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Ontology Extraction from Heterogeneous Documents

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Abstract: *Ontology Extraction play an important role in the Semantic Web as well as in knowledge management. The emergence of Semantic Web and the related technologies promise to make the Web a meaningful experience. Conversely, success of Semantic Web and its applications depends largely on utilization and interoperability of well-formulated ontology bases in an automated heterogeneous environment. Ontology is what exists in a domain and how they relate with each other. The advantage of an ontology is that it represents real world information in a manner that is machine understandable. This leads to a variety of interesting applications for the benefit of the target user groups. An ontology defines the terms used to describe and represent an area of knowledge. Ontologies are critical for applications that need to search across or merge information from diverse communities. In this paper, we present our approach to extract relevant ontology concepts and their relationships from a knowledge base of heterogeneous text documents.*

Keywords: *heterogeneous, knowledge, machine understandable, Ontology Extraction, Semantic Web*

I. Introduction

The Semantic Web is a major research initiative of the World Wide Web Consortium (W3C) [1] to create a metadata-rich Web of resources that can describe themselves not only by how they should be displayed (HTML) or syntactically (XML), but also by the meaning of the metadata. We consider Semantic Web as next generation Web that provides great benefits in Web Services, Internet Commerce, and other promising application areas. However, Semantic Web is still in its primary stage means not fully implemented. and has lots of unsolved problems. One of the major problem is to extract data from heterogeneous documents in such way that it has to understand by machine, which we call ontology extraction.

A basic approach for ontology extraction is by manual. Most of the current research focuses on exploiting various methods to generate ontology automatically or semi-automatically. Manual ontology building is a time consuming activity that requires a lot of efforts for knowledge domain acquisition and knowledge domain modeling. In order to overcome these problems many methods have been developed, including systems and tools that automatically or semi-automatically, using text mining and machine learning techniques, allows to generate ontologies. The research field which study this issues is usually called “ontology generation” or “ontology extraction” or “ontology learning”. However, most approaches have “only” considered one step in the overall ontology engineering process [2], for example, generating concepts & relationships[3] or extracting concepts & relationship whereas one must consider the overall process when building real-world applications. In this paper, we describe our approach for ontology extraction from an existing knowledge base of heterogeneous documents. We required Information Extraction from heterogeneous text because it gives direct access to knowledge when in textual format, only relevant information is accessed by people Knowledge Sharing.

A. Background and Related Works

Two main approaches have been developed in ontology extraction. The first one facilitates manual ontology engineering by providing natural language processing languages, and ontology import tools. The second approach is based on machine learning and automated language processing techniques to extract concepts and ontological relations from structured and unstructured data such as databases and texts. A number of systems have been proposed for ontology extraction from text. We describe some of them in the following.

ASIUM [4] extracts verb frames and taxonomic knowledge, based on statistical analysis of syntactic parsing of texts. Text-To-Onto [5] is an Open source ontology management infrastructure, with a tool suite for building ontologies from an initial core ontology. It combines knowledge acquisition and machine learning techniques to discover conceptual structures.

Information Retrieval[6] is a domain independent that creates clusters of the words appearing in the text. The scope of this is to build a hierarchy of concepts. Its learning method is based on distributional approach: nouns playing the same syntactic role in sentences with the same verb are grouped together in the same class.

Effective ontology management in virtual learning environments[7] is a semi-automatic data driven topic ontology which integrates machine learning and text mining algorithms. Main features are represented by automatic keyword extraction from documents given as an input to the system (the extracted keywords are “candidate concepts” of the ontology) and by the concepts suggestions generation.

II. Approach For Ontology Extraction

Ontology is a basic building block for semantic web[8]. An active line of research in semantic web is focused on how to build and evolve ontologies using the information from different ontological sources such as txt, doc, ppt, pdf etc inherent in the domain. A large part of the IT industry uses software engineering methodologies to build software solutions that solve real-world problems. Ontology Building process consists of following phases.

A. Clustering

We have implemented statistical[9] and data mining algorithm[10] in order to identify the concepts and their relationship in the resulting ontology. This method aims to build ontologies using a data mining approach called cluster mining from domain repositories written in XML.

Algorithm: Generating Concepts and relations.
Input: Folder containing heterogeneous file
Output: Dynamically created XML data by parsing the contents of files from ontology testing folder.

```
❖ Begin
Step1: Read all the file names from input folder.
Step2: Create a string buffer variable to collect all the file names.
Step3: Create a temporary string buffer to read content of each file.
Step4: Process each data of file based on end of sentence.
Step5: Using temporary string buffer which will list the number of possibilities of meaningless words in sentence, Cluster the data by filtering it from meaningless string content.
Step6: Mark first word of sentence as parent and next beginning word will be marked as child.
Step7: Continue to read all the sentences from the folder.
❖ Stop
```

B. Harmonization

This is an optional step that is needed when the user wants to “harmonize” the extracted ontology with the available knowledge bases.

With the term ontology harmonization, we want to refer to the ability of harmonizing two or more ontologies in a unique ontology in order to improve the available knowledge base. It is strictly related to two main issues: ontology matching[11] for the recognition of correspondences between ontologies and ontology merging[12] for the actual fusion of those ontologies.Main aim of harmonization is Extracting concepts and relations means for input string it has to display list of all the match able relations from the input string.

Algorithm: Extracting concepts and relations
Input: Testing string query
Output: Displaying list of all the match able relations from the input string.

```
❖ Begin
Step1: Read the Input text.
Step2: Compare input test string with concept from ontology data.
Step3: Search input text with set of relations from ontology data.
Step4: Read the number of term frequency of the input string appearing in the ontology data.
Step5: Display the number of strings appearing both as concept and relation.
❖ Stop
```

III. Results

This chapter presents the results obtained from the developed system , mainly it shows extracted ontology data, constructed “concept & relationship” data created using the ontology data & verified ontology data process.

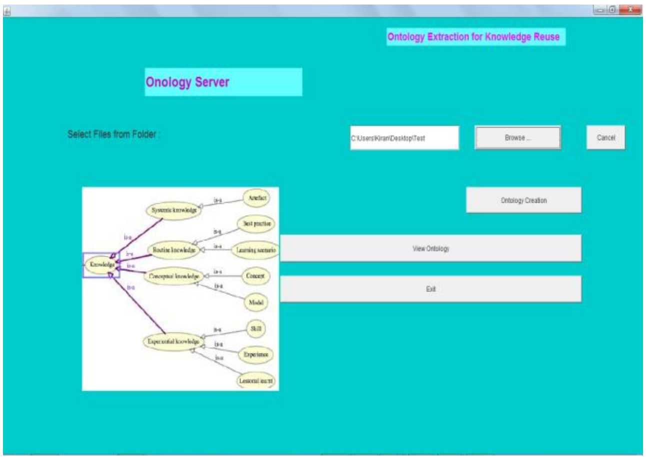
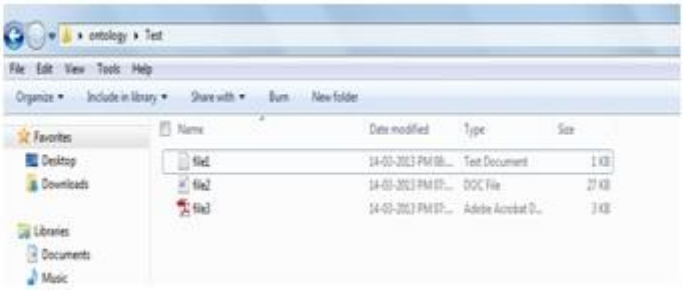

Select Files from Folder : C:\Users\Kiran\Desktop\Test

Fig1: ontology server containing various options.

In fig1 we can see ontology server containing various options. Here the first process you have to browse the folder which contains various heterogeneous documents. In the above figure we are browsing the folder from “c:\Users\Kiran\Desktop\Test” location.

Our experimentation has been made considering the TXT, DOC and PDF formats so our Test folder contains three different format files. The fig2 indicates that.



ontology ▸ Test
File Edit View Tools Help
Organize ▾ Include in library ▾ Share with ▾ Burn New folder
Favorites
Desktop
Downloads
Libraries
Documents
Music

Name	Date modified	Type	Size
file1	14-03-2013 PM 08...	Text Document	1 KB
file2	14-03-2013 PM 07...	DOC File	27 KB
file3	14-03-2013 PM 07...	Adobe Acrobat D...	3 KB

Fig2: Test folder which contains three different formatfiles.

File1 is of text format, Which contains the following text. “Hypertext Markup Language, the languages of the World Wide Web, allows users to produces Web pages that include text, graphics and pointer to other Web pages.HTML provides tags to make the document look attractive”

File2 is of doc format, Which contains the following text. “A HTML document is small and hence easy to send over the net. It is small because it does not include formatted information.”

File3 is of pdf format, Which contains the following text. “HTML is platform independent. HTML tags are not case-sensitive.”

We want to analyze our input data so in all files we taken small amount of text. Our system works fine with huge amount of data also. After browsing the input folder, to construct the ontology data we have to click ontology creation tab. As soon as you click the ontology creation tab within few seconds our system will generate ontology data. After generating ontology data it shows “ontology creation has been successfully completed.” which is shown in fig3.

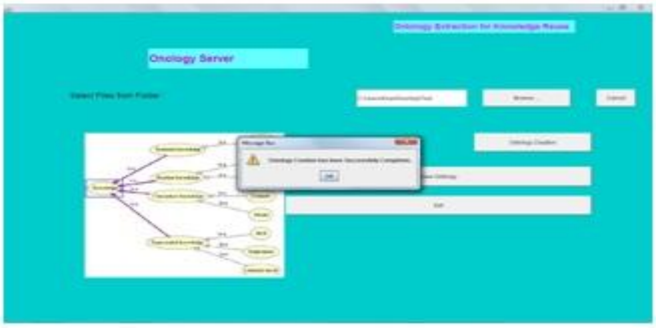
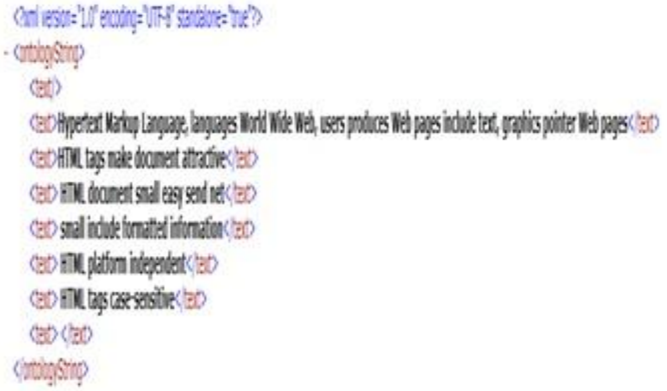


Fig3: Ontology sever displaying message after creating ontology data.

Once the ontology creation successfully completed you can see ontology data by clicking view ontology tab. When you click view ontology tab it displays two xml files. In our system ontology data is stored in xml format. First xml file contains ontology data.



```
<?xml version="1.0" encoding="UTF-8" standalone="true"?>
- <ontologyString>
    <text/>
    <text>Hypertext Markup Language, languages World Wide Web, users produces Web pages include text, graphics pointer Web pages</text>
    <text>HTML tags make document attractive</text>
    <text> HTML document small easy send net</text>
    <text> small include formatted information</text>
    <text> HTML platform independent</text>
    <text> HTML tags case-sensitive</text>
    <text> </text>
  </ontologyString>
```

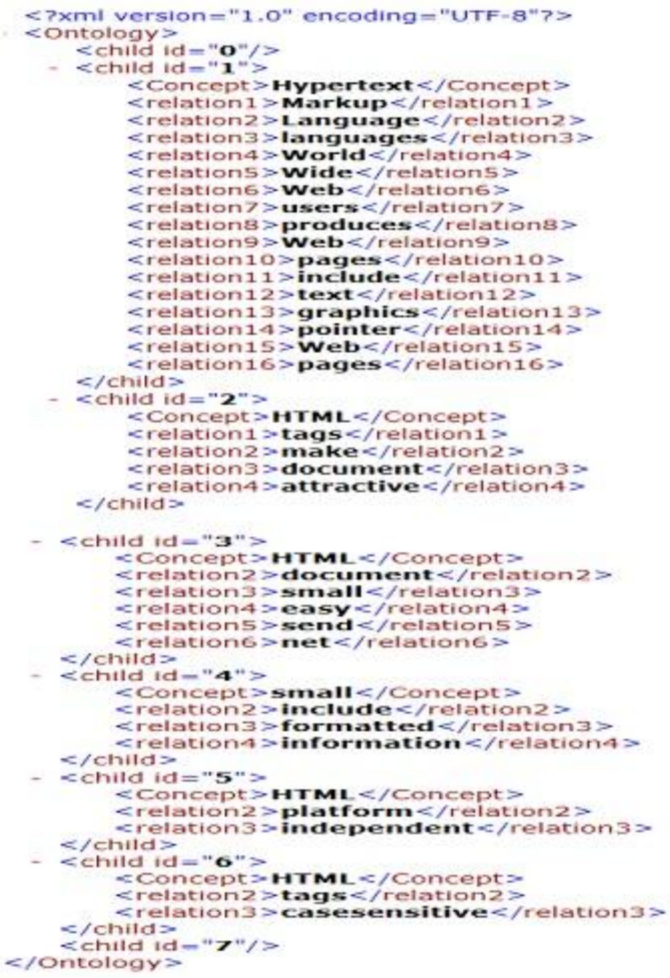
Fig4: Contents of first xml file

The fig4 shows content of first xml file. Here you can observe that our system concatenated all contents of different files. Then content breaks by sentence.

For example by considering content of file1, I will explain the working of our system. First sentence of file1 is stored like below.

"Hypertext Markup Language, the languages of the World Wide Web, allows users to produces Web pages that include text, graphics and pointer to other Web pages."
Second sentence of file1 is stored like below.
"HTML provides tags to make the document look attractive"
Finally our system removes stopwords(unrelated words) from each sentence. Unrelated words means in first sentence the, of, allows, to, that & other words are having no importance when creating ontology data. So those words have been trimmed from the sentence. So trimmed content with respect to first sentence of file 1 is
"Hypertext Markup Language, languages World Wide Web, users produces web pages include text, graphics pointer Web pages"
Trimmed content with respect to second sentence of file 1 is
"HTML tags make document attractive"
Similar process applied to whole content & stopwords have removed from each sentence(refer fig4 for output).

Next the each sentence of ontology data is stored in "Concept-Relationship" manner which is useful when extracting ontology data. In each sentence first word is stored as concept & next words will be stored as relations.



```
<?xml version="1.0" encoding="UTF-8"?>
<Ontology>
    <child id="0"/>
  - <child id="1">
        <Concept>Hypertext</Concept>
        <relation1>Markup</relation1>
        <relation2>Language</relation2>
        <relation3>languages</relation3>
        <relation4>World</relation4>
        <relation5>Wide</relation5>
        <relation6>Web</relation6>
        <relation7>users</relation7>
        <relation8>produces</relation8>
        <relation9>Web</relation9>
        <relation10>pages</relation10>
        <relation11>include</relation11>
        <relation12>text</relation12>
        <relation13>graphics</relation13>
        <relation14>pointer</relation14>
        <relation15>Web</relation15>
        <relation16>pages</relation16>
    </child>
  - <child id="2">
        <Concept>HTML</Concept>
        <relation1>tags</relation1>
        <relation2>make</relation2>
        <relation3>document</relation3>
        <relation4>attractive</relation4>
    </child>

 - <child id="3">
       <Concept>HTML</Concept>
       <relation2>document</relation2>
       <relation3>small</relation3>
       <relation4>easy</relation4>
       <relation5>send</relation5>
       <relation6>net</relation6>
   </child>
 - <child id="4">
       <Concept>small</Concept>
       <relation2>include</relation2>
       <relation3>formatted</relation3>
       <relation4>information</relation4>
   </child>
 - <child id="5">
       <Concept>HTML</Concept>
       <relation2>platform</relation2>
       <relation3>independent</relation3>
   </child>
 - <child id="6">
       <Concept>HTML</Concept>
       <relation2>tags</relation2>
       <relation3>casesensitive</relation3>
   </child>
   <child id="7"/>
</Ontology>
```

Fig5: second xml file storing ontology data in concept-relationship manner.

Once the ontology data is created next optional step is to check match able relations from sentence for input string. In our system it is working fine. Suppose for example your sarching html as input string then it will display mach able relations. Math able relations for html are tags, make, document, attractive, small, easy, send, net, platform, independent, casesensitive. It also shows in which file the particular sentence is found. so you can easily find the exact information.

In fig5 each sentence first word is stored as concept & next words will be stored as relations. It does not mean that you have to search only concept. You can search any word means the particular input string is treated as concept related words are treated as relations.

Suppose if you given input that is not present in documents then it will display the message "search not found, try with another concept."

IV. Conclusion

In this paper, we have presented an ontology information extraction system to extract ontologies from a knowledge base of heterogeneous text documents. We have proposed our approach to build the Concept and Relationship from heterogeneous documents which gives dynamically created XML data by parsing the contents of files. In our project harmonization is an optional step but it is needed to check whether builded ontology is efficient or not, so we even proposed our approach to extracting concepts and relations. Means when you given input as string query our system gives output as list of all the match able relations from the input string. Our work mainly explains the ontology extraction process is general and is not domain dependent. Thus ontology has been served as a most effective technique to solve semantic issues irrespective of any domain.

References

[1] M. Dean and G. Schreiber, "OWL Web ontology language reference," W3C Recommendation, Feb. 2004.
[2] J. Euzenat and P. Shvaiko, Ontology Matching. Heidelberg, Germany: Springer-Verlag, 2007.
[3] R. Farkas, V. Vincze, I. Nagy, R. Ormándi, G. Szarvas, and A. Almási, "Web-based lemmatisation of named entities," in Proc. TSD, vol. 5246, Lecture Notes in Computer Science, P. Sojka, A. Horák, I. Kopeček, and K. Pala, Eds. Berlin, Germany: Springer-Verlag, 2008, pp. 53–60.
[4] D. Faure and T. Poibeau, "First experiences of using semantic knowl- edge learned by ASIUM for information extraction task using INTEX," in Proc. ECAI Workshop Ontology Learning, vol. 31, CEUR Work- shop Proceedings, S. Staab, A. Maedche, C. Nédellec, and P. Wiemer- Hastings, Eds., 2000.
[5] A. Maedche and S. Staab, "The Text-To-Onto ontology learning environ- ment," in Proc. 8th Int. Conf. Conceptual Struct., Darmstadt, Germany,2000, pp. 14-18.
[6] W. B. Frakes and R. A. Baeza-Yates, Eds., Information Retrieval: Data Structures & Algorithms. Englewood Cliffs, NJ: Prentice-Hall,1992.
[7] M. Gaeta, F. Orciuoli, S. Paolozzi, and P. Ritrovato, "Effective ontology management in virtual learning environments," Int. J. Internet Enterprise Manage., vol. 6, no. 2, pp. 96–123, 2009.
[8] A. D. Maedche, Ontology Learning for the Semantic Web. Norwell, MA: Kluwer, 2002.
[9] C. D. Manning and H. Schtze, Foundations of Statistical Natural Language Processing. Cambridge, MA: MIT Press, Jun. 1999.
[10] D. L. McGuinness, R. Fikes, J. Rice, and S. Wilder, "The Chimaera ontology environment," in Proc. AAAI/IAAI, 2000, pp. 1123–1124.
[11] R. Navigli and P. Velardi, "Semantic interpretation of terminological strings," in Proc. 6th Int. Conf. TKE, 2002, pp. 95–100.
[12] R. Navigli, P. Velardi, and A. Gangemi, "Ontology learning and its application to automated terminology translation," IEEE Intell. Syst., vol. 18, no. 1, pp. 22–31, Jan. 2003.