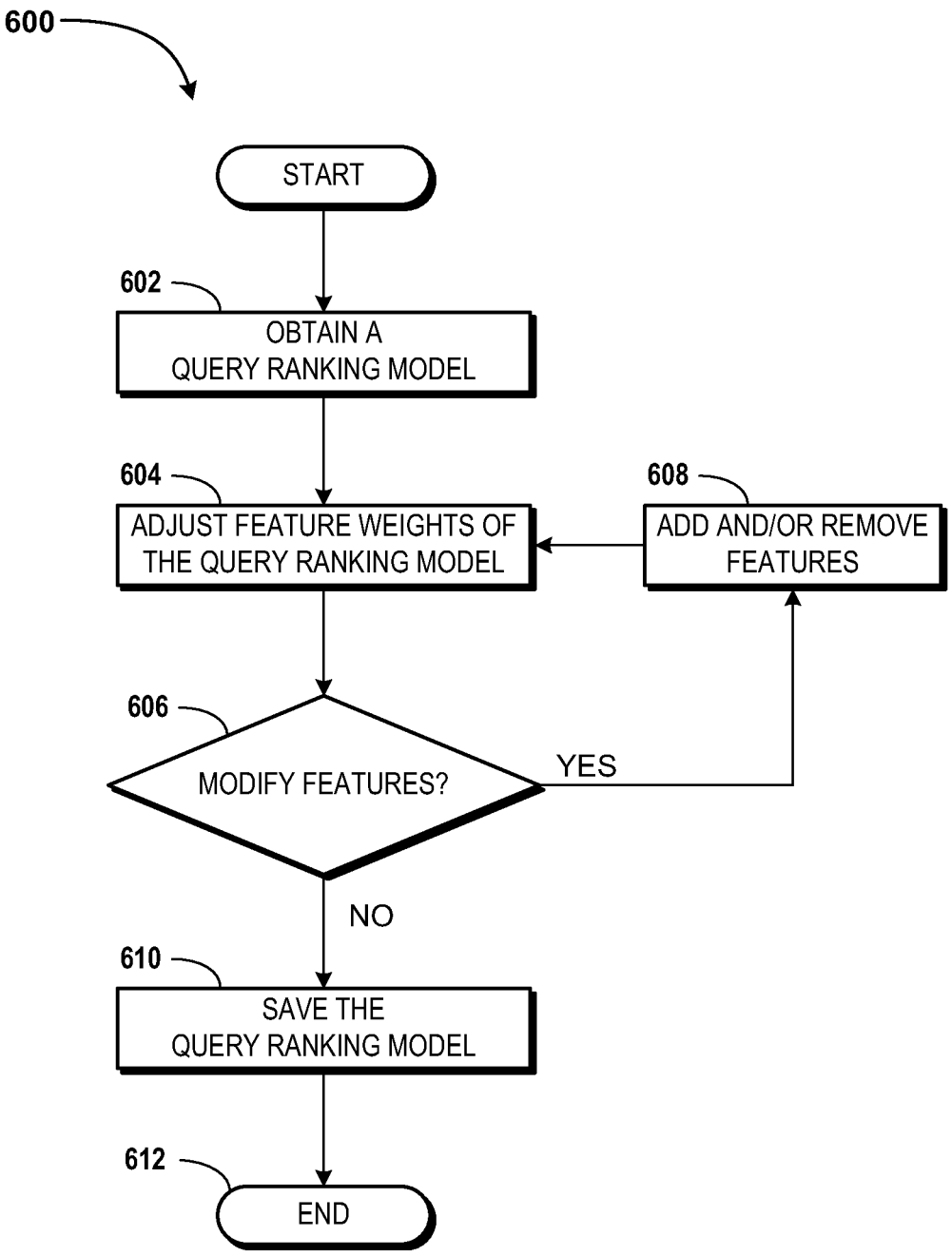
600
START
602
OBTAIN A QUERY RANKING MODEL
604
ADJUST FEATURE WEIGHTS OF THE QUERY RANKING MODEL
608
ADD AND/OR REMOVE FEATURES
606
MODIFY FEATURES?
YES
NO
610
SAVE THE QUERY RANKING MODEL
612
END

FIG. 6

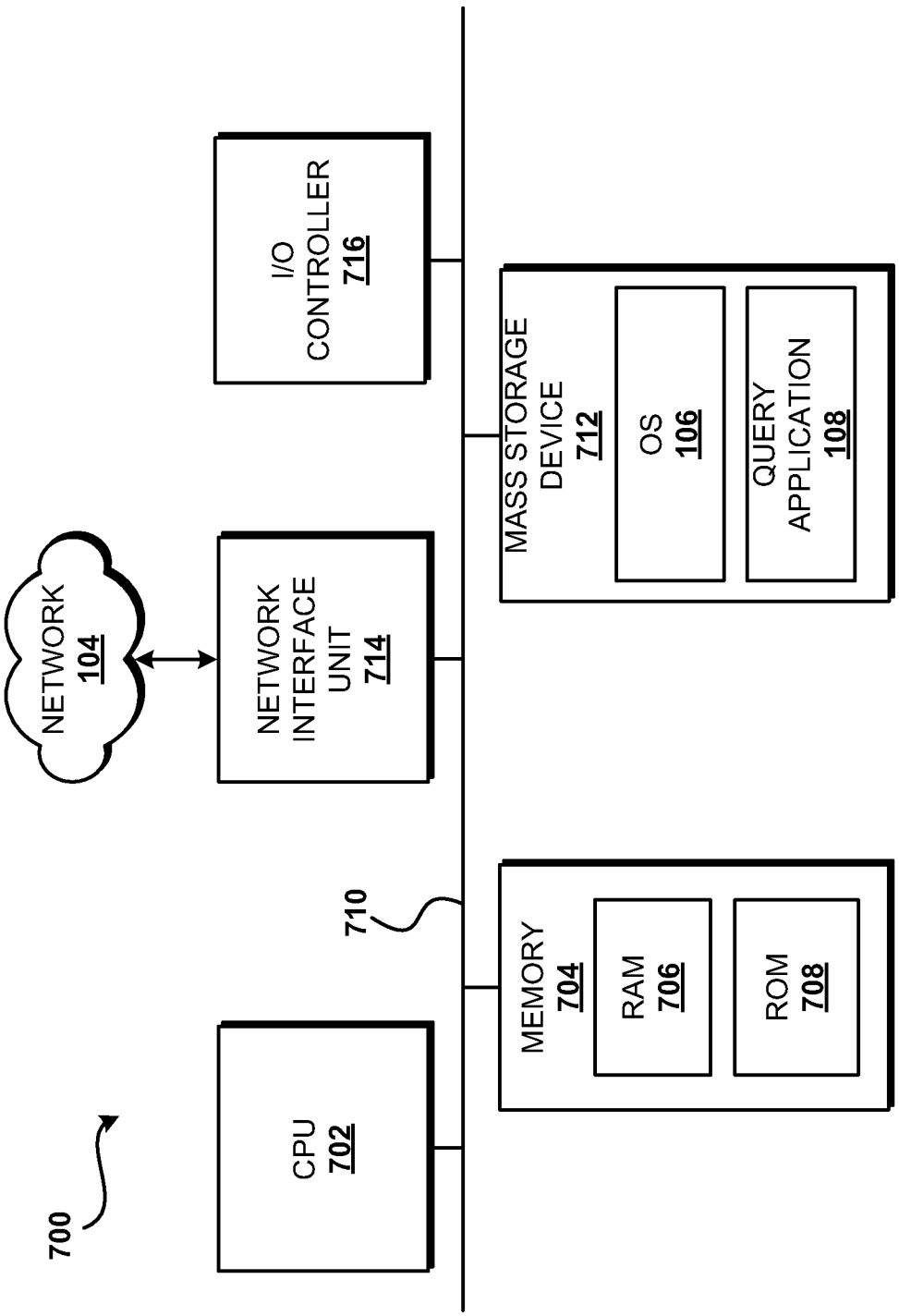
700
CPU
702
710
MEMORY
704
RAM
706
ROM
708
NETWORK
INTERFACE
UNIT
714
NETWORK
104
I/O
CONTROLLER
716
MASS STORAGE
DEVICE
712
OS
106
QUERY
APPLICATION
108

FIG. 7

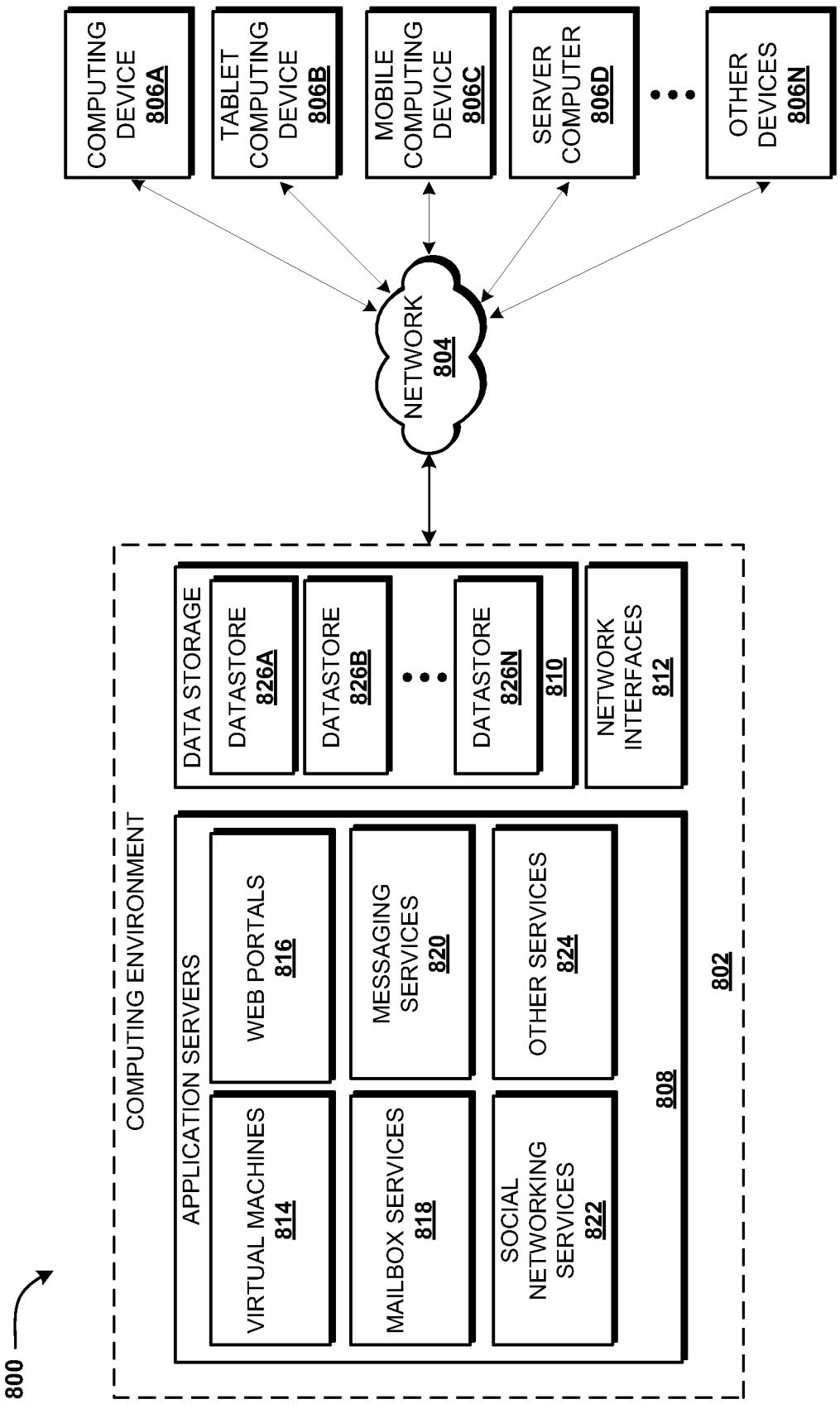
800
COMPUTING ENVIRONMENT
802
APPLICATION SERVERS
808
VIRTUAL MACHINES 814
WEB PORTALS 816
MAILBOX SERVICES 818
MESSAGING SERVICES 820
SOCIAL NETWORKING SERVICES 822
OTHER SERVICES 824
DATA STORAGE
DATASTORE 826A
DATASTORE 826B
DATASTORE 826N
810
NETWORK INTERFACES 812
NETWORK 804
COMPUTING DEVICE 806A
TABLET COMPUTING DEVICE 806B
MOBILE COMPUTING DEVICE 806C
SERVER COMPUTER 806D
OTHER DEVICES 806N

FIG. 8

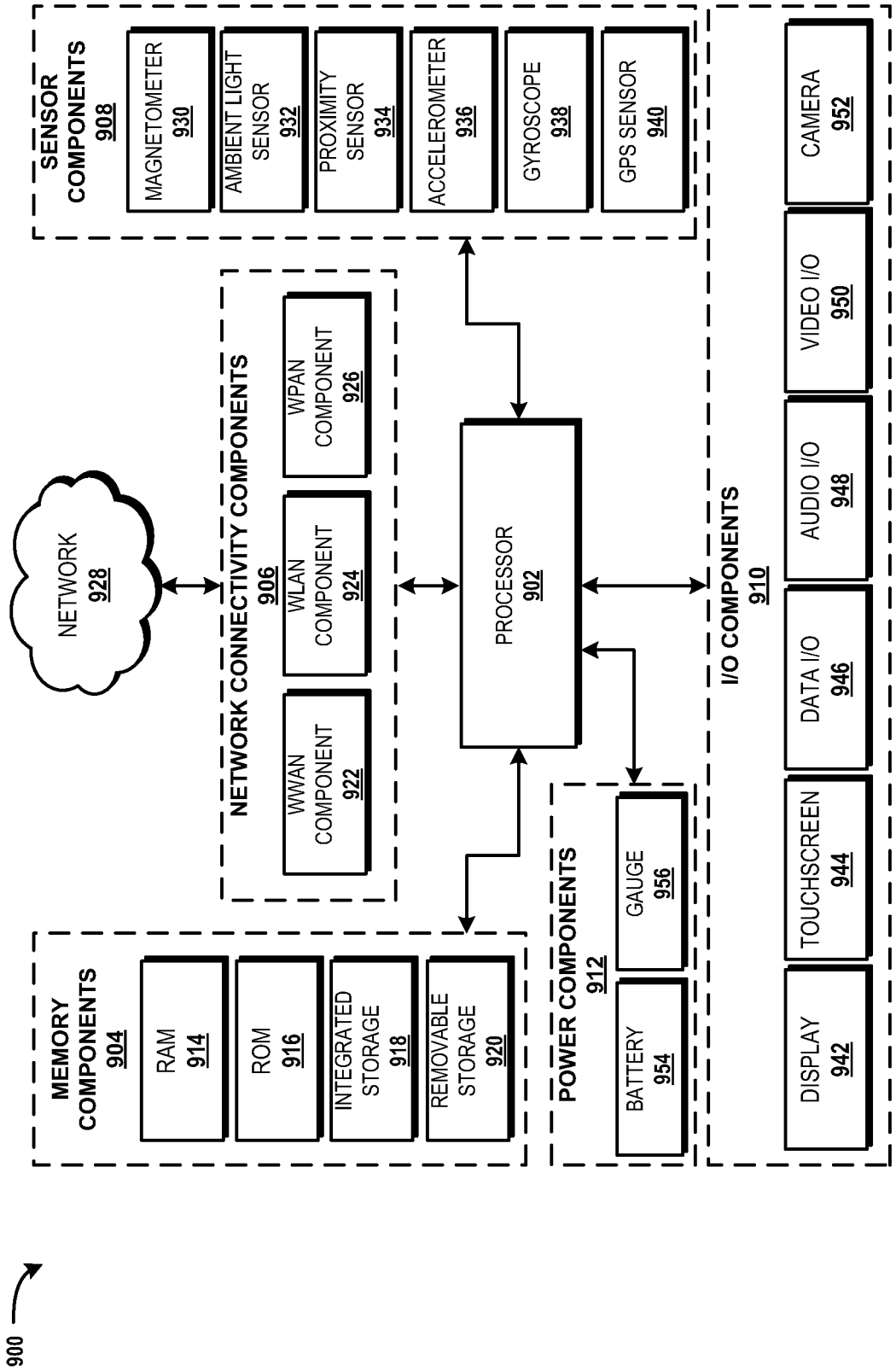
900
MEMORY COMPONENTS 904
RAM 914
ROM 916
INTEGRATED STORAGE 918
REMOVABLE STORAGE 920
POWER COMPONENTS 912
BATTERY 954
GAUGE 956
NETWORK CONNECTIVITY COMPONENTS 906
WWAN COMPONENT 922
WLAN COMPONENT 924
WPAN COMPONENT 926
NETWORK 928
PROCESSOR 902
SENSOR COMPONENTS 908
MAGNETOMETER 930
AMBIENT LIGHT SENSOR 932
PROXIMITY SENSOR 934
ACCELEROMETER 936
GYROSCOPE 938
GPS SENSOR 940
I/O COMPONENTS 910
DISPLAY 942
TOUCHSCREEN 944
DATA I/O 946
AUDIO I/O 948
VIDEO I/O 950
CAMERA 952

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/058354

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

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

B. FIELDS SEARCHED

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

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 012 053 A (PANT SANGAM [US] ET AL) 4 January 2000 (2000-01-04) column 1, line 53 - column 2, line 58; figures 1,3,5,7 column 5, lines 5-27, 49-52 column 5, line 61 - column 6, line 32 column 7, line 44 - column 9, line 37	1-10
X	US 8 001 152 B1 (SOLAN ZACH [IL]) 16 August 2011 (2011-08-16) column 1, line 38 - column 2, line 18; figures 4-6 column 5, line 27 - column 6, line 41	1-10
X	US 2010/070498 A1 (ZHANG RUOFEI [US] ET AL) 18 March 2010 (2010-03-18) paragraphs [0018], [0025], [0028] - [0030]; claims 1,4,7,10,13,16	1-4,7,8, 10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 December 2013	20/12/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Herry, Tzvetanka

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/058354

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6012053 A	04-01-2000	NONE	
US 8001152 B1	16-08-2011	NONE	
US 2010070498 A1	18-03-2010	NONE	