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Knepper et al.

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(45) **Date of Patent: Oct. 12, 2010**

(54) **METHOD FOR DOMAIN IDENTIFICATION OF DOCUMENTS IN A DOCUMENT DATABASE**

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(73) Assignee: **Harris Corporation**, Melbourne, FL (US)

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(22) Filed: **May 5, 2006**

(65) **Prior Publication Data**

US 2006/0206483 A1 Sep. 14, 2006

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/974,304, filed on Oct. 27, 2004.

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

(52) **U.S. Cl.** **707/738**; 707/722; 707/728; 707/731; 707/748

(58) **Field of Classification Search** ..... None
See application file for complete search history.

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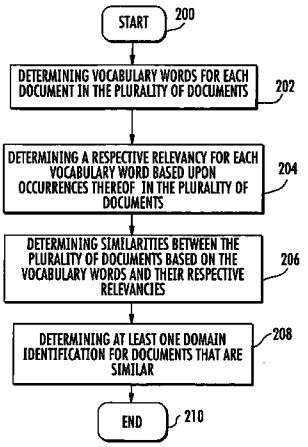
Primary Examiner—Apu M Mofiz
Assistant Examiner—Hung D Le
(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A method for processing documents in a document database includes determining vocabulary words for each document, and determining a respective relevancy for each vocabulary word based upon occurrences thereof in all of the documents. Similarities are determined between the documents based upon the vocabulary words and their respective relevancies. At least one domain identification is determined for the documents based upon the determined similarities.

37 Claims, 19 Drawing Sheets



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2006/0004747 A1* 1/2006 Weare 707/5
2006/0059143 A1 3/2006 Palmon et al. 707/5
2006/0116995 A1* 6/2006 Bloedorn 707/3
2006/0155751 A1* 7/2006 Geshwind et al. 707/102

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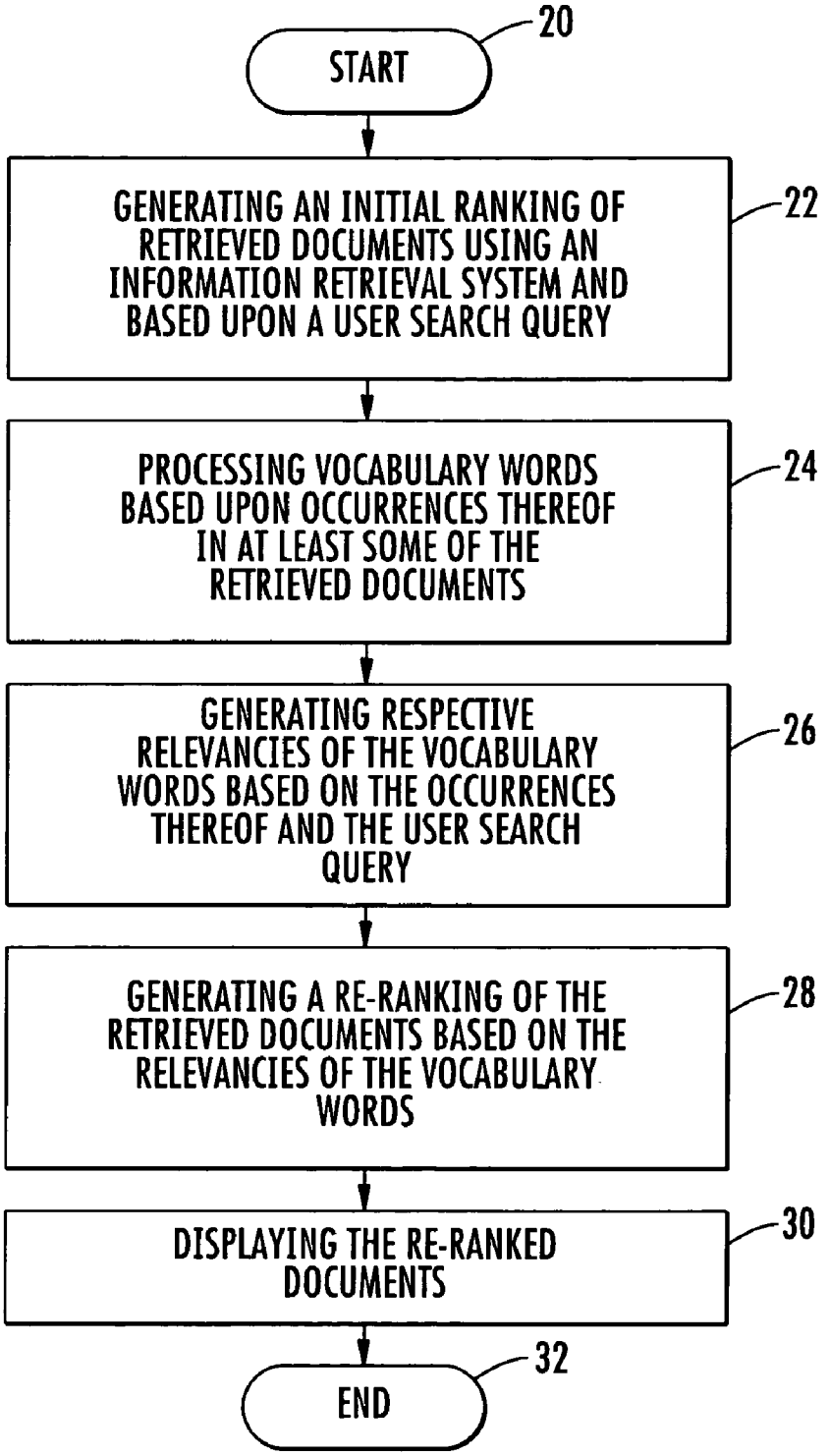

START
20
GENERATING AN INITIAL RANKING OF RETRIEVED DOCUMENTS USING AN INFORMATION RETRIEVAL SYSTEM AND BASED UPON A USER SEARCH QUERY
22
PROCESSING VOCABULARY WORDS BASED UPON OCCURRENCES THEREOF IN AT LEAST SOME OF THE RETRIEVED DOCUMENTS
24
GENERATING RESPECTIVE RELEVANCIES OF THE VOCABULARY WORDS BASED ON THE OCCURRENCES THEREOF AND THE USER SEARCH QUERY
26
GENERATING A RE-RANKING OF THE RETRIEVED DOCUMENTS BASED ON THE RELEVANCIES OF THE VOCABULARY WORDS
28
DISPLAYING THE RE-RANKED DOCUMENTS
30
END
32

FIG. 1

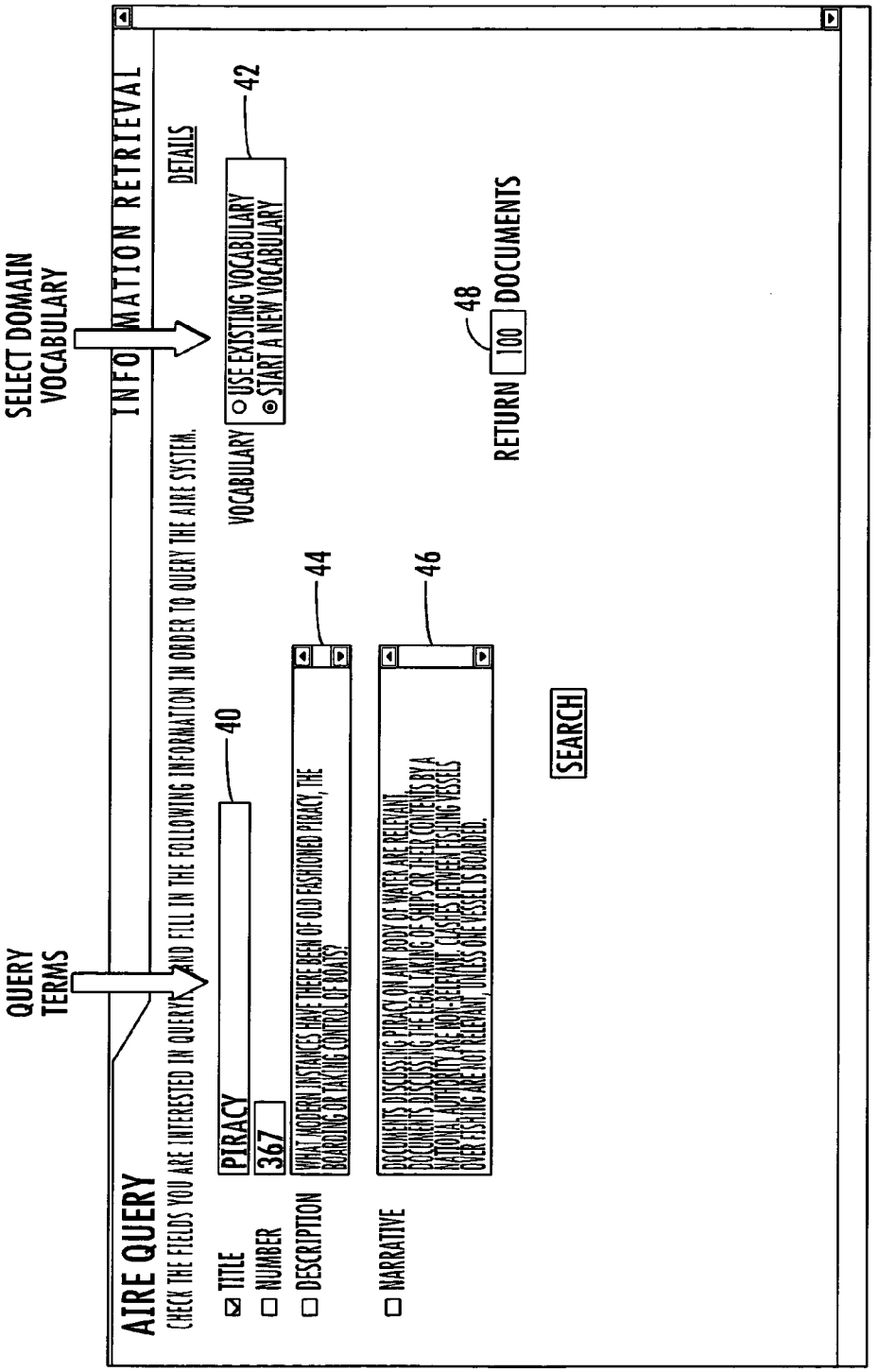

SELECT DOMAIN VOCABULARY
QUERY TERMS
AIRE QUERY
CHECK THE FIELDS YOU ARE INTERESTED IN QUERYING AND FILL IN THE FOLLOWING INFORMATION IN ORDER TO QUERY THE AIRE SYSTEM.
INFORMATION RETRIEVAL
DETAILS
TITLE
NUMBER
DESCRIPTION
NARRATIVE
PIRACY
367
WHAT MODERN INSTANCES HAVE THERE BEEN OF OLD FASHIONED PIRACY, THE BOARDING OR TAKING CONTROL OF BOATS?
DOCUMENTS DISCUSSING PIRACY ON ANY BODY OF WATER ARE RELEVANT. DOCUMENTS DISCUSSING THE LEGAL TAKING OF SHIPS OR THEIR CONTENTS BY A NATIONAL AUTHORITY ARE NON-RELEVANT. CLASHES BETWEEN FISHING VESSELS OVER FISHING ARE NOT RELEVANT, UNLESS ONE VESSEL IS BOARDED.
VOCABULARY
USE EXISTING VOCABULARY
START A NEW VOCABULARY
RETURN
100
DOCUMENTS
SEARCH
40
42
44
46
48

FIG. 2

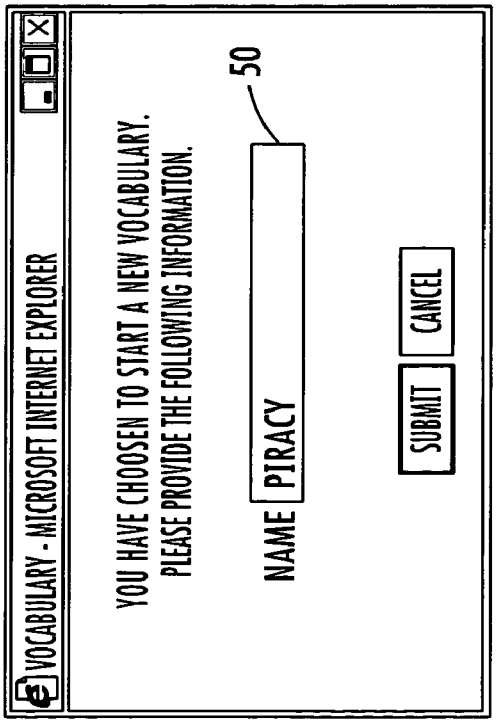

VOCABULARY - MICROSOFT INTERNET EXPLORER
YOU HAVE CHOOSEN TO START A NEW VOCABULARY.
PLEASE PROVIDE THE FOLLOWING INFORMATION.
NAME
PIRACY
50
SUBMIT
CANCEL

FIG. 3a

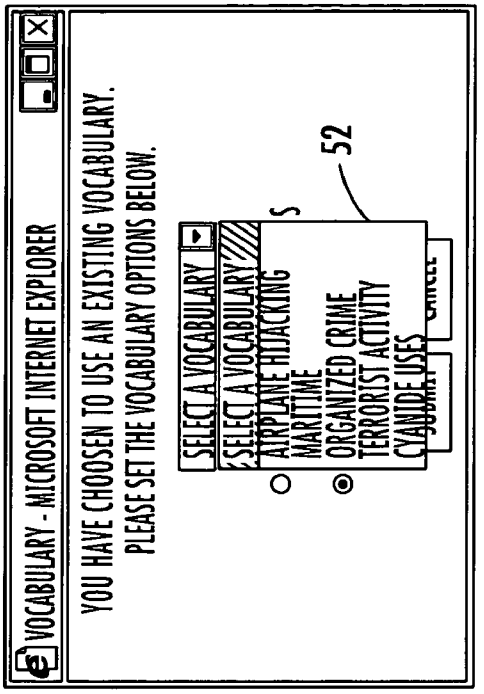

VOCABULARY - MICROSOFT INTERNET EXPLORER
YOU HAVE CHOOSEN TO USE AN EXISTING VOCABULARY.
PLEASE SET THE VOCABULARY OPTIONS BELOW.
SELECT A VOCABULARY
SELECT A VOCABULARY
AIRPLANE HIJACKING
MARITIME
ORGANIZED CRIME
TERRORIST ACTIVITY
CYANIDE USES
52

FIG. 3b

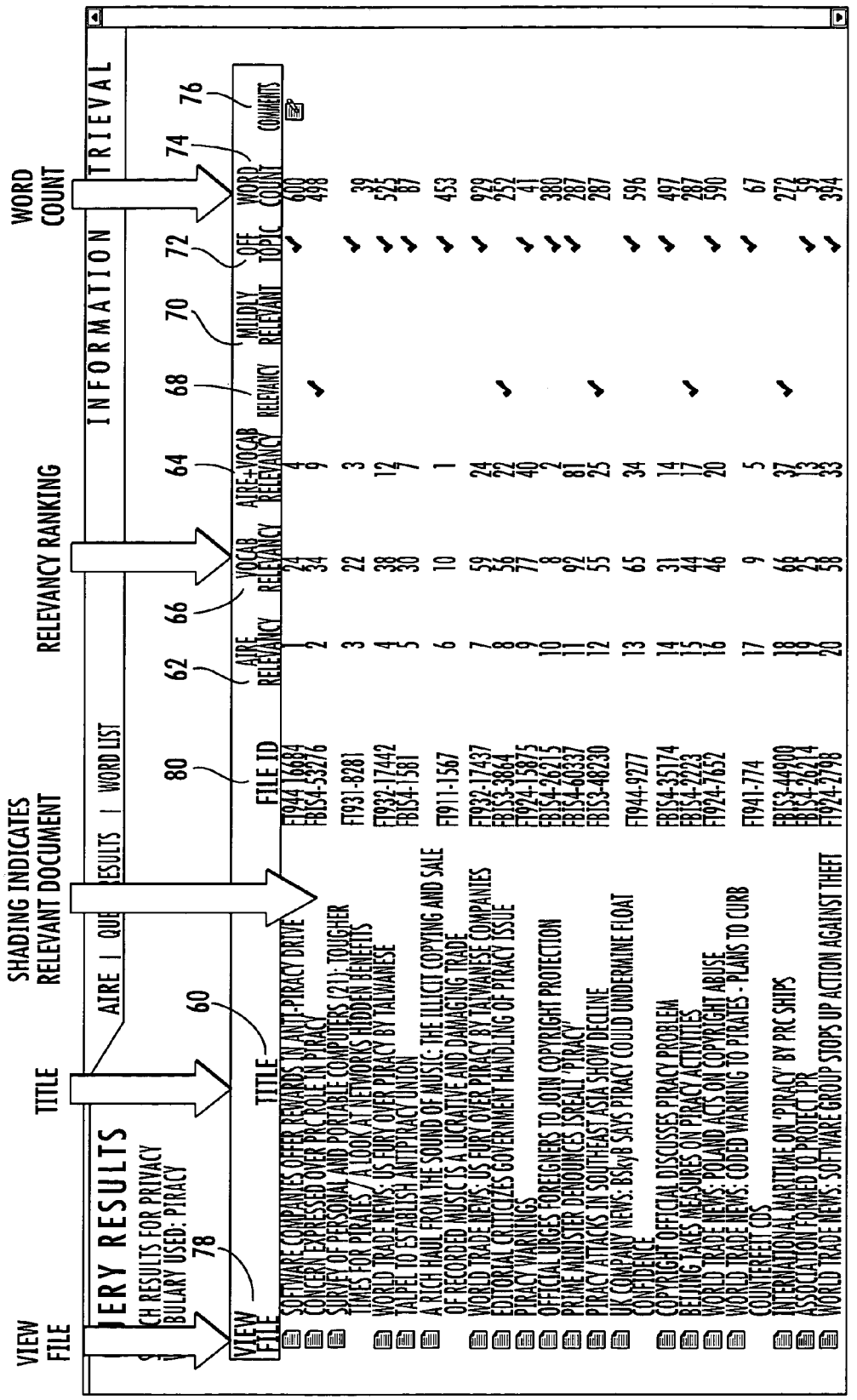

VIEW FILE
TITLE
SHADING INDICATES RELEVANT DOCUMENT
RELEVANCY RANKING
WORD COUNT
JERY RESULTS
CH RESULTS FOR PRIVACY
BULARY USED: PIRACY
78
AIRE | QUE
RESULTS | WORD LIST
INFORMATION
TRIEVAL
60
80
62
64
66
68
70
72
74
76
VIEW FILE
TITLE
FILE ID
AIRE RELEVANCY
VOCAB RELEVANCY
AIRE+VOCAB RELEVANCY
RELEVANCY
MILDLY RELEVANT
OFF TOPIC
WORD COUNT
COMMENTS
SOFTWARE COMPANIES OFFER REWARDS IN ANTI-PIRACY DRIVE FT944-16684 1 2 24 4 600
CONCERN EXPRESSED OVER PRC ROLE IN PIRACY FBIS4-53276 2 34 9 498
SURVEY OF PERSONAL AND PORTABLE COMPUTERS (21): TOUGHER TIMES FOR PIRATES / A LOOK AT NETWORKS HIDDEN BENEFITS FT931-8281 3 22 3 39
WORLD TRADE NEWS: US FURY OVER PIRACY BY TAIWANESE FT932-17442 4 38 12 525
TAIPEI TO ESTABLISH ANTIPIRACY UNITON FBIS4-1581 5 30 7 67
A RICH HAUL FROM THE SOUND OF MUSIC: THE ILLICIT COPYING AND SALE OF RECORDED MUSIC IS A LUCRATIVE AND DAMAGING TRADE FT911-1567 6 10 1 453
WORLD TRADE NEWS: US FURY OVER PIRACY BY TAIWANESE COMPANIES FT932-17437 7 59 24 929
EDITORIAL CRITICIZES GOVERNMENT HANDLING OF PIRACY ISSUE FBIS3-3864 8 56 22 252
PIRACY WARNINGS FT924-15875 9 77 40 41
OFFICIAL URGES FOREIGNERS TO JOIN COPYRIGHT PROTECTION FBIS4-26215 10 8 2 380
PRIME MINISTER DENOUNCES ISREALI 'PIRACY' FBIS4-60337 11 92 81 287
PIRACY ATTACKS IN SOUTHEAST ASIA SHOW DECLINE FBIS3-48230 12 55 25 287
UK COMPANY NEWS: BSkyB SAYS PIRACY COULD UNDERMINE FLOAT FT944-9277 13 65 34 596
CONFIDENCE
COPYRIGHT OFFICIAL DISCUSSES PIRACY PROBLEM FBIS4-35174 14 31 14 497
BEIJING TAKES MEASURES ON PIRACY ACTIVITIES FBIS4-2223 15 44 17 287
WORLD TRADE NEWS: POLAND ACTS ON COPYRIGHT ABUSE FT924-7652 16 46 20 590
WORLD TRADE NEWS: CODED WARNING TO PIRATES - PLANS TO CURB COUNTERFEIT CDS FT941-774 17 9 5 67
INTERNATIONAL MARITIME ON 'PIRACY' BY PRC SHIPS FBIS3-44900 18 66 37 272
ASSOCIATION FORMED TO PROTECT IPR FBIS4-26214 19 25 13 59
WORLD TRADE NEWS: SOFTWARE GROUP STOPS UP ACTION AGAINST THEFT FT924-2798 20 58 33 394

FIG. 4

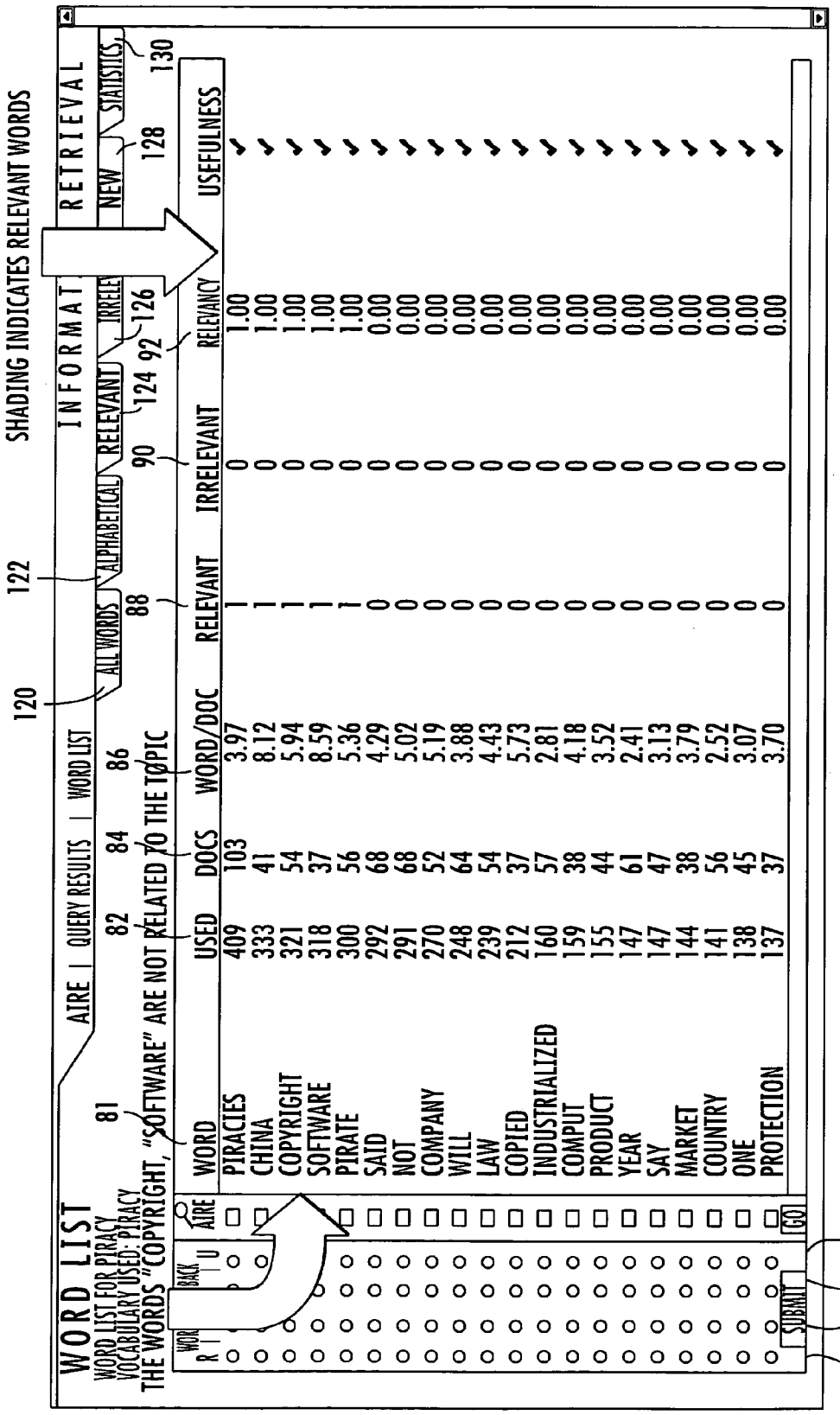

SHADING INDICATES RELEVANT WORDS
WORD LIST
WORD LIST FOR PIRACY
VOCABULARY USED: PIRACY
THE WORDS "COPYRIGHT, "SOFTWARE" ARE NOT RELATED TO THE TOPIC
AIRE | QUERY RESULTS | WORD LIST
INFORMAT
RETRIEVAL
ALL WORDS
ALPHABETICAL
RELEVANT
IRRELEV
NEW
STATISTICS
BACK
AIRE
SUBMIT
GO
WORD
USED
DOCS
WORD/DOC
RELEVANT
IRRELEVANT
RELEVANCY
USEFULNESS
PIRACIES 409 103 3.97 1 0 1.00
CHINA 333 41 8.12 1 0 1.00
COPYRIGHT 321 54 5.94 1 0 1.00
SOFTWARE 318 37 8.59 1 0 1.00
PIRATE 300 56 5.36 1 0 1.00
SAID 292 68 4.29 0 0 0.00
NOT 291 68 5.02 0 0 0.00
COMPANY 270 52 5.19 0 0 0.00
WILL 248 64 3.88 0 0 0.00
LAW 239 54 4.43 0 0 0.00
COPIED 212 37 5.73 0 0 0.00
INDUSTRIALIZED 160 57 2.81 0 0 0.00
COMPUT 159 38 4.18 0 0 0.00
PRODUCT 155 44 3.52 0 0 0.00
YEAR 147 61 2.41 0 0 0.00
SAY 147 47 3.13 0 0 0.00
MARKET 144 38 3.79 0 0 0.00
COUNTRY 141 56 2.52 0 0 0.00
ONE 138 45 3.07 0 0 0.00
PROTECTION 137 37 3.70 0 0 0.00
81
82
84
86
88
90
92
120
122
124
126
128
130
100
102
104
106

FIG. 5

WORD LIST

WORD LIST FOR PIRACY
VOCABULARY USED: PIRACY

AIRE | QUERY RESULTS | WORD LIST

INFORMATION RETRIEVAL

ALL WORDS | ALPHABETICAL | RELEVANT | IRRELEVANT | NEW | STATISTICS

WORD FEEDBACK

R	I	N	U	AIRE	WORD	USED	DOCS	WORD/DOC	RELEVANT	IRRELEVANT	RELEVANCY	USEFULNESS
○	○	○	○	☐	PIRACIES	409	103	3.97	1	0	1.00	✓
○	○	○	○	☐	CHINA	333	41	8.12	1	0	1.00	✓
○	◉	○	○	☐	COPYRIGHT	321	54	5.94	1	0	1.00	✓
○	◉	○	○	☐	SOFTWARE	318	37	8.59	1	0	1.00	✓
○	○	○	○	☐	PIRATE	300	56	5.36	1	0	1.00	✓
○	◉	○	○	☐	ILLEGAL	126	37	3.41	1	0	1.00	✓
○	◉	○	○	☐	DISC	103	21	4.90	1	0	1.00	✓
○	◉	○	○	☐	INTELLECTUAL	97	35	2.77	1	0	1.00	✓
○	◉	○	○	☐	INTELLECTUAL_PROPERTIES	80	31	2.58	1	0	1.00	✓
○	◉	○	○	☐	COUNTERFEIT	64	19	3.37	1	0	1.00	✓
○	◉	○	○	☐	COPYRIGHT_LAW	62	30	2.67	1	0	1.00	✓
○	○	○	○	☐	SHIP	53	20	2.65	1	0	1.00	✓
○	◉	○	○	☐	COMPUT_SOFTWARE	39	28	1.39	1	0	1.00	✓
○	◉	○	○	☐	ANC	40	27	1.48	1	0	1.00	✓
○	◉	○	○	☐	SOFTWARE_PIRACIES	32	20	1.60	1	0	1.00	✓
○	◉	○	○	☐	COMPACT_DISC	31	18	1.72	1	0	1.00	✓
○	○	○	○	☐	VESSEL	27	9	3.00	1	0	1.00	✓
○	○	○	○	☐	MARITIME	21	11	1.90	1	0	1.00	✓
○	○	○	○	☐	CHINA_SEA	19	7	2.57	1	0	1.00	✓
○	○	○	○	☐	INTERN_MARITIME	12	9	1.33	1	0	1.00	✓

SUBMIT GO

100 102 104 106 81 82 84 86 88 90 92 120 122 124 126 128 130

FIG. 6

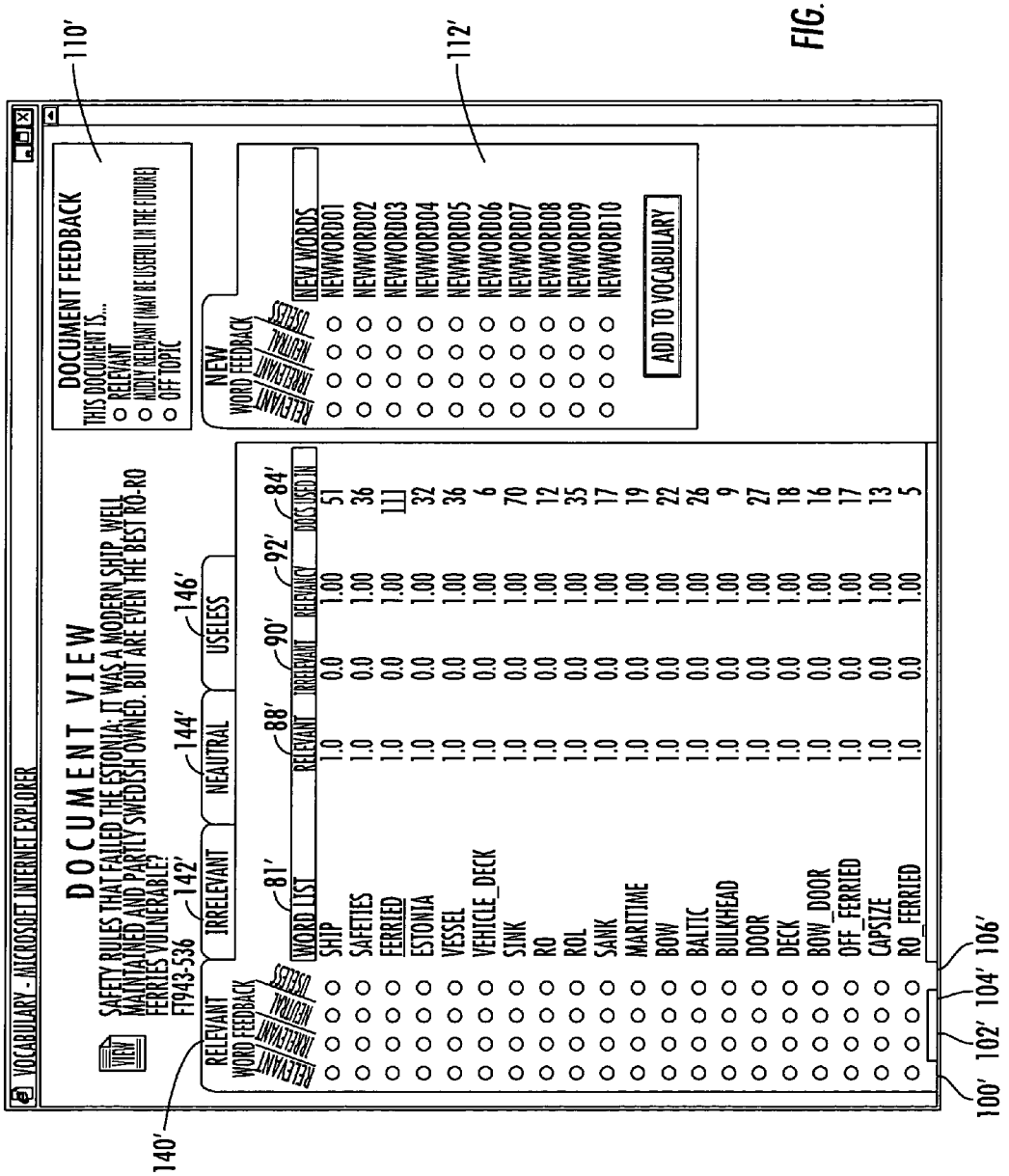

VOCABULARY - MICROSOFT INTERNET EXPLORER
DOCUMENT VIEW
SAFETY RULES THAT FAILED THE ESTONIA: IT WAS A MODERN SHIP WELL MAINTAINED AND PARTLY SWEDISH OWNED. BUT ARE EVEN THE BEST RO-RO FERRIES VULNERABLE?
FT943-536
DOCUMENT FEEDBACK
THIS DOCUMENT IS...
RELEVANT
MIDDLY RELEVANT (MAY BE USEFUL IN THE FUTURE)
OFF TOPIC
NEW WORD FEEDBACK
ADD TO VOCABULARY
RELEVANT
IRRELEVANT
NEUTRAL
USELESS
WORD LIST
RELEVANT
IRRELEVANT
DOCS USED IN
SHIP 1.0 0.0 1.00 51
SAFETIES 1.0 0.0 1.00 36
FERRIED 1.0 0.0 1.00 111
ESTONIA 1.0 0.0 1.00 32
VESSEL 1.0 0.0 1.00 36
VEHICLE_DECK 1.0 0.0 1.00 6
SINK 1.0 0.0 1.00 70
RO 1.0 0.0 1.00 12
ROL 1.0 0.0 1.00 35
SANK 1.0 0.0 1.00 17
MARITIME 1.0 0.0 1.00 19
BOW 1.0 0.0 1.00 22
BALTIC 1.0 0.0 1.00 26
BULKHEAD 1.0 0.0 1.00 9
DOOR 1.0 0.0 1.00 27
DECK 1.0 0.0 1.00 18
BOW_DOOR 1.0 0.0 1.00 16
OFF_FERRIED 1.0 0.0 1.00 17
CAPSIZE 1.0 0.0 1.00 13
RO_FERRIED 1.0 0.0 1.00 5
NEW_WORDS
NEWWORD01
NEWWORD02
NEWWORD03
NEWWORD04
NEWWORD05
NEWWORD06
NEWWORD07
NEWWORD08
NEWWORD09
NEWWORD10
110'
112'
140'
142'
144'
146'
81'
88'
90'
92'
84'
100'
102'
104'
106'

FIG. 7

PIRACY VOCABULARY RANKING

QUERY RESULTS

AIRE | QUERY RESULTS | WORD LIST

INFORMATION RETRIEVAL

SEARCH RESULTS FOR PRIVACY
VOCABULARY USED: PIRACY

60 62 66 64

VIEW FILE	TITLE	FILE ID	AIRE RELEVANCY	VOCAB RELEVANCY	AIRE+VOCAB RELEVANCY	RELEVANCY	MILDLY RELEVANT	OFF TOPIC	WORD COUNT	COMMENTS
	BEIJING TAKES MEASURES ON PIRACY ACTIVITIES	FBIS4-2223	15	1	4	✔			354	
	BEIJING CALLS 'PIRACY' ACTS 'JUST' 'LAWFUL'	FBIS3-3196	40	2	9	✔			582	
	PIRACY ATTACKS IN SOUTHEAST ASIA SHOW DECLINE	FBIS3-48230	12	3	3	✔			758	
	CONCERN EXPRESSED OVER PRC ROLE IN PIRACY	FBIS4-53276	2	4	1	✔			75	
	NEWSPAPER REVIEWS LITERARY EFFORTS IN 1993	FBIS-20590	85	5	28			✔	452	
	EDITORIAL CRITICIZES GOVERMENT HANDLING OF PIRACY ISSUES	FBIS3-3864	8	6	2	✔			685	
	INTERNATIONAL MARITIME ON 'PIRACY' BY PRC SHIPS	FBIS3-44900	18	7	5	✔			245	
	WORLD TRADE NEWS: PIRATED MUSIC IN SALES OF DOLLARS 2.1 BN	FT934-15481	43	8	13			✔	658	
	PRC DENIES SECURITY FORCE PIRACY, DRAWS UP NEW GUIDELINES	FBIS3-3863	45	9	16	✔			457	
	POLICE TARGET PRIVATE SECTOR IN BOOK PIRACY CRACKDOWN	FBIS4-26342	31	10	8			✔	56	
	SIXTIES BUCCANEER DEALS IN HIGH-TECH PIRACY	FT934-14966	29	11	7			✔	754	
	INDONESIA DENIES PIRACY LINK IN SHIPS' COLLISION	FT923-1266	52	12	20	✔			114	
	WORLD TRADE NEWS: WORLDWIDE PIRATE DISC SALES DOUBLE TO 75M-CHINA MAINLY TO BLAME	FT942-5998	94	13	43			✔	858	
	US PRESSURES CHINA FOR SOFTWARE PIRACY	FT943-10345	56	14	21			✔	65	
	MALAYSIA'S DISASTER WARNINGS TO GO UNHEEDED IN STRAIT OF MALACCA: MAESEREK NAVIGATOR COLLISION WAS THE LATEST IN A SERIES OF ACCIDENTS	FT931-13007	64	15	23	✔			117	
	PIRACY WARNINGS	FT924-15875	9	16	6			✔	565	
	DENG'S DAUGHTER PURSUES PUBLISHERS OF PIRATED BIOGRAPHY	FBIS4-1621	103	17	50			✔	985	
	PIRATE DECODERS POSE THREAT TO SATELLITE BROADCASTERS	FT934-16142	95	18	46			✔	658	
	WORLD TRADE NEWS: US RENEWS PRESSURE ON CHINA OVER INTELLECTUAL PIRACY	FT943-12951	88	19	44			✔	266	
	USTING CABLE PIRATES: SIMI VALLEY PIRACY CASE IS ONE OF THE FIRST TO RESULT IN A CONVICTION	LA32889-0045	38	20	18			✔	189	

FIG. 8

AIRE RANKING + PIRACY VOCABULARY RANKING

QUERY RESULTS

AIRE | QUERY RESULTS | WORD LIST

INFORMATION RETRIEVAL

SEARCH RESULTS FOR PRIVACY
VOCABULARY USED: PIRACY

60 62 66 64

VIEW FILE	TITLE	FILE ID	AIRE RELEVANCY	VOCAB RELEVANCY	AIRE+VOCAB RELEVANCY	RELEVANCY	MILDLY RELEVANT	OFF TOPIC	WORD COUNT	COMMENTS
	CONCERN EXPRESSED OVER PRC ROLE IN PIRACY	FBIS4-53276	2	4	1	✓			558	
	EDITORIAL CRITICIZES GOVERNMENT HANDLING OF PIRACY ISSUE	FBIS3-3864	8	6	2	✓			354	
	PIRACY ATTACKS IN SOUTHEAST ASIA SHOW DECLINE	FBIS3-48230	12	3	3	✓			245	
	BEIJING TAKES MEASURES ON PIRACY ACTIVITIES	FBIS4-2223	15	1	4	✓			611	
	INTERNATIONAL MARITIME ON "PIRACY" BY PRC SHIPS	FBIS3-44900	18	7	5	✓			764	
	PIRACY WARNINGS	FT924-15875	9	16	6			✓	542	
	SIXTIES BUCCANEER DEALS IN HIGH-TECH PIRACY	FT934-14966	29	11	7			✓	82	
	POLICE TARGET PRIVATE SECTOR IN BOOK PIRACY CRACKDOWN	FBIS4-26342	31	10	8			✓	115	
	BEIJING CALLS 'PIRACY' ACTS 'JUST', 'LAWFUL'	FBIS3-3196	40	2	9	✓			45	
	PRIME MINISTER DENOUNCES [SREAL] 'PIRACY'	FBIS4-60337	11	33	10			✓	563	
	ASSOCIATION FORMED TO PROTECT IPR	FBIS4-26214	19	27	11			✓	566	
	OFFICIAL URGES FOREIGNERS TO JOIN COPYRIGHT PROTECTION	FBIS4-26215	10	36	12			✓	258	
	WORLD TRADE NEWS: PIRATED MUSIC IN SALES OF DOLLARS 2.1 BN	FT934-15481	43	8	13			✓	746	
	UK COMPANY NEWS: BSKYB SAYS PIRACY COULD UNDERMINE FLOAT CONFIDENCE	FT944-9277	13	35	14			✓	125	
	PLA CHIEF OF STAFF ATTENDS EXHIBIT IN MALAYSIA	FBIS4-34652	22	28	15			✓	475	
	PRC DENIES SECURITY FORCE PIRACY, DRAWS UP NEW GUIDLINES	FBIS3-3863	45	9	16	✓			356	
	EASTERN CARIBBEAN ISLANDS BECOMING 'PREFERRED AREA' FOR	FBIS4-67139	27	29	17	✓			457	
	USTING CABLE PIRATES: SIMI VALLEY PIRACY CASE IS ONE OF THE FIRST TO RESULT IN A CONVICTION	LA032889-0045	38	20	18			✓	56	
	WORLD TRADE NEWS: US HITS AT BARRIERS TO FILM, TV EXPORTS	FT924-11613	34	26	19			✓	785	
	INDONESIA DENIES PIRACY LINK IN SHIPS' COLLISION	FT923-1266	52	12	20	✓			235	

FIG. 9

AIRE RANKING + MARITIME VOCABULARY RANKING

QUERY RESULTS

AIRE | QUERY RESULTS | WORD LIST

INFORMATION RETRIEVAL

SEARCH RESULTS FOR PRIVACY
VOCABULARY USED: PIRACY

60 62 66 64

VIEW FILE	TITLE	FILE ID	AIRE RELEVANCY	VOCAB RELEVANCY	AIRE+VOCAB RELEVANCY	RELEVANCY	MILDLY RELEVANT	OFF TOPIC	WORD COUNT	COMMENTS
	CONCERN EXPRESSED OVER PRC ROLE IN PIRACY	FBIS4-53276	2	4	1	✔			558	
	EDITORIAL CRITICIZES GOVERNMENT HANDLING OF PIRACY ISSUE	FBIS3-3864	8	6	2	✔			354	
	PIRACY ATTACKS IN SOUTHEAST ASIA SHOW DECLINE	FBIS3-48230	12	3	3	✔			245	
	BEIJING TAKES MEASURES ON PIRACY ACTIVITIES	FBIS4-2223	15	1	4	✔			611	
	PIRACY WARNINGS	FT924-15875	18	7	5			✔	764	
	INTERNATIONAL MARITIME ON 'PIRACY' BY PRC SHIPS	FBIS3-44900	9	16	6	✔			542	
	WORLD TRADE NEWS: CODED WARNING TO PIRATES- PLANS TO CURB COUNTERFEIT CDS	FT941-774	29	11	7			✔	82	
	OFFICIAL URGES FOREIGNERS TO JOIN COPYRIGHT PROTECTION	FBIS4-26215	31	10	8			✔	115	
	EASTERN CARIBBEAN ISLANDS BECOMING "PREFERRED AREA" FOR	FBIS4-67139	40	2	9	✔			45	
	BEIJING CALLS 'PIRACY' ACTS 'JUST', 'LAWFUL'	FBIS3-3196	11	33	10	✔			563	
	ASSOCIATION FORMED TO PROTECT IPR	FBIS4-26214	19	27	11			✔	566	
	TOUGHER RESTRICTIONS ON SOFTWARE DUPLICATION HINDERS PIRACY	FT943-17085	10	36	12			✔	258	
	COPYRIGHT OFFICIAL VIEWS IPR PROTECTION	FBIS4-26750	43	8	13			✔	746	
	SOFTWARE COMPANIES OFFER REWARDS IN ANTI-PIRACY DRIVE	FT944-16684	13	35	14			✔	125	
	PRC DENIES SECURITY FORCE PIRACY, DRAWS UP NEW GUIDELINES	FBIS3-3863	22	28	15	✔			475	
	TAIWAN BOOSTS COPYRIGHTS	FT922-6363	45	9	16			✔	356	
	INDONESIA DENIES PIRACY LINK IN SHIPS' COLLISION	FT923-1266	27	29	17	✔			457	
	SURVEY OF PERSONAL AND PORTABLE COMPUTERS(21): TOUGHER TIMES FOR PIRATES/ A LOOK AT NETWORKS' HIDDEN BENEFITS	FT931-8281	38	20	18			✔	56	
	WORLD TRADE NEWS: US FURY OVER PIRACY BY TAIWANESE	FT932-17442	34	26	19			✔	785	
	SOFTWARE COMPANIES CRACK DOWN ON THEFT AND PIRACY	FT911-3757	52	12	20			✔	235	

FIG. 10

MARITIME VOCABULARY RANKING

QUERY RESULTS

AIRE | QUERY RESULTS | WORD LIST

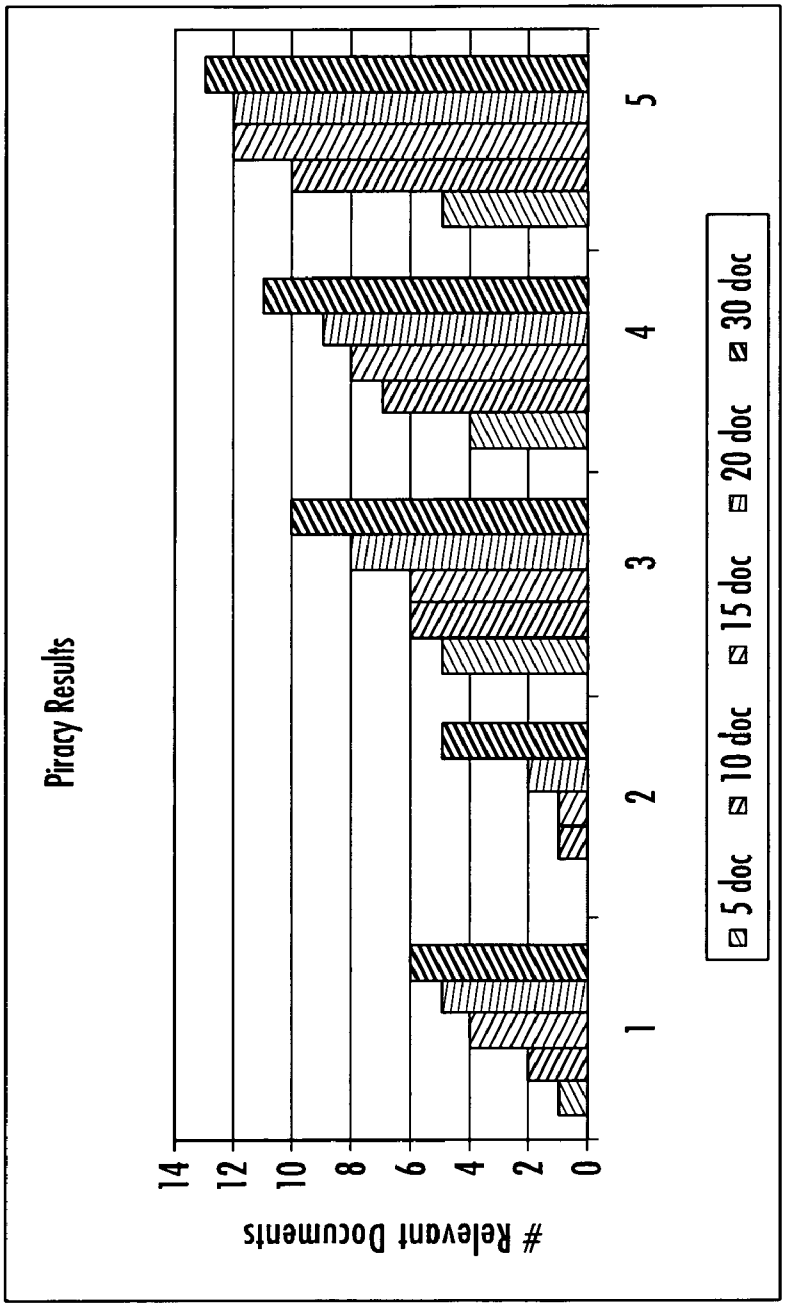
INFORMATION RETRIEVAL

SEARCH RESULTS FOR PRIVACY
VOCABULARY USED: PIRACY

60 62 66 64

VIEW FILE	TITLE	FILE ID	AIRE RELEVANCY	VOCAB RELEVANCY	AIRE+VOCAB RELEVANCY	RELEVANCY	MILDLY RELEVANT	OFF TOPIC	WORD COUNT	COMMENTS
	BEIJING TAKES MEASURES ON PIRACY ACTIVITIES	FBIS4-2223	15	1	4	✓			354	
	MALAYSIA'S DISASTER WARNINGS TO GO UNHEEDED IN STRAIT OF MALACCA: MAESEREK NAVIGATOR COLLISION WAS THE LATEST IN A SERIES OF ACCIDENTS	FT931-13007	64	2	25	✓			562	
	PIRACY ATTACKS IN SOUTHEAST ASIA SHOW DECLINE	FBIS3-48230	12	3	3	✓			758	
	INDONESIA DENIES PIRACY LINK IN SHIPS' COLLISION	FT923-1266	52	4	17	✓			75	
	EDITORIAL CRITICIZES GOVERNMENT HANDLING OF PIRACY ISSUE	FBIS3-3864	8	5	2	✓			452	
	INTERNATIONAL MARITIME ON 'PIRACY' BY PRC SHIPS	FBIS3-44900	18	6	6	✓			685	
	CONCERN EXPRESSED OVER PRC ROLE IN PIRACY	FBIS4-53276	2	7	1	✓			245	
	BEIJING CALLS 'PIRACY' ACTS 'JUST', 'LAWFUL'	FBIS3-3196	40	8	10	✓			658	
	PRC DENIES SECURITY FORCE PIRACY, DRAWS UP NEW GUIDELINES	FBIS3-3863	45	9	15	✓			457	
	PIRACY WARNINGS	FT924-15875	9	10	5	✓			56	
	WORLD TRADE NEWS: US RENEWS PRESSURE ON CHINA OVER INTELLECTUAL PIRACY	FT943-12951	88	11	51			✓	754	
	EASTERN CARIBBEAN ISLANDS BECOMING 'PREFERRED AREA' FOR	FBIS4-67139	27	12	9			✓	114	
	GOVERNMENT CRITICIZED FOR RECEIVING U.S. WARSHIP CREW	FBIS4-13826	78	13	44	✓			658	
	TOUR, U.S. 'PIRACY' EXAMINED	FBIS4-13578	89	14	53	✓			65	
	JOURNAL EXPOSES SHENZHEN PIRATE DISC FACTORY	FBIS3-1847	81	15	48	✓			117	
	CHINA TOUTES PROGRESS IN IPR PROTECTION, WARNS AGAINST	FBIS4-23127	93	16	56			✓	565	
	WORLD TRADE NEWS: CODED WARNING TO PIRATES- PLAN TO CURB COUNTERFEIT CDS	FT941-774	17	17	7			✓	985	
	TAIWAN BOOSTS COPYRIGHTS	FT922-6363	36	18	16			✓	658	
	MANAGEMENT (MARKETING AND ADVERTISING): KNIVES OUT FOR PIRATE'S - A NEW YORK COMPANY IS TAKING LEGAL ACTION AGAINST BANGKOK'S COPYCATS	FT944-17861	73	19	45				266	
	COPYRIGHT OFFICIAL VIEWS IPR PROTECTION	FBIS4-26750	22	20	13			✓	180	

FIG. 11



1 = AIRE Ranking
2 = AIRE Ranking + Piracy Vocabulary Ranking
3 = AIRE Ranking + Piracy Vocabulary Ranking using identification of irrelevant words
4 = AIRE Ranking + Maritime Vocabulary Ranking using identification of irrelevant words
5 = Maritime vocabulary Ranking using identification of irrelevant words

FIG. 12

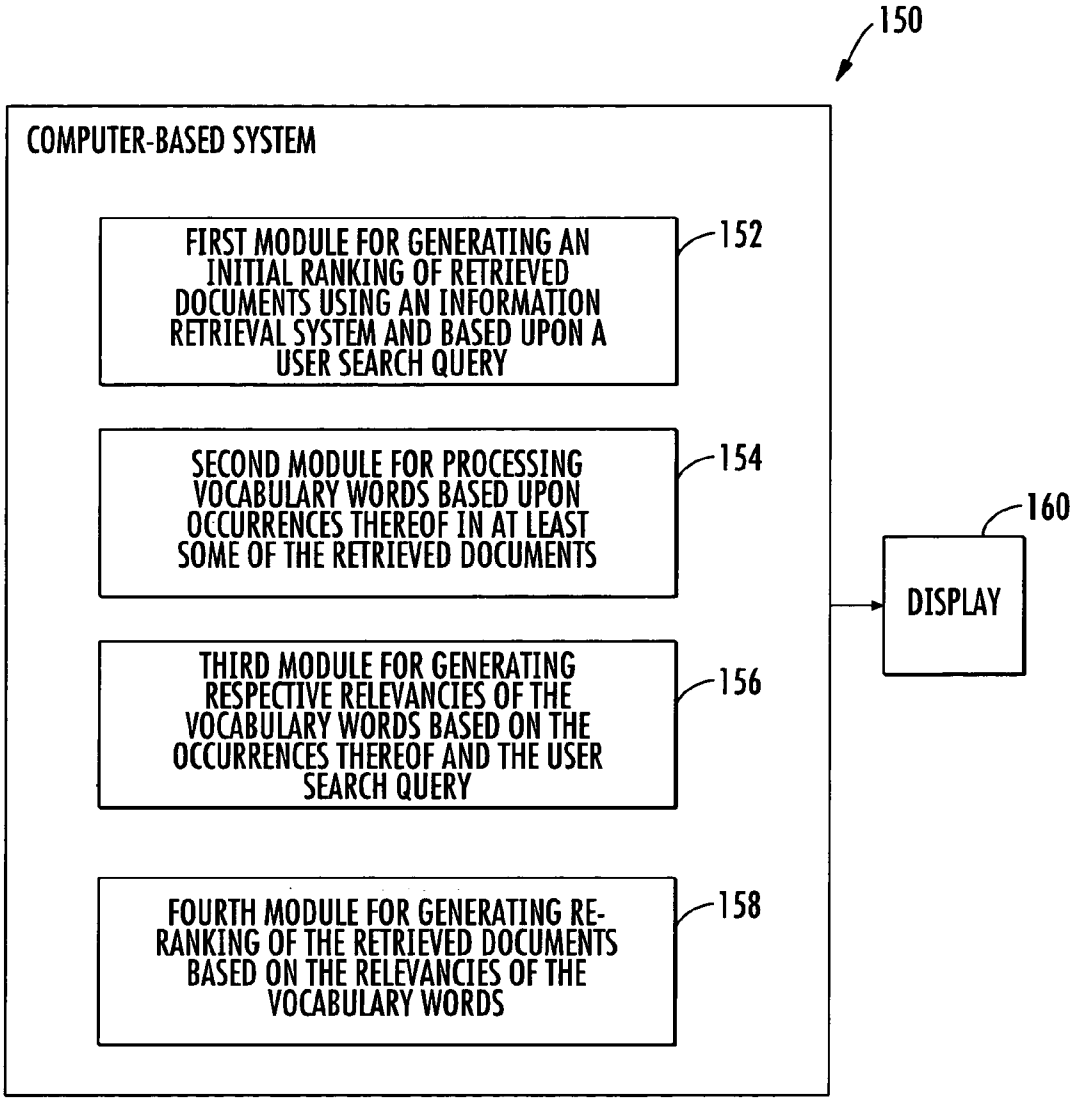

150
COMPUTER-BASED SYSTEM
FIRST MODULE FOR GENERATING AN INITIAL RANKING OF RETRIEVED DOCUMENTS USING AN INFORMATION RETRIEVAL SYSTEM AND BASED UPON A USER SEARCH QUERY
152
SECOND MODULE FOR PROCESSING VOCABULARY WORDS BASED UPON OCCURRENCES THEREOF IN AT LEAST SOME OF THE RETRIEVED DOCUMENTS
154
THIRD MODULE FOR GENERATING RESPECTIVE RELEVANCIES OF THE VOCABULARY WORDS BASED ON THE OCCURRENCES THEREOF AND THE USER SEARCH QUERY
156
FOURTH MODULE FOR GENERATING RE-RANKING OF THE RETRIEVED DOCUMENTS BASED ON THE RELEVANCIES OF THE VOCABULARY WORDS
158
160
DISPLAY

FIG. 13

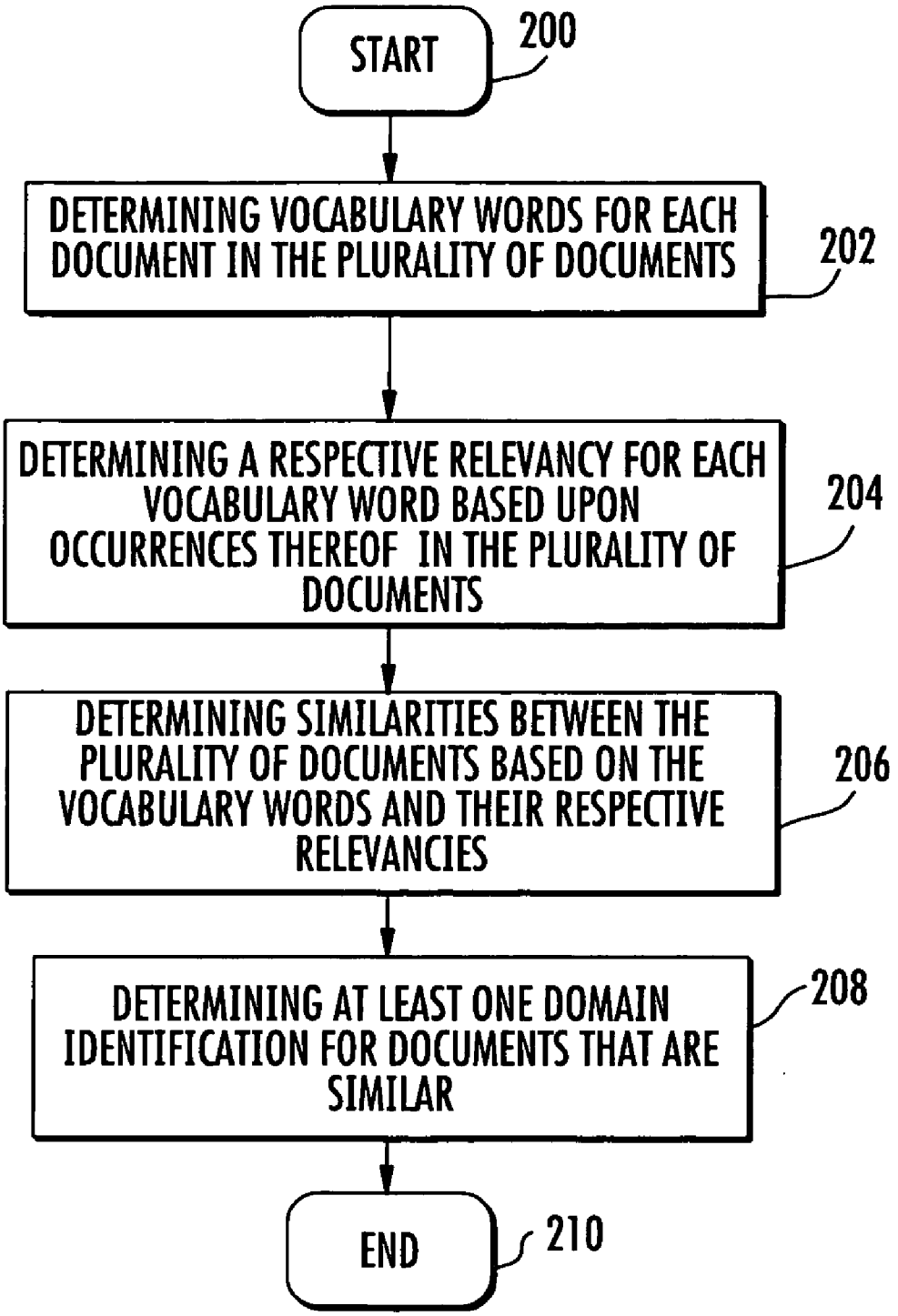

START
200
DETERMINING VOCABULARY WORDS FOR EACH DOCUMENT IN THE PLURALITY OF DOCUMENTS
202
DETERMINING A RESPECTIVE RELEVANCY FOR EACH VOCABULARY WORD BASED UPON OCCURRENCES THEREOF IN THE PLURALITY OF DOCUMENTS
204
DETERMINING SIMILARITIES BETWEEN THE PLURALITY OF DOCUMENTS BASED ON THE VOCABULARY WORDS AND THEIR RESPECTIVE RELEVANCIES
206
DETERMINING AT LEAST ONE DOMAIN IDENTIFICATION FOR DOCUMENTS THAT ARE SIMILAR
208
END
210

FIG. 14

WORD LIST | AIRE | QUERY RESULTS | WORD LIST | INFORMATION RETRIEVAL | HOME

TOP WORDS | ALPHABETICAL | RELEVANT | IRRELEVANT | NEW | STATISTICS

PERFORM RANKING | CHANGE VOCAB PARAMETERS FOR USEFULNESS SETTINGS

WORD LIST FOR PAT_BREASTCANCER
INDEX USED SWEEPSTAKES_INDEX
VOCABULARY USED: CANCER

**Only displaying USEFUL WORDS (go in Vocab Settings to change this feature)

word feedback R I N U	word (181)	Used (182)	Docs (184)	WordDoc (186)	RELEVANT (188)	IRRELEVANT (190)	RELEVANCY (192)	USEFULLNESS
O O O O	uso	33	11	3.00	4	0	1.00	✓
O O O O	sun	31	3	10.33	0	0	0.00	✓
O O O O	power	30	3	10.00	0	0	0.00	✓
O O O O	gene_therapies	30	3	10.00	0	0	0.00	✓
O O O O	one	30	10	3.00	7	3	0.40	✓
O O O O	most	30	8	3.75	4	0	1.00	✓
O O O O	breast_cancer	29	5	5.80	25	0	0.79	✓
O O O O	will	29	8	3.62	6	1	0.71	✓
O O O O	time	29	8	3.62	0	4	-0.14	✓
O O O O	bodies	28	8	3.62	1	1	0.00	✓
O O O O	disease	27	6	4.50	2	0	1.00	✓
O O O O	skin_cancer	27	6	4.50	0	0	0.00	✓
O O O O	develop	27	8	3.00	14	0	1.00	✓
O O O O	blood	25	6	4.17	4	3	0.14	✓
O O O O	women	25	6	4.17	22	3	0.76	✓
O O O O	new	25	9	2.78	3	0	1.00	✓
O O O O	year	25	10	2.50	4	0	1.00	✓
O O O O	effect	24	9	2.67	4	0	1.00	✓

Submit

FIG. 15

WORD LIST | AIRE | QUERY RESULTS | WORD LIST | INFORMATION RETRIEVAL | HOME

TOP WORDS | ALPHABETICAL | RELEVANT | IRRELEVANT | NEW | STATISTICS

PERFORM RANKING | CHANGE VOCAB PARAMETERS FOR USEFULNESS SETTINGS

WORD LIST FOR PAT_BREASTCANCER
INDEX USED SWEEPSTAKES_INDEX
VOCABULARY USED: CANCER

**Only displaying USEFUL WORDS (go in Vocab Settings to change this feature)

word feedback R	I	N	U	Word (181)	Used (182)	Docs (184)	WordDoc (186)	RELEVANT (188)	IRRELEVANT (190)	RELEVANCY (192)	USEFULLNESS
○	○	○	○	cancer	184	12	15.33	40	7	0.70	✓
○	○	○	○	cell	69	9	7.67	1	0	1.00	✓
○	○	○	○	research	69	11	6.27	10	0	1.00	✓
○	○	○	○	gene	63	5	12.60	0	0	0.00	✓
○	○	○	○	said	59	8	7.38	14	35	-0.43	✓
○	○	○	○	studied	50	8	6.25	8	0	1.00	✓
○	○	○	○	skin	47	6	7.83	0	0	0.00	✓
○	○	○	○	breast	47	6	7.83	41	0	0.80	✓
○	○	○	○	not	45	9	5.00	10	4	0.43	✓
○	○	○	○	patient	41	8	5.12	10	1	0.88	✓
○	○	○	○	field	40	2	20.00	0	0	0.00	✓
○	○	○	○	antibodies	40	2	20.00	0	0	0.00	✓
○	○	○	○	therapies	39	3	13.00	0	0	0.00	✓
○	○	○	○	treat	38	6	6.33	6	2	0.50	✓
○	○	○	○	risk	37	7	5.29	7	0	1.00	✓
○	○	○	○	drug	36	5	7.20	7	0	1.00	✓
○	○	○	○	found	33	9	3.67	2	1	0.33	✓
○	○	○	○	use	33	11	3.00	4	0	1.00	✓

Submit

FIG. 16

WORD LIST | AIRE | QUERY RESULTS | WORD LIST | INFORMATION RETRIEVAL | HOME

TOP WORDS | ALPHABETICAL | RELEVANT | IRRELEVANT | NEW | STATISTICS

PERFORM RANKING | CHANGE VOCAB PARAMETERS FOR USEFULNESS SETTINGS

WORD LIST FOR PAT_SKINCANCER
INDEX USED SWEEPSTAKES_INDEX
VOCABULARY USED: CANCER

**Only displaying USEFUL WORDS (go in Vocab Settings to change this feature)

word feedback R	I	N	U	Word (181)	Used (182)	Docs (184)	WordDoc (186)	RELEVANT (188)	IRRELEVANT (190)	RELEVANCY (192)	USEFULLNESS
O	O	O	O	cancer	184	12	15.33	71	2	0.95	✓
O	O	O	O	cell	69	9	7.67	12	5	0.41	✓
O	O	O	O	research	69	11	6.27	26	20	0.13	✓
O	O	O	O	gene	63	5	12.60	6	37	-0.72	✓
O	O	O	O	said	59	8	7.38	31	11	0.48	✓
O	O	O	O	studied	50	8	6.25	10	5	0.33	✓
O	O	O	O	skin	47	6	7.83	46	4	0.84	✓
O	O	O	O	breast	47	6	7.83	4	0	1.00	✓
O	O	O	O	not	45	9	5.00	15	15	0.00	✓
O	O	O	O	patient	41	8	5.12	10	22	-0.30	✓
O	O	O	O	field	40	2	20.00	0	0	0.00	✓
O	O	O	O	antibodies	40	2	20.00	0	0	0.00	✓
O	O	O	O	therapies	39	3	13.00	1	10	-0.82	✓
O	O	O	O	treat	38	6	6.33	4	21	-0.68	✓
O	O	O	O	risk	37	7	5.29	14	1	0.87	✓
O	O	O	O	drug	36	5	7.20	5	4	0.11	✓
O	O	O	O	found	33	9	3.67	13	0	0.24	✓
O	O	O	O	use	33	11	3.00	11	5	0.38	✓

Submit

SKIN CANCER

FIG. 17

WORD LIST | AIRE | QUERY RESULTS | WORD LIST | INFORMATION RETRIEVAL | HOME

TOP WORDS | ALPHABETICAL | RELEVANT | IRRELEVANT | NEW | STATISTICS

PERFORM RANKING | CHANGE VOCAB PARAMETERS FOR USEFULNESS SETTINGS

WORD LIST FOR PAT_BRAINCANCER
INDEX USED SWEEPSTAKES_INDEX
VOCABULARY USED: CANCER

**Only displaying USEFUL WORDS (go in Vocab Settings to change this feature)

word feedback R I N U	Word (181)	Used (182)	Docs (184)	WordDoc (186)	RELEVANT (188)	IRRELEVANT (190)	RELEVANCY (192)	USEFULLNESS
O O O O	cancer	184	12	15.33	59	0	1.00	✓
O O O O	cell	69	9	7.67	34	5	0.74	✓
O O O O	research	69	11	6.27	33	8	0.61	✓
O O O O	gene	63	5	12.60	40	27	0.19	✓
O O O O	said	59	8	7.38	13	0	1.00	✓
O O O O	studied	50	8	6.25	31	32	-0.02	✓
O O O O	skin	47	6	7.83	1	0	1.00	✓
O O O O	breast	47	6	7.83	3	0	1.00	✓
O O O O	not	45	9	5.00	20	7	0.48	✓
O O O O	patient	41	8	5.12	12	4	0.50	✓
O O O O	field	40	2	20.00	40	4	0.82	✓
O O O O	antibodies	40	2	20.00	35	1	0.94	✓
O O O O	therapies	39	3	13.00	37	0	0.85	✓
O O O O	treat	38	6	6.33	19	3	0.73	✓
O O O O	risk	37	7	5.29	18	2	0.70	✓
O O O O	drug	36	5	7.20	23	0	1.00	✓
O O O O	found	33	9	3.67	15	5	0.50	✓
O O O O	use	33	11	3.00	11	1	0.03	✓

Submit

BRAIN CANCER

FIG. 18

WORD LIST | AIRE | QUERY RESULTS | WORD LIST | INFORMATION RETRIEVAL | HOME

TOP WORDS | ALPHABETICAL | RELEVANT | IRRELEVANT | NEW | STATISTICS

PERFORM RANKING | CHANGE VOCAB PARAMETERS FOR USEFULNESS SETTINGS

WORD LIST FOR PAT_BREASTCANCER
INDEX USED SWEEPSTAKES_INDEX
VOCABULARY USED: CANCER

**Only displaying USEFUL WORDS (go in Vocab Settings to change this feature)

word feedback R	I	N	U	Word (181)	Used (182)	Docs (184)	WordDoc (186)	RELEVANT (188)	IRRELEVANT (190)	RELEVANCY (192)	USEFULLNESS
O	O	O	O	cancer	184	12	15.33	40	7	0.70	✓
O	O	O	O	cell	69	9	7.67	1	0	1.00	✓
O	O	O	O	research	69	11	6.27	10	0	1.00	✓
O	O	O	O	gene	63	5	12.60	0	0	0.00	✓
O	O	O	O	said	59	8	7.38	14	35	-0.43	✓
O	O	O	O	studied	50	8	6.25	8	0	1.00	✓
O	O	O	O	skin	47	6	7.83	0	0	0.00	✓
O	O	O	O	breast	47	6	7.83	41	3	0.80	✓
O	O	O	O	not	45	9	5.00	10	4	0.43	✓
O	O	O	O	patient	41	8	5.12	16	1	0.88	✓
O	O	O	O	field	40	2	20.00	0	0	0.00	✓
O	O	O	O	antibodies	40	2	20.00	0	0	0.00	✓
O	O	O	O	therapies	39	3	13.00	0	0	0.00	✓
O	O	O	O	treat	38	6	6.33	6	2	0.50	✓
O	O	O	O	risk	37	7	5.29	7	0	1.00	✓
O	O	O	O	drug	36	5	7.20	7	0	1.00	✓
O	O	O	O	found	33	9	3.67	2	1	0.33	✓
O	O	O	O	use	33	11	3.00	4	0	1.00	✓

Submit

BREAST CANCER

FIG. 19

METHOD FOR DOMAIN IDENTIFICATION OF DOCUMENTS IN A DOCUMENT DATABASE

RELATED APPLICATION

This application is a continuation-in-part of U.S. patent application Ser. No. 10/974,304 filed Oct. 27, 2004, the entire contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to the field of information retrieval, and more particularly, to a method of categorizing documents in a document database.

BACKGROUND OF THE INVENTION

Information retrieval systems and associated methods search and retrieve information in response to user search queries. As a result of any given search, vast amounts of data may be retrieved. These data may include structured and unstructured data, free text, tagged data, metadata, audio imagery, and motion imagery (video), for example. To compound the problem, information retrieval systems are searching larger volumes of information every year. A study conducted by the University of California at Berkley concluded that the production of new information has nearly doubled between 1999 and 2002.

When an information retrieval system performs a search in response to a user search query, the user may be overwhelmed with the results. For example, a typical search provides the user with hundreds and even thousands of items. The retrieved information includes both relevant and irrelevant information. The user now has the burden of determining the relevant information from the irrelevant information.

One approach to this problem is to build a taxonomy. A taxonomy is an orderly classification scheme of dividing a broad topic into a number of predefined categories, with the categories being divided into sub-categories. This allows a user to navigate through the available data to find relevant information while at the same time limiting the documents to be searched. However, creating a taxonomy and identifying the documents with the correct classification is very time consuming. Moreover, a taxonomy requires continued maintenance to categorize new information as it becomes available U.S. Pat. No. 6,938,046 discloses a taxonomy that includes polyarchical coding, which involves using multiple higher level codes applied to the same lower level code. The polyarchical coding means that, for example, a coder need only enter one lower level code for a piece of data and the higher level polyarchical codes are automatically applied.

Another approach is to use an information retrieval system that groups the results to assist the user. For example, the Vivisimo Clustering Engine™ made by Vivisimo, Inc. of Pittsburg, Pa., automatically organizes search results into meaningful hierarchical folders on-the-fly. As the information is retrieved, it is clustered into categories that are intelligently selected from the words and phrases contained in the search results themselves. In particular, the Vivisimo Clustering Engine™ uses only the returned title and abstract for each result. The similarity between documents is based on this raw material (i.e., the visible text of the search result and not the entire article) and nothing else. The documents are then clustered together based on textual similarity. However, this raw similarity is augmented with human knowledge of what users

wish to see when they examine clustered documents. This results in the categories being up-to-date and fresh as the contents therein

Visual navigational search approaches are provided in U.S. Pat. Nos. 6,574,632 and 6,701,318 to Fox et al., the contents of which are hereby incorporated herein by reference. Fox et al. discloses an information retrieval and visualization system utilizing multiple search engines for retrieving documents from a document database based upon user input queries. Each search engine produces a common mathematical representation of each retrieved document. The retrieved documents are then combined and ranked. A mathematical representation for each respective document is mapped onto a display. Information displayed includes a three-dimensional display of keywords from the user input query. The three-dimensional visualization capability based upon the mathematical representation of information within the information retrieval and visualization system provides users with an intuitive understanding, with relevance feedback/query refinement techniques that can be better utilized, resulting in higher retrieval accuracy.

Despite the continuing development of search engines and result visualization techniques, there is still a need to quickly and efficiently group together similar documents in a document database to present search results to the user in a meaningful manner.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the present invention to assist a user in categorizing documents in a document database.

This and other objects, features, and advantages in accordance with the present invention are provided by a method for processing a plurality of documents in a document database comprising determining vocabulary words for each document of the plurality thereof, and determining a respective relevancy for each vocabulary word based upon occurrences thereof in the plurality of documents. The method further comprises determining similarities between the plurality of documents based upon the vocabulary words and their respective relevancies. At least one domain identification is determined for documents based upon the determined similarities.

Determining similarities between the plurality of documents may comprise selecting a portion of the vocabulary words based on their respective relevancies for defining a superset of vocabulary words, with the superset of vocabulary words illustrating similarities between the plurality of documents and having an overall domain identification associated therewith.

The method may further comprise dividing the overall domain identification into lower level domain identifications based upon selecting vocabulary words associated with each respective lower level domain identification. As a result, the relevancies of vocabulary words associated with each lower level domain identification changes so that similar documents are grouped together for each lower level domain identification.

Determining the respective relevancies of the vocabulary words may comprise counting how many times each vocabulary word is used in the plurality of documents, and counting how many of the plurality of documents uses each of the vocabulary words. The method may further comprise generating a word/document ratio for each respective vocabulary word based upon the counting, and if the word/document ratio is less than a threshold, then the relevancy of the word is

not used when determining similarities between the plurality of documents. Alternatively, the method may comprise permitting user setting of the respective relevancy of at least one of the vocabulary words. The respective relevancies for each vocabulary word may be further based upon a relevancy feedback factor. The relevancy feedback factor may be based upon a user search query or an algorithm, for example

Similarities between the documents may be determined based on identifying patterns of words in the vocabulary words. The pattern of words may comprise n-word phrases, where $n \geqq 2$, for example. In other words, the domain identification for similar documents may be determined by a computer based upon overlapping vocabulary words.

In addition, the method may further comprise determining vocabulary words corresponding to a predetermined domain identification. Similarities may be determined between the vocabulary words for the plurality of documents and the vocabulary words corresponding to the predetermined domain identification. The predetermined domain identification may then be assigned to at least one of the documents based on the determined similarities.

The documents may comprise web site documents, electronic mail messages, and non-text documents having metadata associated therewith. The non-text documents may comprise video image files, photograph files, and audio files.

Another aspect of the invention is directed to a computer-readable medium having computer-executable instructions for causing a computer to process documents in a document database as defined above.

Yet another aspect of the invention is directed to a computer-implemented system for processing documents in a document database as defined above.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a flowchart for processing documents in a document database in accordance with the present invention.

FIG. **2** is an initial query display screen in accordance with the present invention.

FIGS. **3***a* and **3***b* respectively illustrate in accordance with the present invention a display screen for starting a new vocabulary and for using an existing vocabulary.

FIG. **4** is a display screen illustrating the query results using the "piracy" vocabulary in accordance with the present invention.

FIGS. **5** and **6** are display screens illustrating the word lists from a selected document in accordance with the present invention.

FIG. **7** is a display screen illustrating another version of a word list from a selected document in accordance with the present invention.

FIGS. **8-11** are display screens illustrating the document rankings for different ranking parameters in accordance with the present invention

FIG. **12** is bar graph illustrating the number of relevant documents in the retrieved documents provided by different ranking parameters in accordance with the present invention.

FIG. **13** is a block diagram of a computer-based system for processing documents in a document database in accordance with the present invention

FIG. **14** is a flowchart for categorizing documents in a document database in accordance with the present invention.

FIGS. **15-19** are display screens illustrating vocabulary words from documents in a document database used to categorize the documents in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout, and prime notation is used to indicate similar elements in alternative embodiments.

Referring initially to FIG. **1**, the present invention is directed to a computer-implemented method for processing documents in a document database. From the start (Block **20**), the method comprises generating an initial ranking of retrieved documents using an information retrieval system and based upon a user search query at Block **22**. A plurality of vocabulary words based upon occurrences thereof in at least some of the retrieved documents is generated at Block **24**, and respective relevancies of the vocabulary words based on the occurrences thereof and the user search query is generated at Block **26**. A re-ranking of the retrieved documents based on the relevancies of the vocabulary words is generated at Block **28**. The method further comprises displaying the retrieved documents after having been re-ranked at Block **30**. The method ends at Block **32**.

The computer-implemented method for processing documents in a document database advantageously allows a user to identify relevant documents and discard irrelevant documents after the documents have been retrieved using an information retrieval system. The user may be a human user or a computer-implemented user. When the user is computer-implemented, identifying relevant documents and discarding irrelevant documents is autonomous. The information retrieval system includes an input interface for receiving the user search query, and a search engine for selectively retrieving documents from a document database.

The search engine is not limited to any particular search engine. An example search engine is the Advanced Information Retrieval Engine (AIRE) developed at the Information Retrieval Laboratory of the Illinois Institute of Technology (IIT). AIRE is a portable information retrieval engine written in Java, and provides a foundation for exploring new information retrieval techniques. AIRE is regularly used in the Text Retrieval Conference (TREC) held each year, which is a workshop series that encourages research in information retrieval from large text applications by providing a large text collection, uniform scoring procedures, and a forum for organizations interested in comparing their results.

Since TREC uses a dataset with known results, this facilities evaluation of the present invention. An example search topic from TREC is "piracy," which is used for illustrating and evaluating the present invention. AIRE provides the initial ranking of the retrieved documents based upon the "piracy" user search query. The number and/or order of the relevant documents in the initial ranking is the baseline or reference that will be compared to the number of relevant documents in the re-ranked documents.

As will be discussed in further detail below, there are a variety of word and document relevancy options available to the user. Individually or in combination, these options improve the retrieval accuracy of a user search query. Implementation of the present invention is in the form of an algo-

rithm requiring user input, and this input is provided via the graphical user interface (GUI) associated with AIRE.

The initial AIRE query screen for assisting a user for providing the relevant feedback for re-ranking the retrieved documents is provided in FIG. **2**. The "piracy" user search query is provided in section **40**, and the user has the option in section **42** of starting a new vocabulary or using an existing vocabulary. In this case, a new vocabulary is being started.

A description of the topic of interest is provided in section **44**, which is directed to "what modern instances have there been of good old-fashioned piracy, the boarding or taking control of boats?" A narrative providing more detailed information about the description is provided in section **46**. The narrative in this case states that "documents discussing piracy on any body of water are relevant, documents discussing the legal taking of ships or their contents by a national authority are non-relevant, and clashes between fishing boats over fishing are not relevant unless one vessel is boarded." The words in the description and narrative sections **44**, **46** were not included as part of the user search query. Nonetheless, the user has the option of making the words in the description and narrative sections **44**, **46** part of the user search query by selecting these sections along with section **40**.

When the user selects starting a new vocabulary in section **42**, a new vocabulary screen appears as illustrated in FIG. **3***a*. Here the user enters a name for the new vocabulary in section **50**, which in the illustrated example is "piracy." In this case, the title of the new vocabulary is also the user search query. Alternatively, if the user had selected using an existing vocabulary in section **42**, then the existing vocabulary screen appears as illustrated in FIG. **3***b*. A topic of interest may overlap two different vocabularies so selecting a preferred vocabulary would be helpful. As in the illustrated example, piracy relates to maritime instead of the illegal coping of movies and songs. Consequently, an existing vocabulary, such as "maritime" may be selected in section **52**, which already includes relevant words that would be found in the retrieved documents. In fact, the vocabulary words in the existing vocabularies may be taken from the words in preferred documents that are known to be relevant to the user search query. The preferred document may or may not be part of the retrieved documents.

The initial ranking of the retrieved documents is a very large number with respect to "piracy," which includes both relevant and irrelevant documents. Before generating a new vocabulary, the user selects the N top ranked documents in section **48** in FIG. **2**. In the illustrated example, the number of top ranked documents to be re-ranked is 100.

To build a new vocabulary, an algorithm counts the number of times words are used throughout the top 100 retrieved documents. The words may be counted at their stemmed version, although this is not absolutely necessary. A domain vocabulary can also be built by providing a list of relevant documents. The information collected for each word in each document is the number of times the word was used in the document, and the number of documents in the top 100 top ranked documents that used the word.

Next, document statistics are calculated for determining how useful each word is to the N top ranked documents. Useless words are not used to calculate information about the document. Useless words are words that do not provide meaning, such as stop words (e.g., am, are, we) or words that act as stop words within the domain (e.g., computer in computer science literature). Statistics used for determining a useless word may include, but are not limited to, the following:

a) word/document ratio=1 (the word needs to appear more than once in a document to be useful);

b) word/document ratio>20 (this determines a meaningful threshold; and a range of thresholds may be used instead of a single threshold); and

c) the number of documents=1 (the word needs to appear in more than one document).

Based upon the criteria in a) through c), the vocabulary thus comprises for each useful word the number of times it was used (traditional term frequency only within a single document, the number of documents using the word (traditional document frequency), and the word/document ratio.

After a list of vocabulary words provided by the top 100 ranked documents and the user search query (i.e., "piracy") has been compiled, the relevancy of the vocabulary words are set. Some vocabulary words may be more relevant/irrelevant than other words. Word relevance is set by topic, which in this case is "piracy" as related to "maritime." Relevant words are useful words that describe the topic "piracy." Irrelevant words are words that do not describe the topic, and are an indicator of irrelevant documents.

Relevance is set to a value of 1 for the query terms supplied by the user. The relevance value of a vocabulary word is based upon the number of times the word was relevant and on the number of times the word was irrelevant. The relevancy value of a word can be written as follows: Relevancy Value=(#Rel−#Irrel)/(#Rel+#Irrel). A word can be deemed relevant, for example, if the relevancy value>0.5, and irrelevant if the relevancy value<−0.5. The 0.5 and −0.5 are example values and may be set to other values as readily appreciated by those skilled in the art. In addition, a range of thresholds may be used instead of a single threshold.

To calculate document statistics, information is calculated based on the words in the N top ranked documents. A document comprises a set of words, and a word can appear 1 or more times therein. Each document is essentially unstructured text, and a word can be characterized as new, useless or useful. A new word is new to the vocabulary. In a training session, i.e., starting with a new vocabulary, all the words are in the vocabulary. A useless word is not used in document calculations, and as noted above, these words do not provide meaning. Useless words are stop words, such as am, are, we, or words that act as stop words within the domain, such as computer in computer science literature. A useful word is a word that will be used in the document statistics.

A useful word can be further classified as relevant, irrelevant or neutral. As defined by these classification terms, a relevant word is important to the topic, and an irrelevant word is not useful to the topic and is usually an indicator of a bad document. A neutral word is one in which the status of the word as related to the topic has not been determined.

To calculate the re-ranking of the retrieved documents, an algorithmic approach is used to rate the documents. The algorithmic approach uses the relevancy information discussed above. The output of the initial document ranking by AIRE is a list of the documents rated from 1 to 100, where 100 was selected by the user. The lowest number indicates the best ranking. Alternatively, the highest number could be the best ranking.

Three different relevancy values are used to re-rank the documents. The first relevancy value is based upon following expression:

$$\text{Unique Rel} - \text{Unique Irrel} \rightarrow \text{UniqueRel} \quad (1)$$

The number of unique relevant words in the document is counted, and the number of irrelevant words in the document is counted. The sum of the irrelevant words is subtracted from the sum of the relevant words. As an observation, this calcu-

lation becomes more useful when there are only individual words identified. That is, entire documents have not been identified as relevant/irrelevant.

The second relevancy value is based upon following expression:

$$\text{Rel NO Freq} - \text{Irrel NO Freq} \rightarrow \text{RelNOFreq} \quad (2)$$

Here the importance of unique relevant/irrelevant words in the document is determined. The sum of the number of times the word is irrelevant in the vocabulary is subtracted from the sum of the number of times the word is relevant in the vocabulary. A word that appears more often in the vocabulary will have a higher weight than words that just appeared a couple of times. As an observation, this value is tightly coupled with the Unique Rel−Irrel value in expression (1), particularly when all the values are positive.

The third relevancy value is based upon following expression:

$$\text{Rel Freq} - \text{Ir Freq} \rightarrow \text{RelFreq} \quad (3)$$

Here the importance of unique relevant/irrelevant words and their frequency in the documents is determined. The sum of the number of times the word is relevant in the vocabulary is multiplied by the number of times the word is used in the document. The sum of the number of times the word is irrelevant in the vocabulary is multiplied by the number of times the word is used in the document. The irrelevancy frequency sum is subtracted from the relevancy frequency sum. A word that appears more often in the vocabulary will have a higher weight than words that just appeared a couple of times. As an observation, this value is more useful when relevant/irrelevant document examples have been trained in the system.

To identify bad documents there are two techniques. One is based upon the over usage of specific words, and the other is based on a low UniqueRel value as defined in expression (1). With respect to over usage of specific words, documents that have a word appearing more than 100 times, for example, in a document are identified as bad documents. Also, words that are used very frequently in a few documents are determined to have a usefulness set to 0. The user has the option of setting the number of times the word appearing in a document is to be considered as a bad value.

The initial ranking of the N top ranked retrieved documents is re-ranked from the highest relevancy values to the lowest relevancy values for expressions 1) UniqueRel, 2) RelNOFreq and 3) RelFreq. The re-ranking of each document is averaged for the three expressions to obtain the final re-ranking of the retrieved documents. In each of the respective document rankings, bad documents are sent to the bottom of the document list. Two different techniques may be used in moving the bad documents to the bottom. One technique is jumping number ordering—which assigns large values to the document's ranking so that it remains at the bottom. The other technique is smooth number ordering—which assigns continuous ranking numbers to the documents.

With respect to the UniqueRel numbers obtained for the documents, all documents with the smallest UniqueRel number are identified as bad. If the second smallest UniqueRel numbers are under 30%, for example, then these documents are also characterized as bad. Additional small UniqueRel documents can be added until the total number of documents does not exceed 30%. In other words, taking the percentage of the lowest number of UniqueRel from the percentage of the highest number of UniqueRel should not exceed 30%. The user has the option of setting this threshold to a value other than 30%, as readily appreciated by those skilled in the art.

In re-ranking the N top ranked retrieved documents, it is also possible to assign priority to a document based upon the source of the document. For example, National Scientific would carry a greater weight than The National Enquirer.

Management of the data will now be discussed with reference to the user display screens provided in FIGS. **4-7**. The data are handled at two levels: vocabulary and topic. The vocabulary is used to define the domain, and includes for each word the number of times used in each document and the number of documents the word appeared. A vocabulary can be used by multiple topics, such as in the form of a predefined vocabulary. However, it is preferable to avoid using the same document to train multiple times. With respect to the managing the data by topic, the relevance/irrelevance of the words and documents are used, as well as using the query search terms.

The majority of the data management deals with the user interface. The user has the ability to view any document and the word information associated therewith. The user has the ability to identify relevant/irrelevant documents and words to use for training, i.e., building the vocabulary. The user has the ability to identify words for a future AIRE query. The user has the ability to run a new AIRE query or re-run the ranking algorithm in accordance with the present invention on the current data based on information supplied to the system

The initial ranking of the retrieved documents using the "piracy" vocabulary is illustrated in FIG. **4**. Column **60** lists the titles of the documents in order from high to low. The AIRE relevancy is provided in column **62**. After the retrieved documents have been re-ranked while taking into account the "piracy" vocabulary, this re-ranking is averaged with the initial ranking provided by AIRE in column **62**. The combination of the two rankings is provided in column **64**. For example, the highest ranked document in column **62** is now the sixth ranked document in column **64**.

Selecting any one of the listed titles in column **60** will display the document words. The relevancy of each vocabulary word with respect to each document is provided in column **66**. For each document, the document may be marked as relevant (column **68**), mildly relevant (column **70**) or off topic (column **72**). In addition, the total word count for each document is provided in column **74**, and comments associated with any of the documents may be added or viewed by selecting the icon in column **76**.

If the user desires to view the entire document, then the user highlights the icon in column **78** next to the title of interest. The information for each document is stored in a respective file, as indicated by column **80**. To further assist the user, when a document is marked as relevant, then the row associated with the relevant document is highlighted.

By selecting on the title of a particular document in column **60**, the words in that document are displayed in column **81** in an order based upon how many times they are used in the document (FIG. **5**). This screen also shows how the words are set in terms of relevancy. The number of times each vocabulary word is used in the document is listed in column **82**, and the number of documents that uses the word is listed in column **84**. The word/document ratio is provided in column **86**. The vocabulary words initially marked by the user as relevant are indicated by the numeral 1 in columns **88** and **92**. If the vocabulary word is irrelevant, then the numeral −1 is placed instead in column **90**.

The highlighted section in FIG. **5** also indicates the relevant words. However, the words "copyright" and "software" are not related to the topic "piracy." While still in this screen, the user can sort the words by relevancy and usage by selecting the appropriate characterization: R for relevant (column **100**),

I for irrelevant (column **102**), N for neutral (column **104**) and U for useless (column **106**). If the word is already marked as relevant, then no action is required for that word.

The screen display illustrated in FIG. **6** illustrates the selection of certain vocabulary words via column **102** as irrelevant. An alternative to the display screen in FIGS. **5** and **6** when viewing the words in a particular document is provided in FIG. **7**. In this particular screen, the user also has the option of selecting in section **110'** whether the document is relevant, mildly relevant or off topic. The user also has the option of adding new words via section **112'** to the vocabulary.

The user also has the option of selecting multiple views (as labeled) according to user preference. For instance, tab **120** list all the vocabulary words in a document, tab **122** list the vocabulary words in alphabetical order, tab **124** list the vocabulary words marked as relevant, tab **126** list the vocabulary words marked as irrelevant, tab **128** list the vocabulary words marked as new, and statistics of the vocabulary words may be obtained by selecting tab **130**. In FIG. **7**, the user has the option of selecting tabs with respect to the relevant/irrelevant/neutral words in the documents. Tab **140'** list the relevant words in the documents, tab **142'** lists the irrelevant words in the documents, tab **144'** list the neutral words in the documents, and tab **146'** list the useless words in the documents.

Comparing various document ranking results of the computer-implemented method for processing documents in a document database in accordance with the present invention will now be compared to the baseline results provided by AIRE, that is, the initial ranking of the retrieved documents. The display screens provided in FIGS. **4** and **8-11** will now be referenced. The initial ranking from 1 to 20 (column **62**) of the retrieved documents is provided in column **60** as shown in FIG. **4**. The document titles corresponding to the "piracy" vocabulary rankings from 1 to 20 (column **66**) are listed in column **60** in FIG. **8**. A visual comparison can be made between the relationships in the ranked baseline documents versus the ranked documents provided by the most relevant "piracy" vocabulary words

Combining the AIRE ranking and the "piracy" vocabulary ranking to obtain a new ranking from 1 to 20 (column **64**) is provided in column **60** in FIG. **9**. In lieu of creating a new vocabulary as discussed above, an existing vocabulary may be used. For example, the results of a predefined "maritime" vocabulary have now been combined with the AIRE results. The documents ranked from 1 to 20 (column **64**) corresponding to this re-ranking are listed in column **60** in FIG. **10**. As yet another comparison, the document titles corresponding to only the "maritime" vocabulary rankings from 1 to 20 (column **66**) are listed in column **60** in FIG. **11**. A visual comparison can again be made between the relationships in the ranked baseline documents provided by AIRE in FIG. **4** versus the ranked documents provided by the most relevant "maritime" vocabulary words in FIG. **11**.

The results of the various approaches just discussed for re-ranking the retrieved documents will now be discussed with reference to FIG. **12**. This discussion is based upon the number of relevant documents in the top 5, 10, 15, 20 and 30 ranked or re-ranked documents. The first set of bar graphs correspond to the baseline AIRE rankings provided in columns **60** and **62** in FIG. **4**. In the 5 top ranked documents there was 1 relevant document; in the 10 top ranked documents there were 2 relevant documents; in the 15 top ranked documents there were 4 relevant documents; in the 20 top ranked documents there were 5 relevant documents, and in the 30 top ranked documents there were 6 relevant documents

When the AIRS ranking was combined with the "piracy" vocabulary ranking as provided in columns **60**, **64** in FIG. **9** there was a decrease in the number of relevant documents in the re-ranked documents, as illustrated by the second set of bar graphs. In contrast, the number of relevant documents increases when the AIRE ranking and the "piracy" vocabulary ranking using the identification of irrelevant words are combined, as illustrated by the third set of bar graphs.

The fourth set of bar graphs is based upon a combined ranking of the AIRE ranking and the "maritime" vocabulary ranking as provided in columns **60**, **64** in FIG. **10**. Here, there is a greater increase in the number of relevant documents in the re-ranked documents

A further increase in the number of relevant documents in the re-ranked documents is based upon just the "maritime" vocabulary as provided in columns **60**, **66** in FIG. **11**. In the 5 top ranked documents there were 5 relevant documents; in the 10 top ranked documents there were 10 relevant documents; in the 15 and 20 top ranked documents there were 12 relevant documents for each; and in the 30 top ranked documents there were 13 relevant documents.

As best illustrated in FIG. **12**, the present invention advantageously allows the user to re-rank the retrieved documents from a document database so that more of the top ranked documents are relevant documents. A vocabulary is built based upon the user search query, or an existing vocabulary is selected. A newly created vocabulary is analyzed to identify the importance of specific words and to also identify problem words. Relevant/irrelevant words are identified through the user search query, applicable algorithms and via user input. In addition, based upon the relevancy of the words, relevant/irrelevant documents are identified. The irrelevant documents are moved to the bottom of the ranking

The method may be implemented in a computer-based system **150** for processing documents in a document database, as illustrated in FIG. **13**. The computer-based system **150** comprises a plurality of first through fourth modules **152-158**. The first module **152** generates an initial ranking of retrieved documents using an information retrieval system and based upon a user search query. The second module **154** generating a plurality of vocabulary words based upon occurrences thereof in at least some of the retrieved documents. The third module **156** generates respective relevancies of the vocabulary words based on the occurrences thereof and the user search query. The fourth module **158** generates a re-ranking of the retrieved documents based on the relevancies of the vocabulary words. A display **160** is connected to the computer-based system **150** for displaying the re-ranked documents.

Another aspect of the present invention is directed to a method for assisting a user in categorizing documents in a document database. The documents may be the result of an information retrieval system operating in response to a user search query. Alternatively, the documents are collected in response to monitoring selected web site documents, monitoring conversations (i.e., audio files), e-mail messages, and news group transactions, for example. Regardless of how the documents are provided to the user, they form the document database

Referring to FIG. **14**, a method for determining domain identifications for a plurality of documents in a document database will now be discussed. From the start (Block **200**), vocabulary words are determined for each document at Block **202**.

The vocabulary words for each document can be determined in a number of ways. One approach is to simply use all

of the words in each document. Another approach is to use a word extractor for selecting words with particular meanings.

Yet another approach is to build the vocabulary on the fly. For example, N documents from a list M of documents are selected, where M≧N. The N documents form the document database. Alternatively, the vocabulary is built from specific documents. For example, the user identifies a list of relevant documents. The list of relevant documents is given to the above-described computer-implemented method for processing documents for building a vocabulary from the list of documents. As the user identifies relevant documents, they add the words of the document to the vocabulary. Building the vocabulary from specific documents provides better document rankings as compared to building the vocabulary on-the-fly.

Once the vocabulary words are determined for each document, a respective relevancy is determined for each vocabulary word based upon occurrences thereof in the plurality of documents at Block **204**.

As noted above, the respective relevancies of the vocabulary words may be determined based on statistics. For example, relevancy of a vocabulary word may be based on how many times each vocabulary word is used in the plurality of documents, and how many of the plurality of documents uses each of the vocabulary words. Another statistic is based upon generating a word/document ratio for each respective vocabulary word based upon the counting, and if the word/document ratio is less than a threshold, then the relevancy of the word is not used when determining similarities between the plurality of documents.

Yet another approach for determining relevancy of a particular vocabulary word is determined by the user. Alternatively, a relevancy feedback factor is determined, and the respective relevancy of each vocabulary word may be further based upon this relevancy feedback factor. The relevancy feedback factor may be based upon a user search query or based upon an algorithm, for example.

Similarities are determined at Block **206** between the plurality of documents based on the vocabulary words and their respective relevancies. In one approach, this involves selecting at least a portion of the vocabulary words based on their respective relevancies for defining a superset of vocabulary words, with the superset of vocabulary words better illustrating similarities between the documents. In other words, the top X words (in terms of relevance) from the documents in the document database are selected to define the superset of vocabulary words. For example, X is equal to 100.

The similarities may be based on identifying single words with a high degree of relevance within the top 100 words. In addition, the similarities may be based on patterns of words in the top 100 vocabulary words. A pattern of word includes n-word phrases, where n≧2. "New York City" is a 3-word phase, for example.

At least one domain identification for documents that are similar is determined at Block **208**. A number of approaches may be used for determining domain identification. One approach is for the domain identification to be determined by the user. Another approach is for the domain identification to be determined by a computer based upon overlapping vocabulary words

Another approach for determining domain identification is to determine vocabulary words corresponding to a predetermined domain identification, and then determine similarities between the vocabulary words (top 100 words, for example) for the documents and the vocabulary words corresponding to the predetermined domain identification. The predetermined domain identification is assigned to the documents that have vocabulary words similar to the vocabulary words corresponding to the predetermined domain identification. The vocabulary words corresponding to the predetermined domain identification may be user defined, for example, or they may be predetermined. The method ends at Block **210**.

For illustrative purposes, an example document database may be formed based upon user search queries directed to "cancer." The collected documents are from different cancer queries. Once the documents have been collected, vocabulary words from each of the collected documents are determined. Also, a respective relevancy of each vocabulary word is determined based upon occurrences thereof in the collection of documents. After the vocabulary words have been determined along with their respective relevancies, the top words are used to define a superset of vocabulary words directed to "cancer," as shown by the screens provided in FIGS. **15** and **16**.

The top words may be limited to 100 words, for example, describing cancer. In other words, a cancer vocabulary made up of selected documents is defined. The importance of each vocabulary word is also provided by the screens in FIGS. **15** and **16**.

The screens in FIGS. **15** and **16** show how the top words **181** are set in terms of relevancy. The number of times each vocabulary word **181** is used in the document is listed in column **182**, and the number of documents that uses the word is listed in column **184**. The word/document ratio is provided in column **186**.

However, it is important to determine the relevancy of the words **181**. The degree of relevancy is provided in columns **188** and **190**. In column **192**, an overall relevancy number between −1 and 1 is determined. A threshold may be set for determining relevancy. For example, words having a relevancy≧0.50 are highlighted as being relevant. Of course, the user has the option to change the threshold and to add/remove words to/from the cancer vocabulary as necessary. Words **181** having a 0 relevancy number are removed from the cancer vocabulary.

Based on the cancer vocabulary words as partially shown by the screens in FIGS. **15** and **16**, documents relating to cancer may now be separated or grouped into different categories or domain identifications. Referring now to the screens provided in FIGS. **17-19**, three categories have been created: skin cancer, brain cancer and breast cancer. Each of these categories is using the cancer vocabulary. The illustrated words, and consequently the documents associated with these words, are based upon a respective query of the cancer vocabulary for each of these categories. As a result of the respective queries, the word relevancy in columns **188-192** is set differently for each category. Based on the vocabulary words in the screens provided in FIGS. **17-19**, the documents associated with these words are given a respective domain identification.

As noted above, the documents may comprise web site documents, electronic mail messages, and non-text documents having metadata associated therewith. The non-text documents comprise video image files, photograph files, and audio files. For example, news articles collected by a newspaper over a selected period of time may be categorized. However, many of the articles may be pictures only. The metadata associated with the pictures may be used to provide the necessary vocabulary words for domain identification. Similarly, metadata associated with video may be used to provide the necessary vocabulary words for domain identification. The photograph files may be in a JPEG formant, whereas the video image files may be in an MPEG format, for example. Audio files may be in the following formats, for

example: Microsoft "wave" format (WAV), audio interchange file format (AIFF) and resource interchange file format (RIFF).

Another aspect of the invention is directed to a computer-readable medium having computer-executable instructions for causing a computer to process documents in a document database as defined above. Yet another aspect of the invention is directed to a computer-implemented system for processing documents in a document database as defined above.

Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is understood that the invention is not to be limited to the specific embodiments disclosed, and that modifications and embodiments are intended to be included within the scope of the appended claims

That which is claimed is:

1. A method for processing a plurality of documents in a document database using a computer-implemented system comprising a processor and a display operatively coupled to the processor, the method comprising:

operating the processor to perform the following without requiring pre-computations

a) determining vocabulary words for each document of the plurality thereof;

b) determining a respective relevancy for each vocabulary word based upon occurrences thereof in the plurality of documents;

c) determining similarities and differences between the plurality of documents based upon the vocabulary words and their respective relevancies;

d) defining supersets of vocabulary words based on the determined similarities and differences; and

e) determining domain identifications for the supersets of vocabulary words using results of a) through d) and only after a) through d); and

operating the display to display the defined supersets of vocabulary words and their domain identifications, including display of the vocabulary words as being relevant and irrelevant based on occurrences thereof in the plurality of documents.

2. A method according to claim **1** further comprising dividing the domain identifications into lower level domain identifications based upon selecting vocabulary words associated with each respective lower level domain identification; and wherein relevancies of vocabulary words associated with each lower level domain identification changes so that similar documents are grouped together for each lower level domain identification.

3. A method according to claim **1** wherein determining the respective relevancies of the vocabulary words comprises:

counting how many times each vocabulary word is used in the plurality of documents; and

counting how many of the plurality of documents uses each of the vocabulary words.

4. A method according to claim **3** further comprising generating a word/document ratio for each respective vocabulary word based upon the counting, and if the word/document ratio is less than a threshold, then the relevancy of the word is not used when determining similarities and differences between the plurality of documents.

5. A method according to claim **1** further comprising permitting user setting of the respective relevancy of at least one of the vocabulary words.

6. A method according to claim **1** further comprising determining a relevancy feedback factor; and wherein determining the respective relevancies for each vocabulary word is further based upon the user feedback factor; and wherein determining the similarities and differences is further based on the respective relevancies with respect to the feedback factor.

7. A method according to claim **6** wherein the relevancy feedback factor is based upon at least one of a user search query and an algorithm.

8. A method according to claim **1** wherein determining the similarities and differences are based on identifying patterns of words in the vocabulary words.

9. A method according to claim **8** wherein the pattern of words comprises n-word phrases, where n is greater than or equal to 2.

10. A method according to claim **1** further comprising:

determining vocabulary words corresponding to a predetermined domain identifications;

determining similarities and differences between the vocabulary words for the plurality of documents and the vocabulary words corresponding to the predetermined domain identifications; and

assigning the predetermined domain identifications to the plurality of documents based on the determined similarities and differences of the vocabulary words.

11. A method according to claim **10** wherein the vocabulary words corresponding to the predetermined domain identifications are user definable.

12. A method according to claim **1** wherein the domain identifications are user determinable.

13. A method according to claim **1** wherein the domain identifications are determined based upon overlapping vocabulary words.

14. A method according to claim **1** wherein the plurality of documents comprises at least one web site document.

15. A method according to claim **1** wherein the plurality of documents comprises at least one electronic mail message.

16. A method according to claim **1** wherein the plurality of documents comprises at least one non-text document having metadata associated therewith.

17. A method according to claim **16** wherein the at least one non-text documents comprises at least one of a video image file, a photograph file, and an audio file.

18. A method for processing a plurality of documents in a document database using a computer-implemented system comprising a processor and a display coupled to the processor, the method comprising:

operating the processor to perform the following without requiring pre-computations

a) determining vocabulary words for each document of the plurality thereof;

b) determining a respective relevancy for each vocabulary word based upon occurrences thereof in the plurality of documents using a computer;

c) determining similarities and differences between the plurality of documents based upon the vocabulary words and their respective relevancies;

d) defining supersets of vocabulary words based on the determined similarities and differences;

e) determining domain identifications for the supersets of vocabulary words based upon the determined similarities and differences using results of a) through d) and only after a) through d); and

dividing the domain identifications into lower level domain identifications based upon selecting vocabulary words associated with each respective lower level domain identification, with relevancies of vocabulary words associated with each lower level domain iden-

tification changing so that similar documents are grouped together for each lower level domain identification; and

operating the display to display the defined supersets of vocabulary words and their domain identifications including the lower level domain identifications, including display of the vocabulary words as being relevant and irrelevant based on occurrences thereof in the plurality of documents.

19. A method according to claim **18** wherein determining the respective relevancies of the vocabulary words comprises:

counting how many times each vocabulary word is used in the plurality of documents; and

counting how many of the plurality of documents uses each of the vocabulary words.

20. A method according to claim **19** further comprising generating a word/document ratio for each respective vocabulary word based upon the counting, and if the word/document ratio is less than a threshold, then the relevancy of the word is not used when determining similarities and differences between the plurality of documents.

21. A method according to claim **20** wherein determining the similarities and differences are based on identifying patterns of words in the vocabulary words.

22. A method according to claim **18** further comprising:

determining vocabulary words corresponding to predetermined domain identifications;

determining similarities and differences between the vocabulary words for the plurality of documents and the vocabulary words corresponding to the predetermined domain identifications; and

assigning the predetermined domain identifications to the plurality of documents based on the determined similarities and differences of the vocabulary words.

23. A method according to claim **18** wherein the plurality of documents comprises at least one of a web site document, an electronic mail message, and a non-text document having metadata associated therewith.

24. A computer-readable storage medium having computer-executable instructions stored thereon for causing a computer-implemented system comprising a processor and a display coupled to the processor to perform steps comprising:

operating the processor to perform the following without requiring pre-computations

a) determining vocabulary words for each document of the plurality thereof;

b) determining a respective relevancy for each vocabulary word based upon occurrences thereof in the plurality of documents;

c) determining similarities and differences between the plurality of documents based upon the vocabulary words and their respective relevancies;

d) defining supersets of vocabulary words based on the determined similarities and differences; and

e) determining domain identifications for the supersets of vocabulary words using results of a) through d) and only after a) through d); and

operating the display to display the defined supersets of vocabulary words and their domain identifications, including display of the vocabulary words as being relevant and irrelevant based on occurrences thereof in the plurality of documents.

25. A computer-readable medium according to claim **24** further comprising dividing the domain identifications into lower level domain identifications based upon selecting vocabulary words associated with each respective lower level domain identification; and wherein relevancies of vocabulary words associated with each lower level domain identification changes so that similar documents are grouped together for each lower level domain identification.

26. A computer-readable medium according to claim **24** wherein determining the respective relevancies of the vocabulary words comprises:

counting how many times each vocabulary word is used in the plurality of documents; and

counting how many of the plurality of documents uses each of the vocabulary words.

27. A computer-readable medium according to claim **26** further comprising generating a word/document ratio for each respective vocabulary word based upon the counting, and if the word/document ratio is less than a threshold, then the relevancy of the word is not used when determining similarities and differences between the plurality of documents.

28. A computer-readable medium according to claim **24** wherein determining the similarities and differences are based on identifying patterns of words in the vocabulary words.

29. A computer-readable medium according to claim **24** further comprising:

determining vocabulary words corresponding to predetermined domain identifications;

determining similarities and differences between the vocabulary words for the plurality of documents and the vocabulary words corresponding to the predetermined domain identifications; and

assigning the predetermined domain identifications to the plurality of documents based on the determined similarities and differences of the vocabulary words.

30. A computer-readable medium according to claim **24** wherein the plurality of documents comprises at least one of a web site document, an electronic mail message and non-text document having metadata associated therewith.

31. A computer-implemented system comprising:

a processor for processing documents in a document database, said processor configured to perform the following without requiring pre-computations

a) determining vocabulary words for each document of the plurality thereof;

b) determining a respective relevancy for each vocabulary word based upon occurrences thereof in the plurality of documents;

c) determining similarities and differences between the plurality of documents based upon the vocabulary words and their respective relevancies;

d) defining supersets of vocabulary words based on the determined similarities and differences; and

e) determining domain identifications for the supersets of vocabulary words based upon the determined similarities and differences using results of a) through d) and only after a) through d); and

a display coupled to said processor for displaying the defined supersets of vocabulary words and their domain identifications, including display of the vocabulary words as being relevant and irrelevant based on occurrences thereof in the plurality of documents.

32. A computer-implemented system according to claim **31** wherein said processor is further configured for dividing the domain identifications into lower level domain identifications based upon selecting vocabulary words associated with each respective lower level domain identification; and wherein relevancies of vocabulary words associated with each lower level domain identification changes so that similar documents are grouped together for each lower level domain identification.

33. A computer-implemented system according to claim **31** wherein determining the respective relevancies of the vocabulary words comprises:

counting how many times each vocabulary word is used in the plurality of documents; and

counting how many of the plurality of documents uses each of the vocabulary words.

34. A computer-implemented system according to claim **33** wherein said processor is further configured for generating a word/document ratio for each respective vocabulary word based upon the counting, and if the word/document ratio is less than a threshold, then the relevancy of the word is not used when determining similarities and differences between the plurality of documents.

35. A computer-implemented system according to claim **31** wherein determining the similarities and differences are based on identifying patterns of words in the vocabulary words.

36. A computer-implemented system according to claim **31** wherein said processor is further configured for:

determining vocabulary words corresponding to predetermined domain identifications;

determining similarities and differences between the vocabulary words for the plurality of documents and the vocabulary words corresponding to the predetermined domain identifications; and

assigning the predetermined domain identifications to the plurality of documents based on the determined similarities and differences of the vocabulary words.

37. A computer-implemented system according to claim **31** wherein the plurality of documents comprises at least one of a web site document, an electronic mail message and non-text document having metadata associated therewith.

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