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(54) **Title:** A SYSTEM AND METHOD FOR AUTOMATED GENERATION OF LEARNING OBJECT FROM ONLINE SOCIAL CONTENT

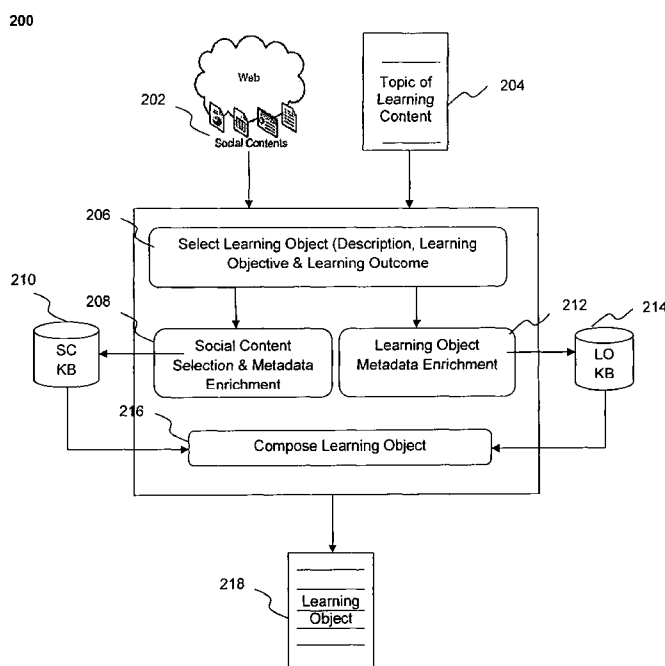


FIG. 2.0

(57) **Abstract:** A system and method for automated generation of learning object from online social content by producing a list of semantic tags through an Entity Recognition System upon matching of concepts in domain ontology. The system of the present invention includes a plurality of Social Contents (202); a plurality of Recognition Engines which includes at least one Entity Recognition Engine (302, 414), at least one Speech Recognition Engine (416), at least one Image Recognition Engine (428); at least one Semantic Tag Enrichment Engine (308); at least one Social Content knowledge base (206); and at least one Learning Object knowledge base (210). The at least one Entity Recognition Engine (302, 414) having means for receiving Learning Object that is associated with description, learning objective and learning outcome; producing a list of semantic tags upon matching of concepts in domain ontology; and forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine for metadata enrichment. In short, the present invention provides for automated generation of LO from social contents through LO enrichment; social content selection and metadata enrichment and thereafter composing complete LO which includes text, image and video.

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- *of inventorship (Rule 4.17(iv))*

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- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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A SYSTEM AND METHOD FOR AUTOMATED GENERATION OF LEARNING OBJECT FROM ONLINE SOCIAL CONTENT

FIELD OF INVENTION

5

The present invention relates to a system and method for automated generation of learning object from online social content.

BACKGROUND ART

10

Creation and generation of current Learning Object (LO) is time consuming and extremely challenging due to the complexity in the development of the LO while the content of the multimedia material to create the said LO are costly. In addition to that, the generated LOs are static and may be outdated based on availability of enhanced LOs while current social contents available does not provide for users to annotate the contents of the web pages. Existing mechanism for the creation of LO does not provide for semantic tagging of social contents as provided in the present invention.

Example of existing mechanism was proposed in United States Patent Publication No. 2011/0217685 A1 hereby denoted as US 685 Publication. It relates generally to an automated system and method for multiple types of knowledge content generation for enhancing learning, creativity, insights and assessments. Although learning content is annotated and enriched, the system of US 685 Publication classifies the content by bookmarking and annotating as compared to the present invention wherein Entry Recognition System produces a list of semantic tags after matching the concepts in the domain ontology. Captured content is disaggregated logically into constituent parts to provide a multidimensional representation of content as compared to the present invention which aggregates LO. Rules and algorithms are specified for automatic generation of knowledge content and the generated knowledge content is displayed to candidate in the said US 685 Publication. In contrast, the present invention creates LO by retrieving and matching LO sub graphs and Social Content (SC) sub graphs and thereafter ranking is performed to compose sub graphs to produce complete LO.

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Another mechanism for automatically producing accessible LOs is described in a published paper entitled "Automatically Producing Accessible Learning Objects" by Di Iorio et al., hereby denoted as Iorio describes the creation and management process of LO based on common personal productivity tools which guarantees both content
5 accessibility and a friendly interface to authors. In Iorio's paper, metadata enrichment is enhanced by the user manually as compared to the present invention wherein Semantic Tag Enrichment Engine retrieves the concepts that are the same semantically and enrich it with the concepts matched by Distributed Link Data (DLD). Also, it does not auto-generate Social Content (SC) as provided in the present invention as LO is manually
10 created by the user as content creation (authoring) is done manually using a word processor.

In another published paper entitled "An Integrated Approach for Automatic Aggregation of Learning Knowledge Objects" published by the Interdisciplinary Journal of Knowledge
15 and Learning Objects; Volume 3, 2007 relates to enrichment of LO metadata. However, ontology is used to enhance metadata and the said metadata is manually annotated and raw data is used as compared to the present invention whereby metadata is annotated and enriched automatically while utilizing social contents.

20 The subject matter claimed herein is not limited to embodiments that solve any disadvantages or that operate only in environments such as those described above. Rather, this background is only provided to illustrate one exemplary technology area where some embodiments described herein may be practiced.

SUMMARY OF INVENTION

The present invention relates to a system and method for automated generation of learning object from online social content. One aspect of the present invention provides
5 a system (200, 400) for automated generation of learning object from online social content. The system comprising a plurality of Social Contents (202); a plurality of Recognition Engines which includes at least one Entity Recognition Engine (302, 414), at least one Speech Recognition Engine (416), at least one Image Recognition Engine (428); at least one Semantic Tag Enrichment Engine (308); at least one Social Content
10 knowledge base (206); and at least one Learning Object knowledge base (210). The at least one Entity Recognition Engine (302, 414) further having means for receiving Learning Object that is associated with description, learning objective and learning outcome; producing a list of semantic tags upon matching of concepts in domain ontology; and forwarding said list of semantic tags to at least one Semantic Tag
15 Enrichment Engine for metadata enrichment.

Another aspect the invention provides for the at least one Semantic Tag Enrichment Engine (308) whereby said Semantic Tag Enrichment Engine (308) further having means for checking for available tags based on list of semantic tags produce in
20 respective recognition engines; retrieving associated information from Distributed Link Data (DLD); composing semantic structure; and storing said semantic structure in knowledge base.

In yet another aspect of the invention is the knowledge bases; the at least one Social
25 Content knowledge base (206) and the at least one Learning Object knowledge base (210) for storing enriched Learning Object metadata and social contents sub graphs.

In another aspect the invention provides a method for automated generation of learning object from online social content. The method comprising steps of selecting Learning
30 Object (206) by retrieving topic of learning content and a plurality of social contents from web-based materials (202); selecting social content and enriching metadata (208); storing enriched Social Content metadata in at least one Social Content KB (210); enriching metadata associated to said Learning Object (212); and storing enriched Learning Object metadata in at least one Learning Object knowledge base (214); and

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composing Learning Object (216). The step of enriching metadata associated to said Learning Object further comprises steps of forwarding Learning Object that is associated with description, learning objective and learning outcome to at least one Entity Recognition Engine for enrichment of said Learning Object (302); producing a list of semantic tags upon matching of concepts in domain ontology (306); forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine (308); and generating conceptual structures which represents metadata for said Learning Object by retrieving concepts that are semantically similar and enriching said concepts as matched with properties in Distributed Link Data (DLD) (312).

In a further aspect of the invention there is provided with the methodology for selecting social content and enriching metadata which further comprises steps of checking type of social content (402); determining and selecting suitability of recognition engine based on type of social content (404); producing a list of semantic tags based on concept matching in domain ontology with social contents processed through respective recognition engines (420); forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine for metadata enrichment by matching (422), retrieving tags, concepts and properties in Distributed Link Data (DLD) (424); and generating a list of conceptual structures (426).

In still another aspect of the invention there is provided with the methodology for forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine for metadata enrichment by matching, retrieving tags, concepts and properties in Distributed Link Data (DLD). The said step further comprises of checking for available tags (502); retrieving associated information from Distributed Link Data (DLD) (506); composing semantic structure (510); and storing said semantic structure in knowledge base (512).

In a further aspect of the invention there is provided with the methodology for composing Learning Object which further comprising steps of retrieving and matching Learning Object sub graphs and social content sub graphs from Learning Object knowledge base and social content knowledge base (602); ranking matched sub graphs based on rules set in rules of knowledge base by grouping Learning Objects by Learning Object set, sorting and ranking highest match of Learning Object set against social content, and performing rule selection based on social content type (604); composing sub graphs to

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produce complete Learning Object which at least includes text, audio, image and video (610).

- In another aspect the invention provides the methodology for retrieving and matching
- 5 Learning Object sub graphs and social content sub graphs from Learning Object knowledge base and social content knowledge base. The said method further comprising steps of extracting Learning Object sub graph from Learning Object knowledge base (702); extracting social content sub graph from social content knowledge base (704); sending social content sub graph and Learning Object
- 10 knowledge base to matching component (706); performing semantic matching through maximal join between Learning Object sub graph and social content sub graph (708); performing similarity matching by calculating similarity score of each match (710); and storing similarity score in score database (712).
- 15 The present invention consists of features and a combination of parts hereinafter fully described and illustrated in the accompanying drawings, it being understood that various changes in the details may be made without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

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BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS

To further clarify various aspects of some embodiments of the present invention, a more particular description of the invention will be rendered by references to specific
5 embodiments thereof, which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the accompanying drawings in which:

10 FIG. 1.0 illustrates current architecture for automated generation of Learning Object from online social content.

FIG. 2.0 is a flowchart illustrating the methodology of the present invention for automated generation of Learning Object from online social content.

15 FIG. 3.0 is a flowchart illustrating the methodology of the present invention for enriching metadata associated to said Learning Object.

FIG. 4.0 is a flowchart illustrating the methodology of the present invention for selecting
20 social content and enriching metadata.

FIG. 5.0 is a flowchart illustrating the methodology of the present invention for forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine for metadata enrichment by matching, retrieving tags, concepts and properties in Distributed Link Data
25 (DLD).

FIG. 6.0 is a flowchart illustrating the methodology of the present invention for composing Learning Object.

30 FIG. 7.0 is a flowchart illustrating the methodology of the present invention for retrieving and matching Learning Object sub graphs and social content sub graphs from Learning Object knowledge base and social content knowledge base.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a system and method for automated generation of learning object from online social content. Hereinafter, this specification will describe the present invention according to the preferred embodiments. It is to be understood that limiting the description to the preferred embodiments of the invention is merely to facilitate discussion of the present invention and it is envisioned without departing from the scope of the appended claims.

FIG. 1.0 illustrates the current architecture for automated generation of Learning Object from online social content. Referring to FIG. 2.0, FIG. 3.0 and FIG. 4.0 respectively, the system and the methodology of the present invention is illustrated. The system of the present invention includes a plurality of Social Contents (202); a plurality of Recognition Engines which includes an Entity Recognition Engine (302, 414), a Speech Recognition Engine (416), an Image Recognition Engine (428); a Semantic Tag Enrichment Engine (308); a Social Content knowledge base (206); and a Learning Object knowledge base (210). Learning Object (LO) consist of various element types which include video, images, text and audio. From the profile and learning history of each individual user, the present invention would be aware of the topic covered and learned by the use and each topic is inclusive of its description, learning objective and learning outcome.

As illustrated in FIG. 2.0, FIG. 3.0, FIG. 4.0 and FIG. 5.0, an embodiment of the method (200, 300, 400, 500) of the invention is illustrated. Generally, the invention includes the steps of selecting LO by retrieving the topic of learning content (204) and social contents from web-based materials (202). Social contents are selected for metadata enrichment (208) and metadata associated to LO is enriched (212). Enriched social content metadata are stored in a Social Content KB (214). The step of selecting social content begins with checking of type of social content (402) whereby it goes through a selection process to determine and select the suitability of recognition engine based on the type of social content (404). If it is a text based (406) social content, said social content will be forwarded to the Entity Recognition Engine (414) while if it is an audio type (408) social content, the said social content will be forwarded to a Speech Recognition Engine (416) and if social content is determined as video type (410), the engines then splits the content to audio and image through an audio and image splitter (418). Thereafter, the audio type social content will be forwarded to the Speech Recognition Engine and the

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image type to the Image Recognition Engine. If the social content is image type (412), the said image will be forwarded to the Image Recognition Engine (428). The output from the respective recognition engine is a list of Semantic tags produced based on concept matching in domain ontology with social contents processed through respective
5 recognition engines (420). Thereafter, the said list of semantic tags is forwarded to a Semantic Tag Enrichment Engine for metadata enrichment by matching (422), retrieving tags, concepts and properties in Distributed Link Data (DLD) (424); and generating a list of conceptual structures (426).

10 In the Semantic Tag Enrichment Engine, the previous generated semantic tags are checked to determine if list of tags are empty (502). Thereafter, the next tag is selected (504) and associated information is retrieved from DLD (506) to further compose semantic structure (510) and said semantic structures are stored into the respective knowledge base (512).

15 Metadata associated to LO is enriched (208) by forwarding LO that is associated with description, learning objective and learning outcome to an Entity Recognition Engine for enrichment of said LO (302). The said Entity Recognition Engine produces a list of semantic tags upon matching of concepts in domain ontology (306). Thereafter, the said
20 list of semantic tags are forwarded to a Semantic Tag Enrichment Engine (308) and conceptual structures (310) which represents metadata for said LO is generated by retrieving concepts that are semantically similar and enriching said concepts as matched with properties in Distributed Link Data (DLD) (312). DLD contains a repository of linked data which connects the data structure on the web. Thereafter, the enriched LO
25 metadata is stored in the LO knowledge base (210) and subsequently the LO is compose (212) to produce complete LO which consist of text, image and audio.

Referring to FIG. 6.0 and FIG. 7.0, an embodiment of the method (600, 700) of the invention to compose LO is illustrated. To compose LO, LO sub graphs and social
30 content sub graphs are retrieved and matched from LO knowledge base and social content knowledge base (602). The knowledge based; the social content knowledge base and LO knowledge base stores enriched LO metadata and social contents sub graphs. Thereafter, the matched sub graphs are ranked based on rules set in rules of knowledge base by grouping LOs by LO set (604). Upon satisfaction of rules (606), the

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highest match of LO set is sorted and ranked against social content and rule selection is performed based on social content type (608). Subsequently, sub graphs are composed to produce complete Learning Object which includes text, audio, image and video (610). The step of retrieving and matching LO sub graphs and social content sub graphs from LO knowledge base and social content knowledge base begins by extracting LO sub graph and social content sub graph from LO knowledge base (702) and social content knowledge base (704) respectively. Thereafter, said social content sub graph and LO sub graph is forwarded to matching component (706) for semantic matching. Semantic matching component acquires both of the conceptual structures of LO1 and SC1 to perform a maximal join operation between the said graphs (708). Subsequently, in the Similarity Matching module, similarity score is calculated (710) whereby each of the matches is given a similarity score and all scores are recorded in the score table which is stored in a score database (712).

The present invention provides for automated generation of LO from social contents through LO enrichment; social content selection and metadata enrichment and thereafter composing complete LO which includes text, audio, image and video. Specifically, the present invention produces a list of semantic tags through an Entity Recognition System upon matching of concepts in domain ontology.

Unless the context requires otherwise or specifically stated to the contrary, integers, steps or elements of the invention recited herein as singular integers, steps or elements clearly encompass both singular and plural forms of the recited integers, steps or elements.

Throughout this specification, unless the context requires otherwise, the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated step or element or integer or group of steps or elements or integers, but not the exclusion of any other step or element or integer or group of steps, elements or integers. Thus, in the context of this specification, the term "comprising" is used in an inclusive sense and thus should be understood as meaning "including principally, but not necessarily solely".

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It will be appreciated that the foregoing description has been given by way of illustrative example of the invention and that all such modifications and variations thereto as would be apparent to persons of skill in the art are deemed to fall within the broad scope and ambit of the invention as herein set forth.

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CLAIMS

1. A system (200, 400) for automated generation of learning object from online social content, the system comprising:

5 a plurality of Social Contents (202);
 a plurality of Recognition Engines which includes at least one Entity Recognition Engine (302, 414), at least one Speech Recognition Engine (416), at least one Image Recognition Engine (428);
 at least one Semantic Tag Enrichment Engine (308);
10 at least one Social Content knowledge base (206); and
 at least one Learning Object knowledge base (210)
 characterized in that the at least one Entity Recognition Engine (302, 414) further having means for:
 receiving Learning Object that is associated with description,
15 learning objective and learning outcome;
 producing a list of semantic tags upon matching of concepts in domain ontology; and
 forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine for metadata enrichment.

20

2. A system according to Claim 1, wherein the at least one Semantic Tag Enrichment Engine (308) further having means for:

 checking for available tags based on list of semantic tags produce in respective recognition engines;
25 retrieving associated information from Distributed Link Data (DLD);
 composing semantic structure; and
 storing said semantic structure in knowledge base.

3. A system according to Claim 1, wherein said knowledge bases; the at least one
30 Social Content knowledge base (206) and the at least one Learning Object knowledge base (210) further having means for storing enriched Learning Object metadata and social contents sub graphs.

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4. A method (200) for automated generation of learning object from online social content, the method comprising steps of:
- 5 selecting Learning Object (206) by retrieving topic of learning content (204) and a plurality of social contents from web-based materials (202);
- selecting social content and enriching metadata (208);
- storing enriched Social Content metadata in at least one Social Content KB (210)
- enriching metadata associated to said Learning Object (212); and
- 10 storing enriched Learning Object metadata in at least one Learning Object knowledge base (214); and
- composing Learning Object (216)
- characterized in that
- enriching metadata associated to said Learning Object further comprises steps of:
- 15 forwarding Learning Object that is associated with description, learning objective and learning outcome to at least one Entity Recognition Engine for enrichment of said Learning Object (302);
- producing a list of semantic tags upon matching of
- 20 concepts in domain ontology (306);
- forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine (308); and
- generating conceptual structures which represents metadata for said Learning Object by retrieving concepts
- 25 that are semantically similar and enriching said concepts as matched with properties in Distributed Link Data (DLD) (310).
5. A method (400) according to Claim 4, wherein selecting social content and
- 30 enriching metadata further comprises steps of:
- checking type of social content (402);
- determining and selecting suitability of recognition engine based on type of social content (404);

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producing a list of semantic tags based on concept matching in domain ontology with social contents processed through respective recognition engines (420);

5 forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine for metadata enrichment by matching (422), retrieving tags, concepts and properties in Distributed Link Data (DLD) (424); and generating a list of conceptual structures (426).

10 6. A method (500) according to Claim 5, wherein forwarding said list of semantic tags to at least one Semantic Tag Enrichment Engine for metadata enrichment by matching, retrieving tags, concepts and properties in Distributed Link Data (DLD) further comprises steps of:

checking for available tags (502);

retrieving associated information from Distributed Link Data (DLD) (506);

15 composing semantic structure (510); and

storing said semantic structure in knowledge base (512).

7. A method (600) according to Claim 4, wherein composing Learning Object further comprising steps of:

20 retrieving and matching Learning Object sub graphs and social content sub graphs from Learning Object knowledge base and social content knowledge base (602);

ranking matched sub graphs based on rules set in rules of knowledge base by grouping Learning Objects by Learning Object set, sorting and ranking highest match of Learning Object set against social content, and performing rule selection based on social content type (604);

25 composing sub graphs to produce complete Learning Object which at least includes text, audio, image and video (610).

30 8. A method (700) according to Claim 7, wherein retrieving and matching Learning Object sub graphs and social content sub graphs from Learning Object knowledge base and social content knowledge base further comprising steps of:

extracting Learning Object sub graph from Learning Object knowledge base (702);

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- 5 extracting social content sub graph from social content knowledge base (704);
 sending social content sub graph and Learning Object knowledge base to matching component (706);
 performing semantic matching through maximal join between Learning Object sub graph and social content sub graph (708);
 performing similarity matching by calculating similarity score of each match (710); and
 storing similarity score in score database (712).

100

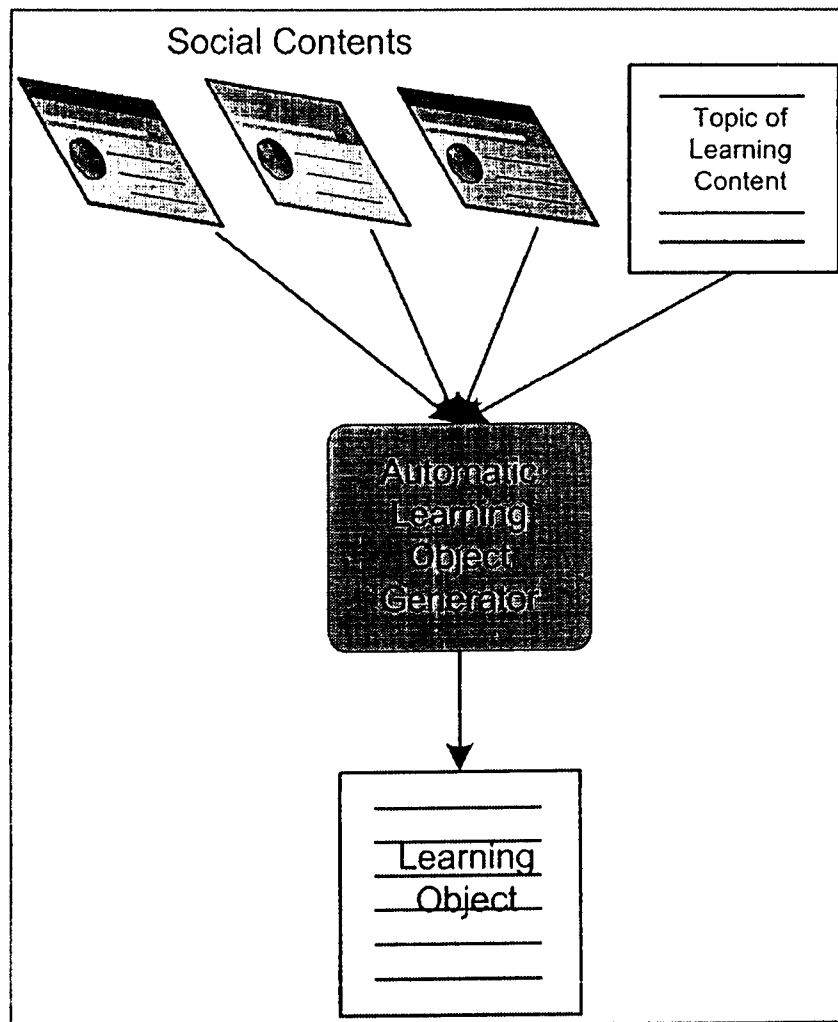


FIG. 1.0

200

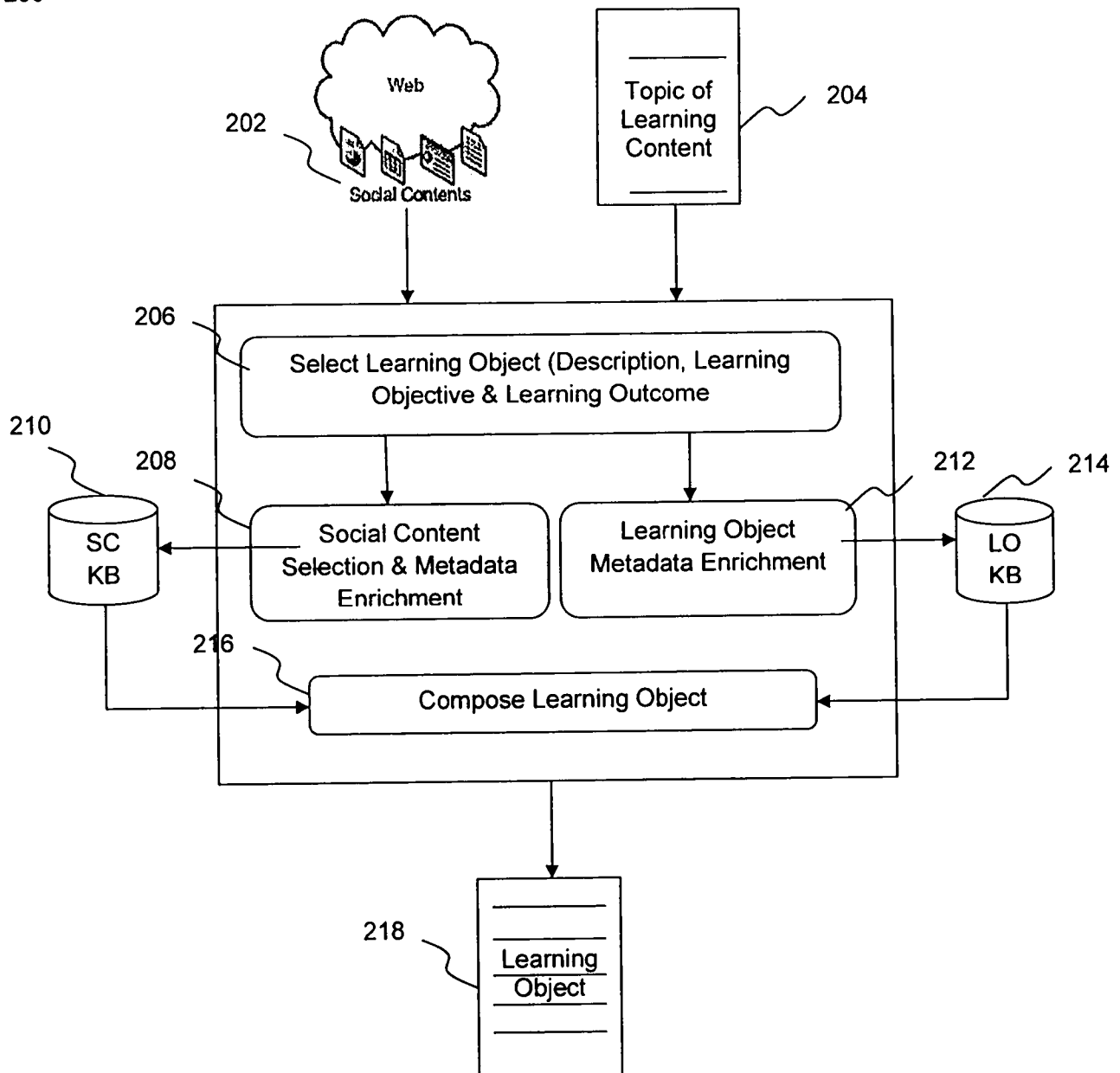
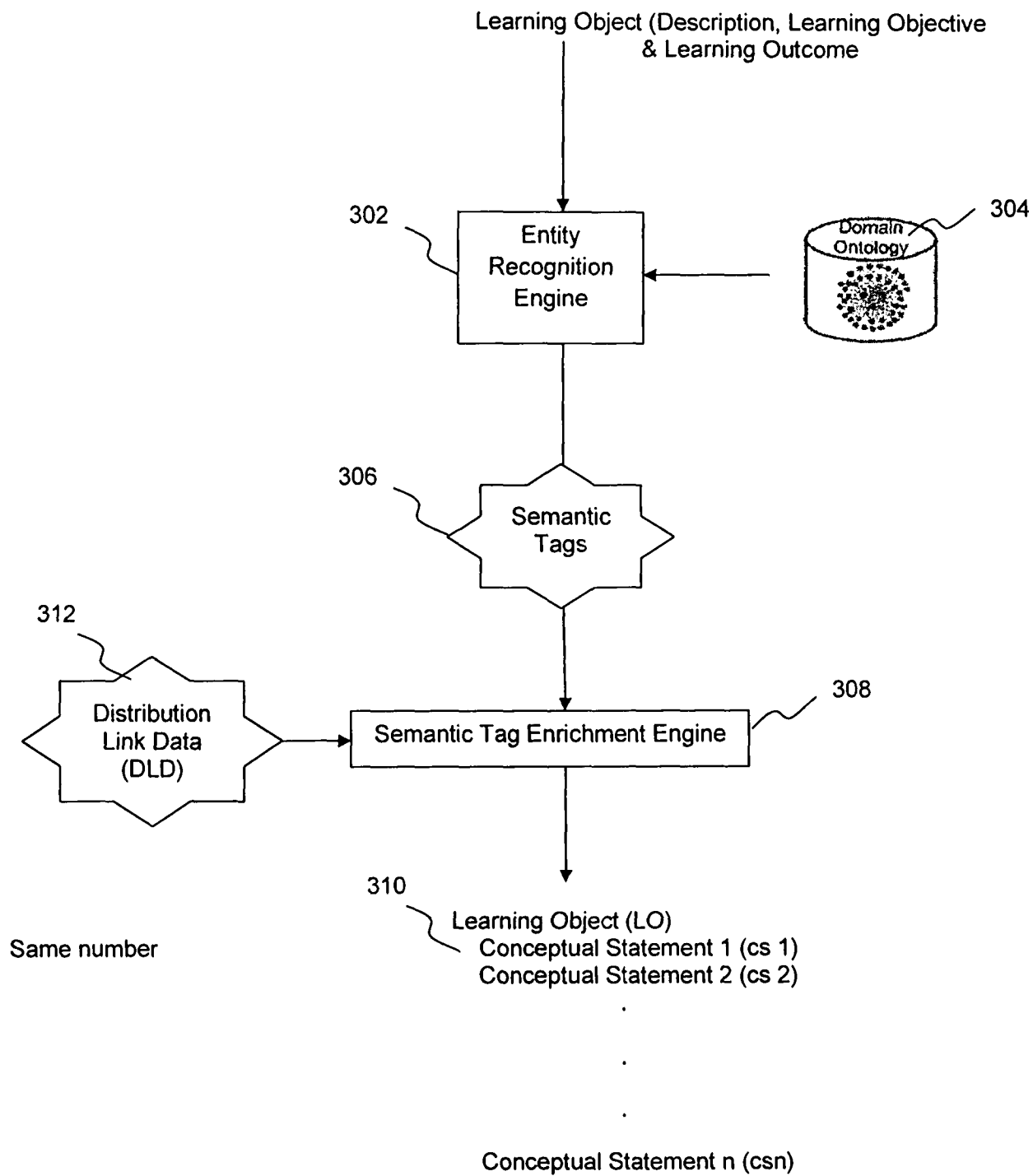


FIG. 2.0

300



Same number

FIG. 3.0

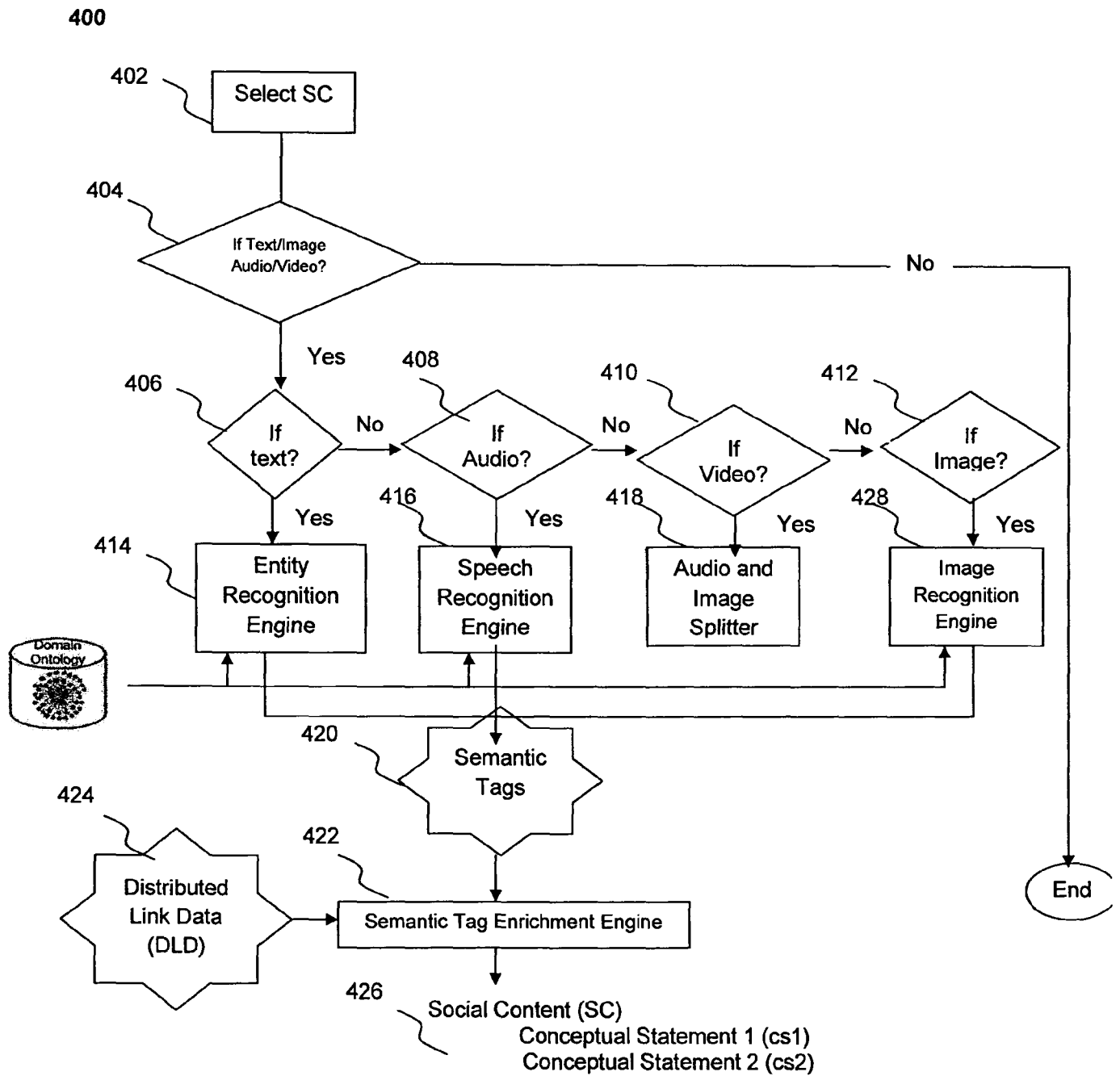


FIG. 4.0

500

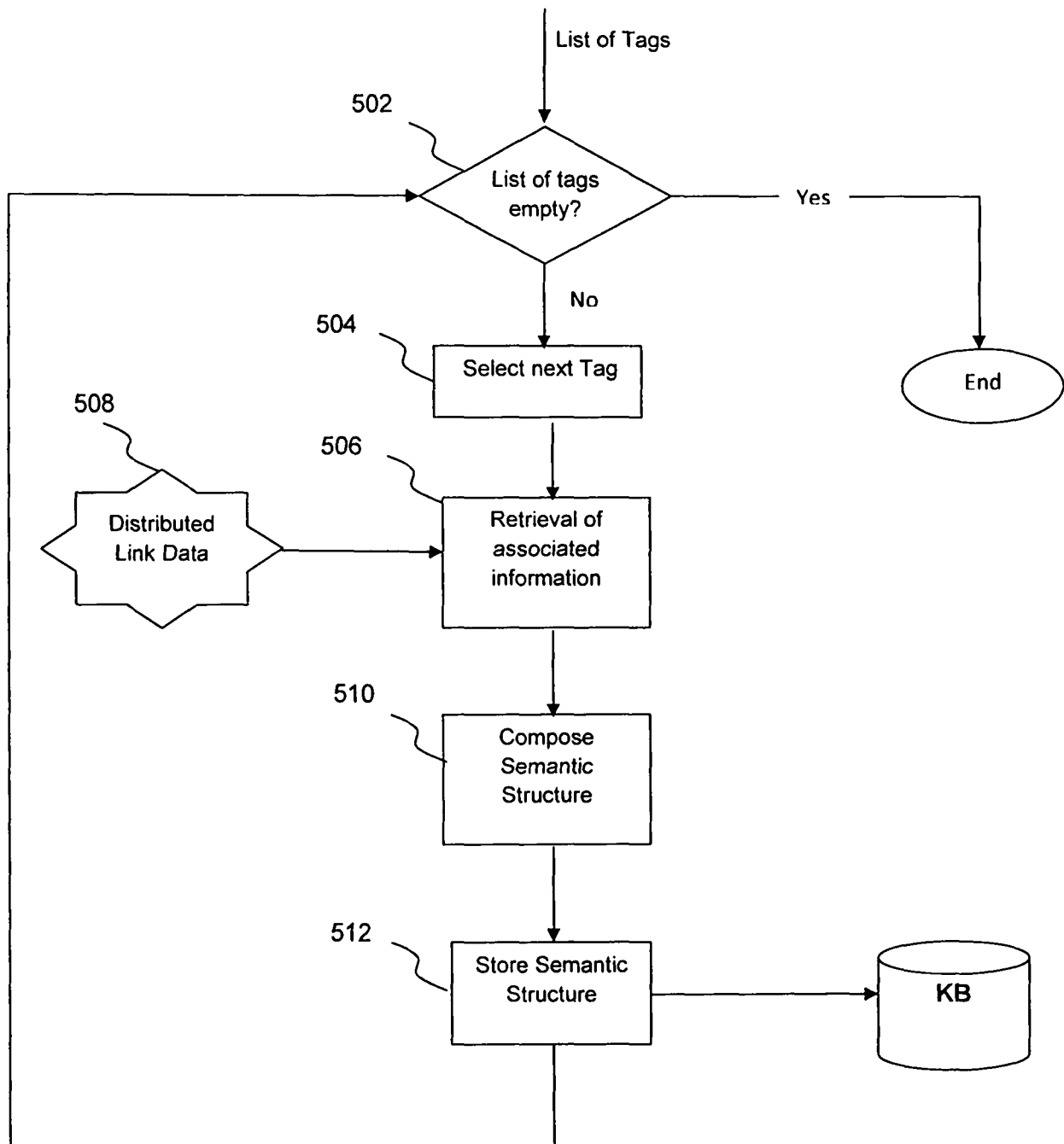


FIG. 5.0

600

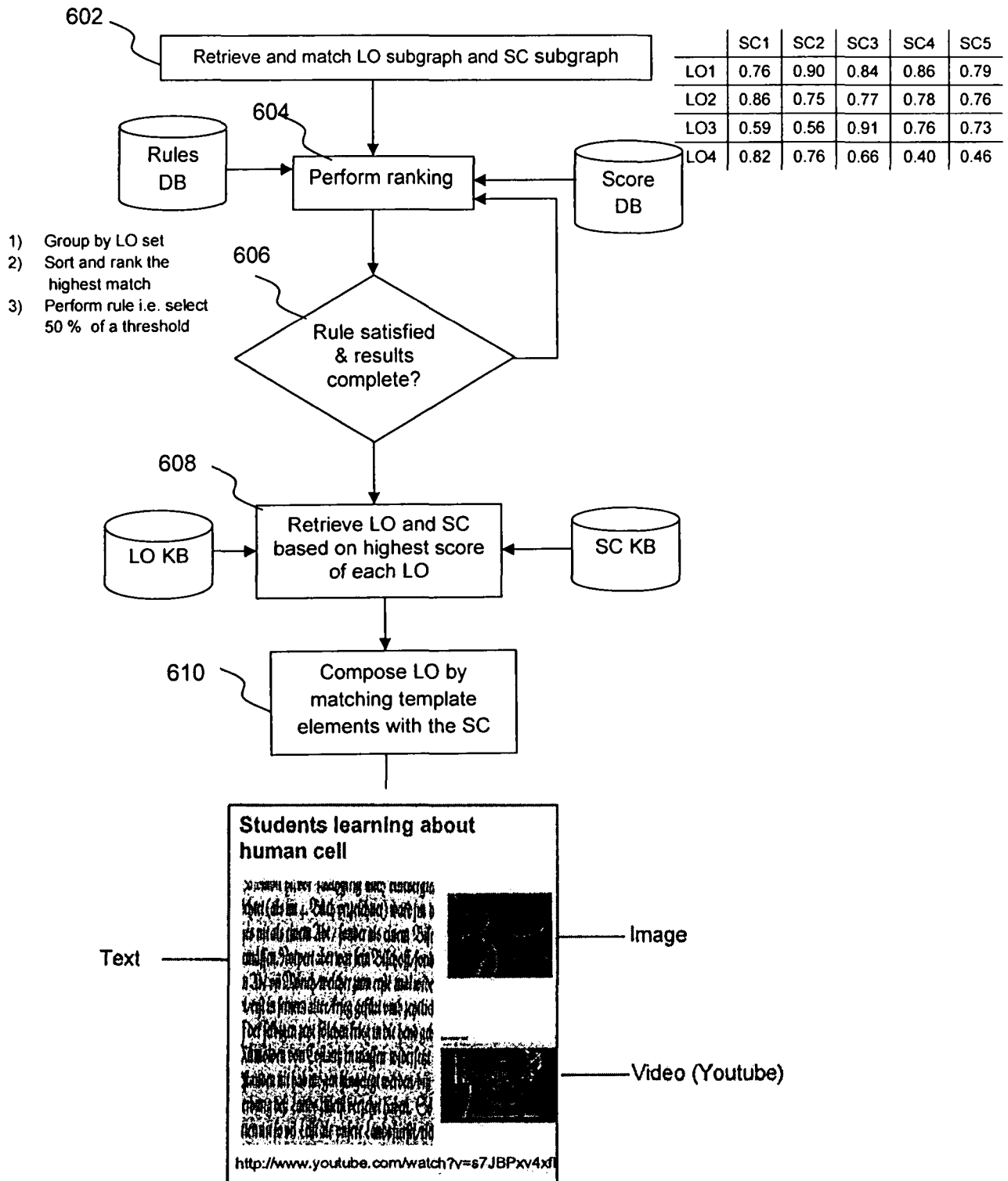


FIG. 6.0

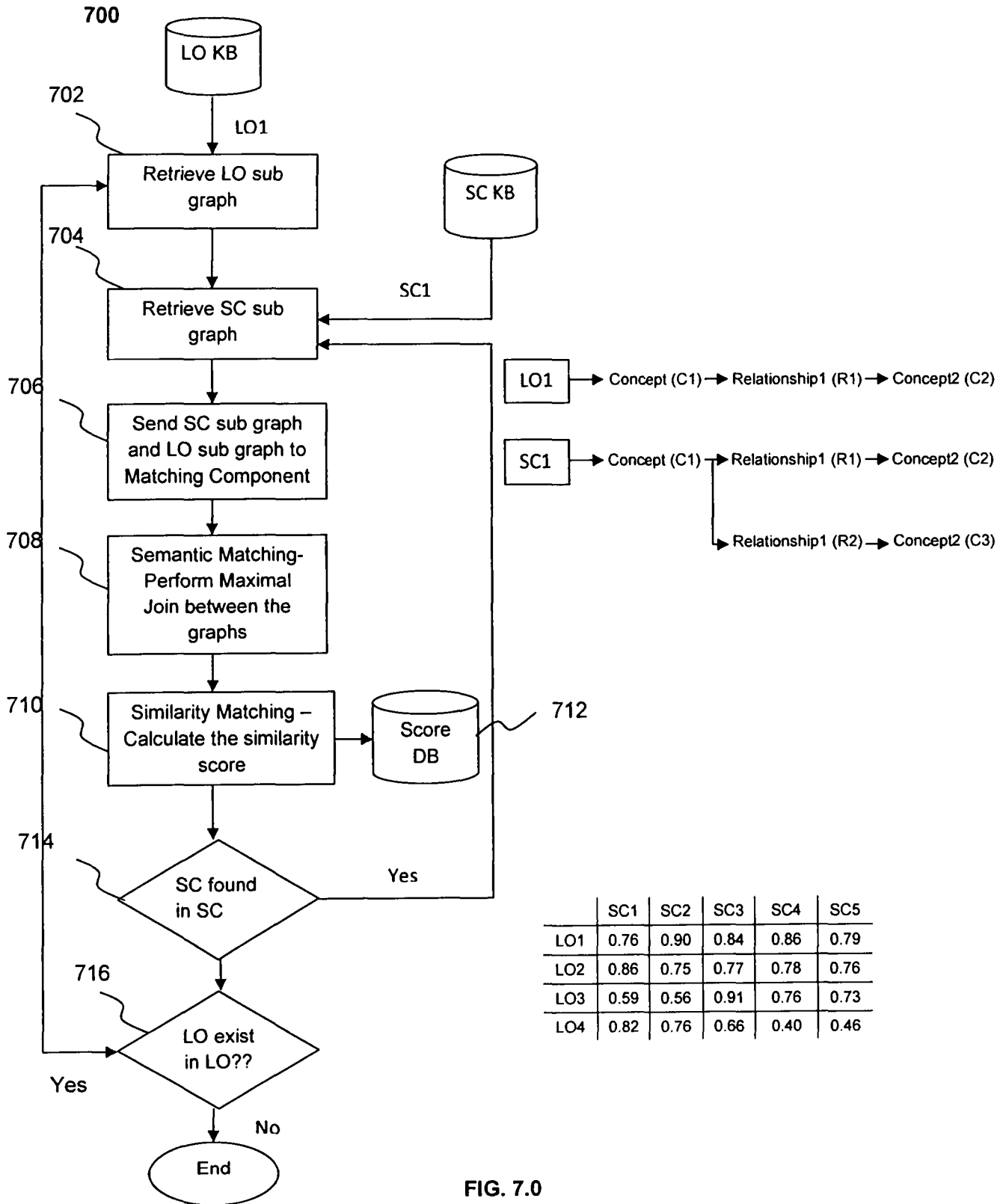


FIG. 7.0

INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2013/000234

A. CLASSIFICATION OF SUBJECT MATTER

INV. G06Q50/00 G06Q10/10
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06Q

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/217685 A1 (SRINIVASAN RAMAN [IN] ET AL) 8 September 2011 (2011-09-08) cited in the application abstract paragraph [0040] - paragraph [0062] -----	1-8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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

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Date of the actual completion of the international search

12 May 2014

Date of mailing of the international search report

20/05/2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/MY2013/000234

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011217685	A1	08-09-2011	NONE
