Web Semantization

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ABSTRACT

We understand Web Semantization as an automated process of increasing degree of semantic content on the web. Part of content of the web is further usable, semantic content (usually annotated) is more suitable for machine processing. Our idea is supported by models, methods, prototypes and experiments with a web repository, automated annotation tools producing third party semantic annotations, semantic repository serving as a sample of semantized web and a proposal of an intelligent software agent. We are working on a proof of concept that even today it is possible to develop a semantic search engine designed for software agents.

Categories and Subject Descriptors

H.3.1 [**INFORMATION STORAGE AND RETRIEVAL**]: Content Analysis and Indexing; H.3.3 [**INFORMATION STORAGE AND RETRIEVAL**]: Information Search and Retrieval; I.2.4 [**ARTIFICIAL INTELLIGENCE**]: Knowledge Representation Formalisms and Methods

General Terms

Web Semantization

Keywords

Semantic Web, Web Content Mining, Linguistic Analysis

1. INTRODUCTION

In their Scientific American 2001 article [3], Tim Berners-Lee, James Hendler and Ora Lassila unveiled a nascent vision of the semantic web: a highly interconnected network of data that could be easily accessed and understood by a desktop or handheld machine. They painted a future of intelligent software agents that would "answer to a particular question without our having to search for information or pore through results" (quoted from [6]). Lee Feigenbaum, Ivan Herman, Tonya Hongsermeier, Eric Neumann and Susie Stephens in their Scientific American 2007 article [6] conclude that "Grand visions rarely progress exactly as planned, but the Semantic Web is indeed emerging and is making online information more useful as ever". L. Feigenbaum et al. support their claim with success of semantic web technology in drug discovery and health care (and several further applications). These are mainly corporate applications with data annotated by humans. Ben Adida when bridging clickable and Semantic Web with RDFa ([1]) assumes also human (assisted) activity by annotations of newly created web resources.

But what to do with the content of the web of today or of pages published without annotations? The content of the web of today is too valuable to be lost for emerging semantic web applications. We are looking for a solution how to make it accessible in semantic manner.

We would like to address the problem of semantization (enrichment) of current web content as an automated process of third party annotation for making at least a part of today's web more suitable for machine processing and hence enabling it intelligent tools for searching and recommending things on the web (see [2]).

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2. THE IDEA OF WEB SEMANTIZATION

Our main idea is to fill a semantic repository with information that is automatically extracted from the web and make it available to software agents. We are working on a proof of concept that this idea is realizable and we give results of several experiments in this direction.

Our web crawler (see Fig.1) downloads a part of the web to the web repository (Web Store). Resources with semantic content can be uploaded directly to the semantic reposi-

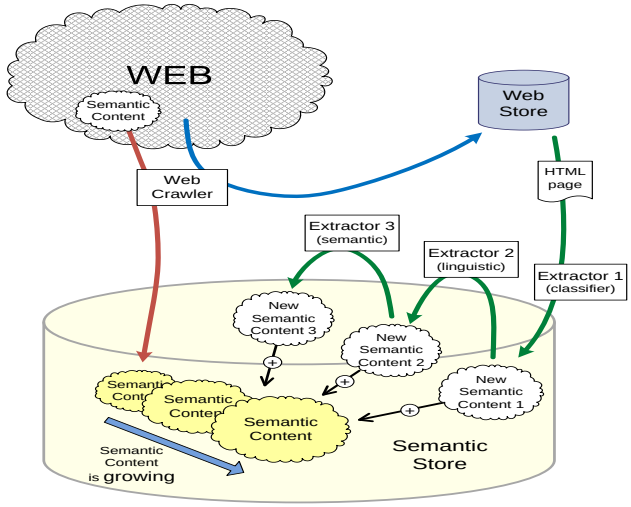

Figure 1: The process of semantization of the Web

tory (Semantic Store). Extractor 1 (classifier) extracts those parts of Web Store which are suitable for further semantic enrichment (we are able to enrich only a part of resources). More semantic content is created by several extractors and annotators in several phases.

(1) The idea of a web repository. It develops as follows in details. Semantic enrichment is in fact a data mining task (although a special one) - to add to web documents a piece of knowledge, which is obvious for human perception not for a machine. That means to annotate data by concepts from an ontology which is the same as to map instances to ontology. Such a data mining task will be easier to solve when there is a sort of a repetition (modulo some similarity).

The Web repository is a temporal repository of Web documents crawled by a crawler. The repository supports document's metadata, e.g. modification and creation dates, domain name, ratio HTML code/text, content type, language, grammatical sentences etc. It keeps track of all changes in a document and simplifies access to and further processing of Web documents. We are experimenting with the Web crawler Egothor[1] 2.x and it's Web repository. We have filled this repository with several terabytes of textual part of Czech web (domain *.cz) and it very simplified access to this data.

(2) Second idea is to split annotation process to two parts, one domain independent intermediate annotation and second domain dependent user directed annotation. Both should be automated, with some initial human assisted learning. This first part of learning could require assistance of a highly skilled expert; the second (probably faster part) should be doable by an user with average computer literacy.

Domain independent intermediate annotation can be done with respect to general ontologies. First ontology is the general PDT tectogrammatical structure [7] (it is not exactly an ontology written in ontology language, but could be considered this way) which captures semantic meaning of a grammatical sentence. Of course tectogrammatical structure is not the only option for this purpose. English language for example can be parsed in many different ways (most often according to some kind of grammar). All the other possibilities are applicable, but in our current solution we make use of a tree structure of the annotations. In this paper we will present our experience with Czech language and tectogrammatical structure that we have used for domain independent intermediate annotation of pages dominantly consisting of grammatical sentences.

For structured survey or product summary pages (we call them "tabular pages") we assume that their structure is often similar and the common structure can help us to detect data regions and data records and possibly also attributes and values from detailed product pages. Here annotation tools will be also trained by humans – nevertheless only once for the annotation of the whole repository.

Domain (task) dependent (on demand) annotation is concerning only pages previously annotated by general ontologies. This makes second annotation faster and easier. An assistance of a human is assumed here for each domain and new ontology. For textual pages repetitions make possible to learn a mapping from structured tectogrammatical instances to an ontology.

[1]http://www.egothor.org/

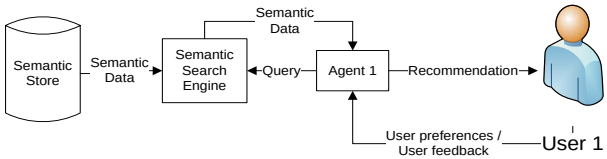

Figure 2: Querying Semantic Search Engine

(3) Next idea is to design semantic repository. It should store all the semantic data extracted by extraction tools and accessed thorough a semantic search engine. Of course many different problems (e.g. querying and scalability) are connected with this but they are at least partially solved now days. Let us mention work of our colleges [5] that is available for use.

The semantic repository should also contain some sort of uncertainty annotation besides other ontologies. The main reason is that annotation process is error prone and we can have in future different alternative annotation tools and aggregate results. This aspect is not further described in the paper but can be found with many details in [4].

(4) Design of an software agent, which will give evidence that our semantization really improved general web search. Besides using annotated data it should also contain some user dependent preference search capabilities.

The process of a user agent searching and making use of semantic search engine is represented in Figure 2.

3. ACKNOWLEDGMENTS

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