US 20060122957A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2006/0122957 A1

Chen (43) Pub. Date: Jun. 8, 2006

(54) METHOD AND SYSTEM TO DETECT E-MAIL SPAM USING CONCEPT CATEGORIZATION OF LINKED CONTENT

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(21) Appl. No.: 11/004,250

(22) Filed: Dec. 3, 2004

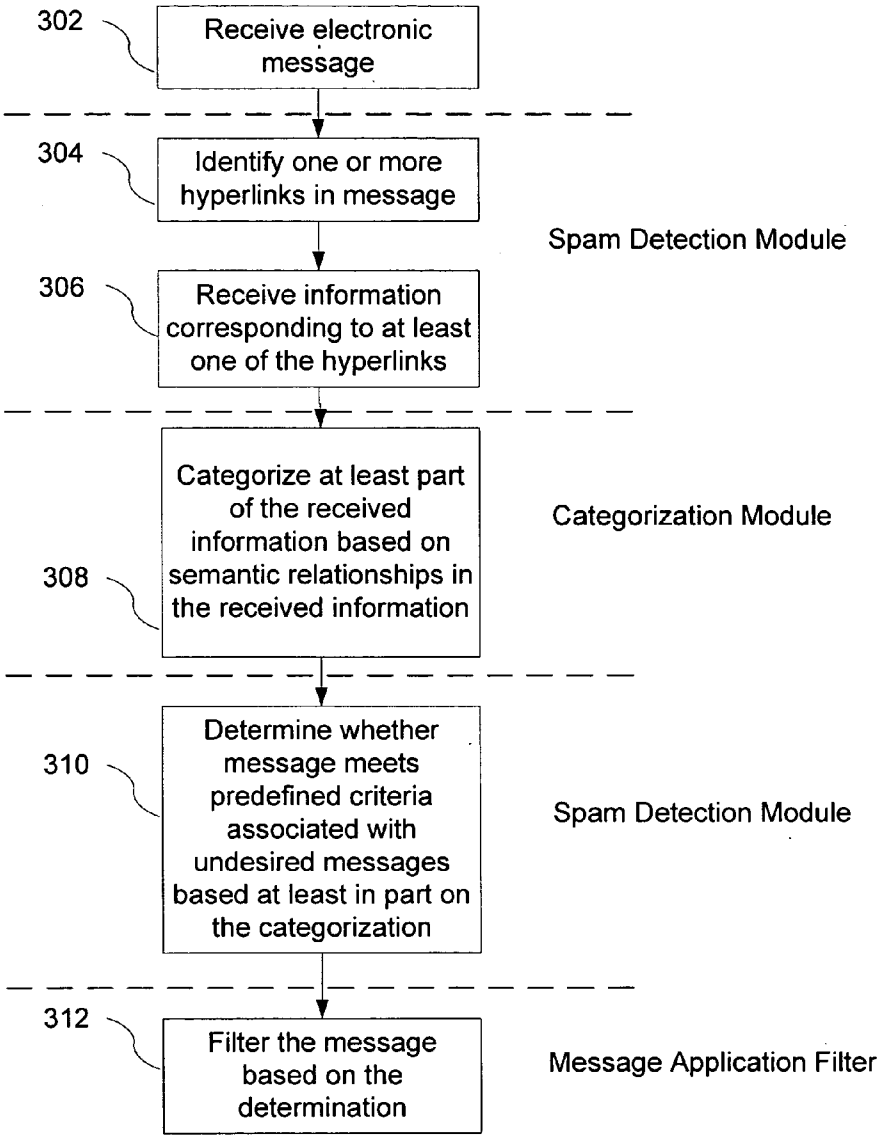
Publication Classification

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

(52) U.S. Cl. 707/1

(57) ABSTRACT

A system and method for detecting undesired electronic messages (e.g., spam) using concept categorization of hyperlinks is disclosed. A server receives an electronic message and retrieves web pages that correspond to hyperlinks in the message. The server performs concept categorization on the retrieved web pages based on semantic relationships in the received information to determine whether the electronic message meets predefined criteria associated with undesired messages.



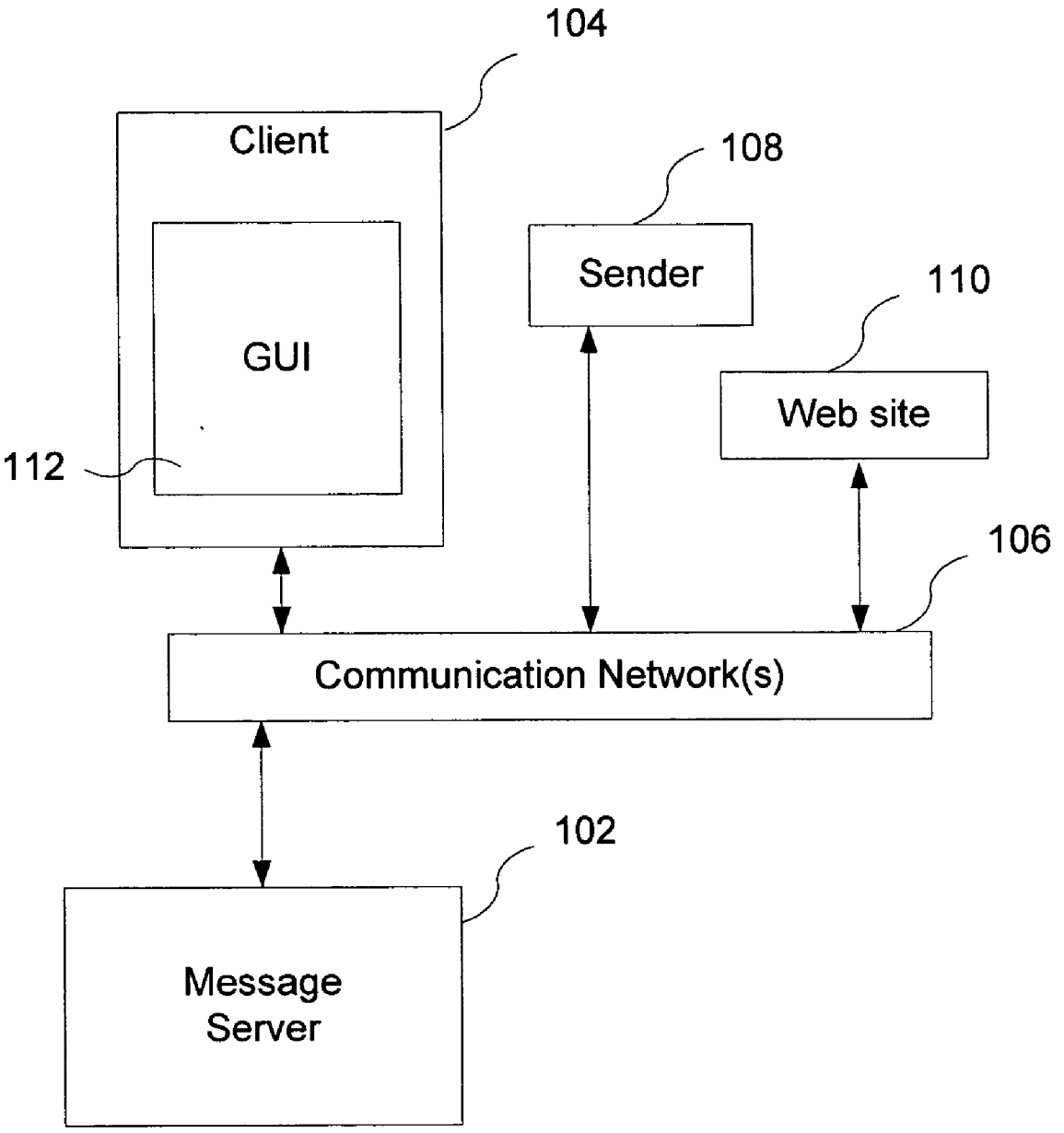

104
Client
GUI
112
108
Sender
110
Web site
106
Communication Network(s)
102
Message Server

Figure 1

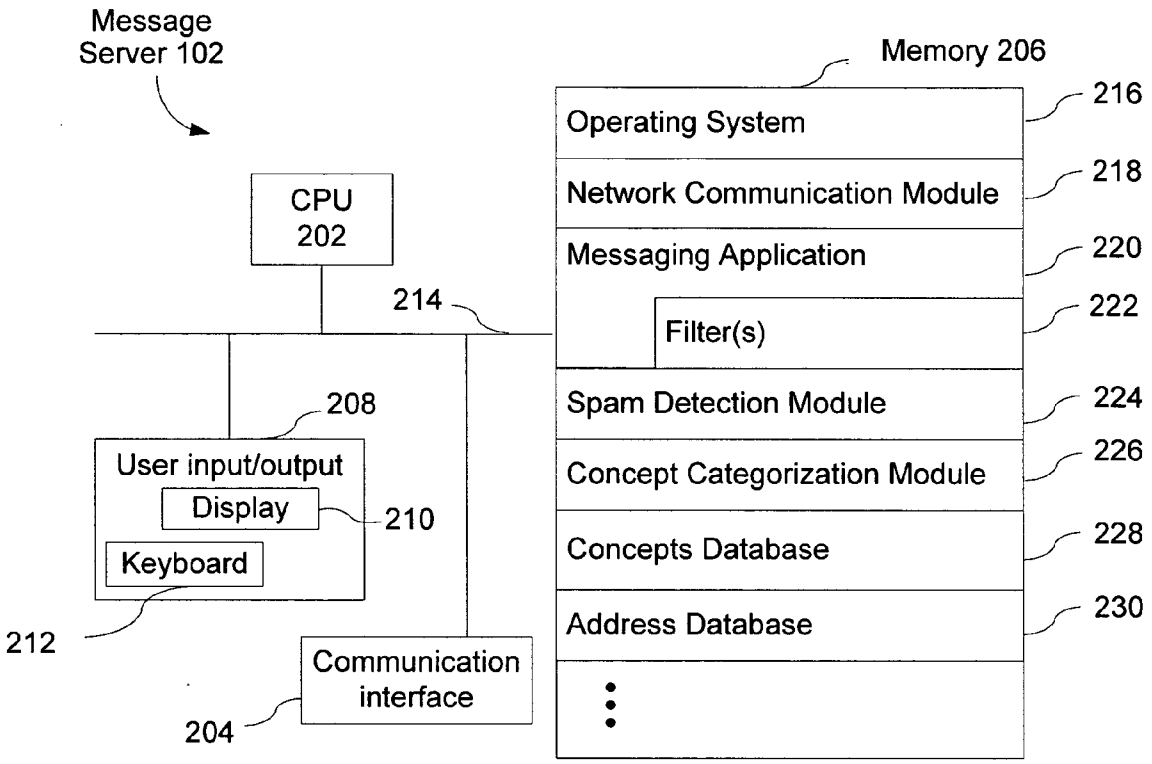

Message Server 102
Memory 206
Operating System
216
Network Communication Module
218
CPU 202
Messaging Application
220
214
Filter(s)
222
208
Spam Detection Module
224
User input/output
Display
210
Concept Categorization Module
226
Keyboard
Concepts Database
228
212
Address Database
230
Communication interface
204

Figure 2

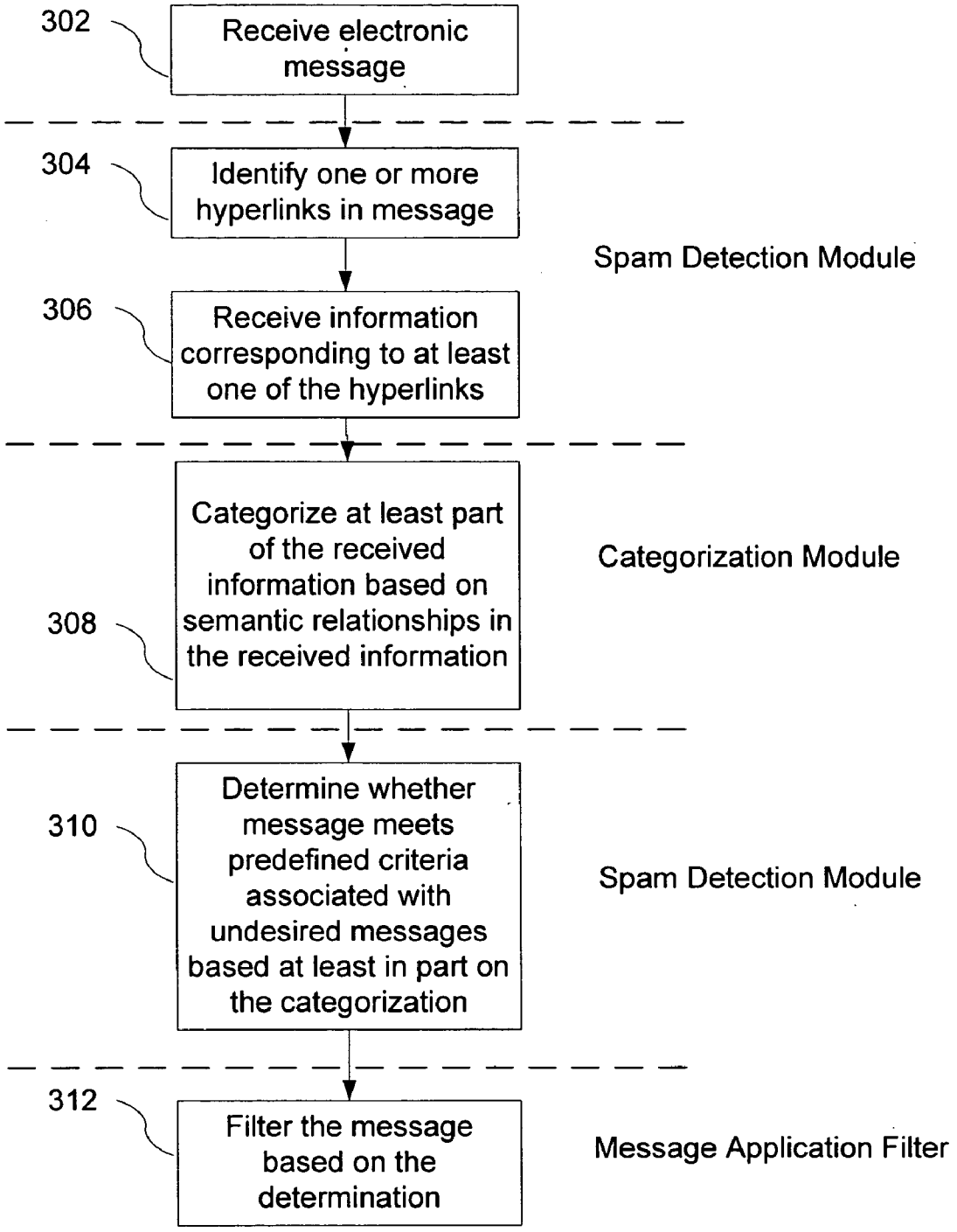

302
Receive electronic message
304
Identify one or more hyperlinks in message
Spam Detection Module
306
Receive information corresponding to at least one of the hyperlinks
Categorize at least part of the received information based on semantic relationships in the received information
Categorization Module
308
310
Determine whether message meets predefined criteria associated with undesired messages based at least in part on the categorization
Spam Detection Module
312
Filter the message based on the determination
Message Application Filter

Figure 3

METHOD AND SYSTEM TO DETECT E-MAIL SPAM USING CONCEPT CATEGORIZATION OF LINKED CONTENT

RELATED APPLICATIONS

[0001] This application is related to U.S. patent application Ser. No. 10/676,571, filed Sep. 30, 2003, entitled "Method and Apparatus for Characterizing Documents Based on Clusters of Related Words," which application is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] The disclosed embodiments relate generally to electronic message filters. More particularly, the disclosed embodiments relate to methods and systems to detect undesired electronic messages using concept categorization of linked content.

BACKGROUND

[0003] Every day, people send and receive millions of electronic messages, such as e-mail, over computer networks for business and leisure. Indeed, e-mail (also written as "email") has become an extremely popular communication channel for people to exchange information.

[0004] Unfortunately, the e-mail that a computer user receives frequently includes spam, unsolicited bulk mailings, junk mail, or other undesired messages. Numerous techniques have been developed to try to detect and filter out such messages, with limited success. Thus, it would be highly desirable to more efficiently detect undesired electronic messages.

SUMMARY

[0005] In one aspect of the invention, an electronic message is received. One or more hyperlinks in the electronic message are identified and information corresponding to at least one of the hyperlinks is received. At least part of the received information is categorized based on semantic relationships in the received information. Based at least in part on the categorization, whether the electronic message meets predefined criteria associated with undesired messages is determined.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] For a better understanding of the aforementioned aspect of the invention as well as additional aspects and embodiments thereof, reference should be made to the Description of Embodiments below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

[0007] **FIG. 1** is a block diagram illustrating an exemplary distributed computer system according to an embodiment of the invention.

[0008] **FIG. 2** is a block diagram illustrating message server **102** in accordance with one embodiment of the present invention.

[0009] **FIG. 3** is a flowchart representing a method of detecting undesired electronic messages using concept categorization of linked content according to one embodiment.

DESCRIPTION OF EMBODIMENTS

[0010] Methods and systems are described that show how to detect undesired electronic messages using concept categorization of linked content. Reference will be made to certain embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the embodiments, it will be understood that it is not intended to limit the invention to these particular embodiments alone. On the contrary, the invention is intended to cover alternatives, modifications and equivalents that are within the spirit and scope of the invention as defined by the appended claims.

[0011] Moreover, in the following description, numerous specific details are set forth to provide a thorough understanding of the present invention. However, it will be apparent to one of ordinary skill in the art that the invention may be practiced without these particular details. In other instances, methods, procedures, components, and networks that are well-known to those of ordinary skill in the art are not described in detail to avoid obscuring aspects of the present invention.

[0012] **FIG. 1** is a block diagram illustrating an exemplary distributed computer system according to one embodiment of the invention. This system includes client computer **104**, sender computer **108**, web site **110**, message server **102**, and communication network(s) **106** for interconnecting these components. Client **104** includes graphical user interface (GUI) **112**. Sender computer **108** sends one or more electronic messages (e.g., e-mail) to client **104** via communications network(s) **106** and server **102**. Server **102** receives the electronic message and identifies one or more hyperlinks in the message to other URLs or network addresses, such as a URL or network address for web site **110**. Server **102** requests and receives information (e.g., a web page or other content) corresponding to the URL or network address from web site **110** and categorizes the concepts in this information based on semantic relationships in the received information. Server **102** determines whether the message meets predefined criteria associated with undesired messages based at least in part on the categorization and filters the message accordingly. Client **104** receives filtered messages via communication network **106** from server **102**. GUI **112** displays the messages.

[0013] **FIG. 2** is a block diagram illustrating message server **102** in accordance with one embodiment of the present invention. Server **102** typically includes one or more processing units (CPU's) **202**, one or more network or other communications interfaces **204**, memory **206**, and one or more communication buses **214** for interconnecting these components. Server **102** optionally may include a user interface **208** comprising a display device **210** and a keyboard **212**. Memory **206** may include high speed random access memory and may also include non-volatile memory, such as one or more magnetic disk storage devices. Memory **206** may optionally include one or more storage devices remotely located from the CPU(s) **202**. In some embodiments, the memory **206** stores the following programs, modules and data structures, or a subset thereof:

[0014] an operating system **216** that includes procedures for handling various basic system services and for performing hardware dependent tasks;

[0015] a network communication module **218** that is used for connecting server **102** to other computers (e.g.,

sender **108** and client **104**) via one or more communication network interfaces **204** (wired or wireless), such as the Internet, other wide area networks, local area networks, metropolitan area networks, and so on;

[**0016**] a messaging application **220** with one or more filters **222** that receives, filters, and distributes electronic messages (e.g., from sender **108** to client **104**);

[**0017**] a spam detection module **224** that identifies hyperlinks in the messages, requests and receives information (e.g., web pages or files) corresponding to the hyperlinks, and determines whether the message meets predefined criteria associated with undesired messages based at least in part on concept categorization of the received information;

[**0018**] a concept categorization module **226** that categorizes at least part of the received information into concepts based on semantic relationships in the received information;

[**0019**] a concepts database **228** that stores concepts (also called clusters because the concepts can be used to generate related words); and

[**0020**] an address database **230** that stores the URLs and/or network addresses of web sites **110** and web pages that have previously been received and categorized, as well as the categorization results for these web sites and web pages.

[**0021**] Each of the above identified modules and applications corresponds to a set of instructions for performing a function described above. These modules (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules may be combined or otherwise re-arranged in various embodiments. In some embodiments, memory **206** may store a subset of the modules and data structures identified above. Furthermore, memory **206** may store additional modules and data structures not described above.

[**0022**] Although **FIG. 2** shows server **102** as a number of discrete items, **FIG. 2** is intended more as a functional description of the various features which may be present in server **102** rather than as a structural schematic of the embodiments described herein. In practice, and as recognized by those of ordinary skill in the art, items shown separately could be combined and some items could be separated. For example, some items shown separately in **FIG. 2** could be implemented on single servers and single items could be implemented by one or more servers. The actual number of servers in server **102** and how features are allocated among them will vary from one implementation to another, and may depend in part on the amount of data traffic that the system must handle during peak usage periods as well as during average usage periods.

[**0023**] **FIG. 3** is a flowchart representing a method of detecting undesired electronic messages using concept categorization of linked content according to one embodiment. The process shown in **FIG. 3** is performed by message server **102** (**FIG. 1**). It will be appreciated by those of ordinary skill in the art that one or more of the acts described may be performed by hardware, software, or a combination thereof, as may be embodied in one or more computing systems. In other embodiments, an analogous process can be performed by client **104** using components analogous to those shown for server **102** in **FIG. 2**.

[**0024**] Messaging application **220** receives an electronic message (**302**) from sender **108** that is being sent to client **104**. In some embodiments, the electronic message is an e-mail message.

[**0025**] Spam detection module **224** identifies one or more hyperlinks in the electronic message (**304**).

[**0026**] Spam detection module **224** sends a request for the web page, file, or other information corresponding to the hyperlink(s). A web site (e.g., **110**) corresponding to the URL or network address in a given request receives the request and sends the corresponding information (i.e., the information stored at a location designated by the URL or network address) to server **102**. In some embodiments, the corresponding information can be substantially all of the information stored at the web site.

[**0027**] Spam detection module **224** receives information corresponding to at least one of the hyperlinks in the electronic message (**306**). In some embodiments, the received information comprises a web page corresponding to one of the identified hyperlinks.

[**0028**] Categorization module **226** categorizes the concepts in at least part of the received information based on semantic relationships in the received information (**308**). In some embodiments, the categorizing is performed by determining a probability that a concept is part of the received information. In some embodiments, the categorizing is performed by determining respective probabilities that respective concepts are part of the received information and ranking the respective concepts according to those respective probabilities.

[**0029**] In some embodiments, a subset of conceptual categories, such as the ones with the highest scores in the received information, are associated with the received message.

[**0030**] Based at least in part on the concept categorization (**308**), spam detection module **224** determines whether the electronic message meets predefined criteria associated with undesired messages (**310**). In some embodiments, if the web page or other information has previously been received (**306**) and categorized (**308**) for a URL or network address, spam detection module **224** will use the information and/or categorization for that URL/network address that is stored in address database **230** to determine if the message is undesired.

[**0031**] In some embodiments, the categorizing associates a set of categories with the received information, and the determining is performed by generating a score, based on how well the categories match a predefined set of categories (e.g., categories associated with spam), and comparing the score with a threshold. In some embodiments, the categorizing associates a set of categories with the received information, and the determining includes determining whether any of the N highest ranked categories of the associated categories are included in a predefined set of undesired categories, where N is a predefined number (e.g., a number between 1 and 10). For example, if concepts database **228** includes the concepts (clusters) listed in **FIG. 16** of U.S. patent application Ser. No. 10/676,571, the clusters "free sex

porn pic movies xxx" and "nude naked pics pictures photos . . . " may be predefined as undesirable categories. The categories associated with the received information can be compared to these two undesirable categories to determine how well the categories associated with the received information match the undesired categories. The comparison can be scored and compared to a threshold score. Alternatively, if any of the undesired concepts matches any of the N highest ranked categories in the received information, the message can be deemed to be undesirable.

[0032] In some embodiments, concept characterization is the sole basis for determining if the message is undesirable. For example, if the most probable concept contained in the received information, or in at least one part of the received information, is a concept previously categorized as undesirable, the message is deemed undesirable.

[0033] In other embodiments, concept characterization can be combined with other methods to determine if the message is undesirable in accordance with predefined criteria. These methods can examine other features in the message or the received information, such as the page layout (many spammers create new sites by copying one of their previously shut-down sites), the use of graphics, the existence of words like "buy now", "enter here", "porn" or "Viagra" that are disproportionate to spam sites, and/or the use of capitalized words.

[0034] In some embodiments, a message can be determined to be undesirable by looking at the domain registration information of the web sites associated with the hyperlinks in the message. This information can be determined by performing a who is lookup on the domain names that correspond to the hyperlinks. Domain name registration information of interest may include, without limitation, the contact and address information, and/or the expiration date of the domain name. Spammers typically register a site for just one year (the minimal duration permitted), so an expiration date corresponding to a one-year duration is often a sufficient criterion by itself to identify an undesired message.

[0035] In some embodiments, there may also be rules that permit messages received from a list of addresses (e.g., addresses to which the user has previously sent messages and/or addresses specified by the user) to not be considered undesirable, even if links in those messages are suspect.

[0036] In some embodiments, messaging application **220** includes one or more filters **222**, which filter the message based on the determination of whether the electronic message meets predefined criteria associated with undesired messages (**312**). For messages that are determined to be undesirable, filtering can include not sending the message to client **104**, deleting the message, flagging the message as undesirable, or sending the message to a folder labeled as "spam,""junk mail,""unsolicited mail," or other similar name for undesirable messages. In some embodiments, the filtering can be done by another computer, such as client **104**, rather than by server **102**. Messages that are not determined to be undesirable are sent to client **104** (e.g., to an inbox in a messaging application at client **104**).

[0037] The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated.

What is claimed is:

1. A method, comprising:

a. receiving an e-mail message at a message server;

b. identifying one or more hyperlinks in the electronic message;

c. receiving a web page corresponding to one of the hyperlinks;

d. categorizing the received web page based on semantic relationships in the received web page; and

e. determining, based at least in part on the categorization of the received web page, whether the electronic message meets predefined criteria associated with undesired messages.

2. A method, comprising:

a. receiving an electronic message;

b. identifying one or more hyperlinks in the electronic message;

c. receiving information corresponding to at least one of the hyperlinks;

d. categorizing at least part of the received information based on semantic relationships in the received information; and

e. determining, based at least in part on the categorization of at least part of the received information, whether the electronic message meets predefined criteria associated with undesired messages.

3. The method of claim 2, wherein the electronic message is an e-mail message.

4. The method of claim 2, wherein the received information comprises a web page corresponding to one of the identified hyperlinks.

5. The method of claim 2, wherein the categorizing is performed by determining a probability that a concept is part of the received information.

6. The method of claim 2, wherein the categorizing is performed by determining respective probabilities that respective concepts are part of the received information.

7. The method of claim 6, wherein the categorizing includes ranking the respective concepts according to the respective probabilities that the respective concepts are present in the received information.

8. The method of claim 2, further comprising associating a subset of conceptual categories with the received message.

9. The method of claim 2, wherein the categorizing associates a set of categories with the received information, and the determining is performed by generating a score, associated with how well the associated categories match a predefined set of categories, and comparing the score with a threshold.

10. A system comprising at least one server, wherein said at least one server is configured to:

a. receive an electronic message;

b. identify one or more hyperlinks in the electronic message;

c. receive information corresponding to at least one of the hyperlinks;

d. categorize at least part of the received information based on semantic relationships in the received information; and

e. determine, based at least in part on the categorization of at least part of the received information, whether the electronic message meets predefined criteria associated with undesired messages.

11. A machine readable medium having stored thereon data representing sequences of instructions, which when executed by a computer, cause the computer to:

a. receive an electronic message;

b. identify one or more hyperlinks in the electronic message;

c. receive information corresponding to at least one of the hyperlinks;

d. categorize at least part of the received information based on semantic relationships in the received information; and

e. determine, based at least in part on the categorization of at least part of the received information, whether the electronic message meets predefined criteria associated with undesired messages.

12. A system, comprising:

a. means for receiving an electronic message;

b. means for identifying one or more hyperlinks in the electronic message;

c. means for receiving information corresponding to at least one of the hyperlinks;

d. means for categorizing at least part of the received information based on semantic relationships in the received information; and

e. means for determining, based at least in part on the categorization of at least part of the received information, whether the electronic message meets predefined criteria associated with undesired messages.

13. A method, comprising:

a. receiving an electronic message;

b. identifying one or more hyperlinks in the electronic message;

c. receiving domain name registration information for at least one of the hyperlinks that includes an expiration date of the domain name; and

d. determining, based at least in part on the expiration date of the domain name, whether the electronic message meets predefined criteria associated with undesired messages.

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