Ontologies and Ontological Representation

Tudor Colomeischi
Eugenia Iancu
"Stefan cel Mare" University of Suceava, Romania,
tudorcolomeischi@yahoo.ro
eugenia.iancu@usm.ro

Abstract

The present paper aims to present the main theoretical and practical aspects of what ontology and knowledge bases mean, having the role of providing as precise information as possible. Ontologies are considered to be a vocabulary of concepts, and the purpose of this "vocabulary" is to ensure a semantically based level of knowledge based on semantics in order to define semantic ideas and relationships between them. Starting from this concept, it should be noted the idea of using the knowledge by a system that groups them into a knowledge base, which means representing the experience accumulated by human specialists in solving the problems in the field in question. This knowledge refers strictly to an ontology of the domain, to the rules used, but also to the restrictions that minimize the search space.

Key words: information society, ontology, knowledge society, data mining
J.E.L. classification: M1, M15, M21

1. Introduction

In the last decade, ontologies have become an important means of knowledge exchange and integration, and after the vision of the semantic web was transposed, the ontology became a basic element for solving computer problems, so that the ontology is recognized, and in the field of knowledge representation, processing and retrieval of information.

The information society is a synagogue of the information age, so we must be aware that information becomes a strategic and fundamental resource. By definition, information is the basis of reasoning for the purpose of acquiring new knowledge. For the establishment of the information society, it is important to identify the rules by which they operate and the social and economic relations.

2. Literature review

The notion of information society is probably well understood by the vast majority of people, as it refers to a human society in which the use of computers is ubiquitous, and this omnipresence leads to a huge volume of information stored in databases, when they are transmitted, but also for their processing for different purposes (Draganescu, 2001, p.137).

Two important events marked the emergence and development of the information society:

- The first dates from 1992, when the Vice President of the United States of America, Al Gore, spread the idea of the Information Highway. The concept had a strong technical and technological character and was based in principle on the technological increase of the United States in the field of electronics and communications. It was a time when the United States had the technical, technological and financial resources to develop equipment and models that would provide the transmission of information in more cost-effective ways;
- Europe, being put at risk by this American challenge, took the lead and produced the report entitled "Europe and the Global Information Society: Recommendations for the Council of Europe" (also known as the Bangemann Report). It is the moment when the Council of

Europe decided to set up the Council for the Information Society (CIS) a specialized body dedicated exclusively to establishing tangible ways of applying the guidelines in the Bangemann report, and on July 19, 1994, the first European action plan for the Information Society was devised, nicknamed "The Road to Europe for the Information Society".

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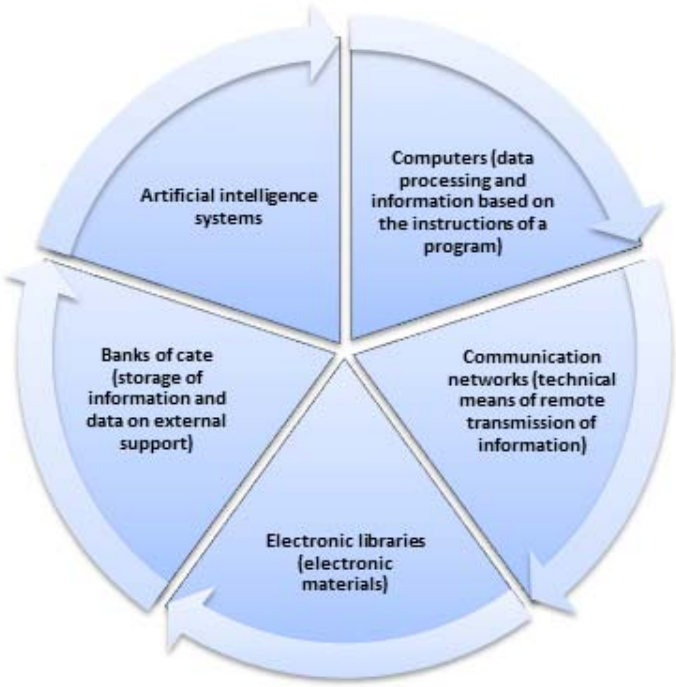
The characteristic features of the information society are represented in figure 1.

The notion of the knowledge society is used today throughout the world, being a compression of the term of a knowledge-based society, which represents more than the information society, including this one.

Figure no. 1 Characteristic features of the information society



Source: Own elaboration

The term "knowledge society" appeared in 1970 to underline the significance of scientific and technological knowledge for the economy and society. What's new at the moment is the volume of knowledge we have available that goes beyond the world of information technologies. Knowledge is not only a component of the modern economy, but becomes a basic organizational principle of the existence of mankind. It is part of a knowledge society because we systematize our social reality based on the knowledge we have (Gruber, 1993, p.107). According to the definition of Alan Newell, one of the pioneers and theorists of artificial intelligence, knowledge represents what can be an attribute of an agent, whether human or artificial, so that his behavior can be defined as rational (Rosenbloom, Allan, 1993, p.236). In the context of ordinary computer programs, knowledge is embedded in the program, many of which are embedded in the mathematical theories underlying the programs, and others are implicit in algorithms or constructions written in the programming language. The knowledge that is used by the system is grouped into a knowledge base and represents the experience gained by the human specialists in solving the problems in the field in question, these knowledge referring to an ontology of the domain, the rules used and the space-constraining constraints search (Klaus, 2016, p. 175).

3. Research methodology

Ontology is a term that dates back to the seventeenth century, representing a branch of philosophy that analyzes the features of human being or existence (Berners, 2001, p.245). In the field of computer science or rather, in terms of the real domain, the ontology is a term designed for a purpose, namely to allow the modeling of knowledge about a particular domain, real or imaginary (Salim, 2009, p.187).

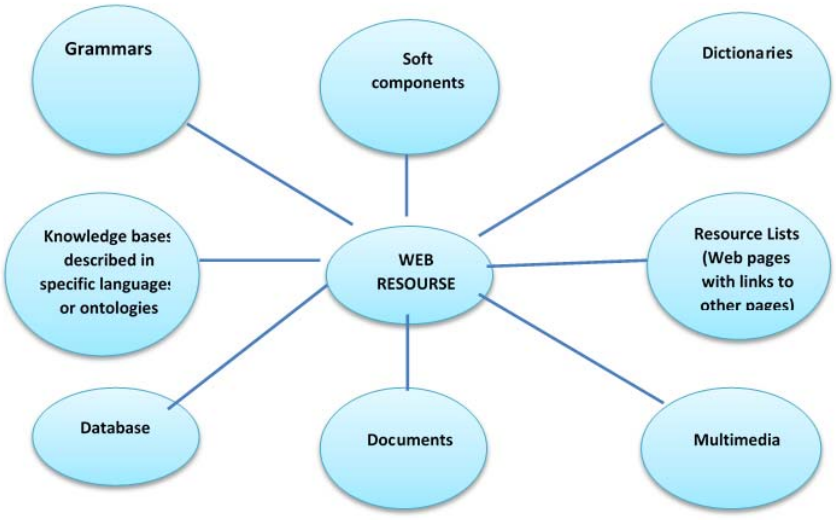
The main objective of an ontology is to represent a reusable conceptualization in which the specific details of the applications are ignored. The scope of an ontology refers to all the applications of the domain, not only to a certain application, and regarding the content of an ontology, here are the specifications of the knowledge in which the meaning of the structures is clearly represented together with the inference rules of the new ones. pieces of knowledge (Natalya, 2001, p.129). Depending on the domain in which they are used, there are two types of ontologies, namely (Avron, 2011, p.234):

- Ontologies for knowledge-based systems
- Ontologies used in human language processing systems.

The web is a huge repository of knowledge, both implicit, for example in texts or computer programs, and explicit in ontologies or knowledge bases.

At present, the Web is not only the most convenient and all-encompassing means of information and documentation, but also the place where human or artificial agents (computer programs seeking information or making electronic transactions) can meet "virtual" with partners. business or other activities. Thus it can be said that the Web is a space that supports the knowledge of human or artificial agents, not only through easy access to the places where it is stored but also through collaboration with other agents. The resources available on the Web (figure no.2) are of several categories as follows:

Figure no. 2 Resources available on the Web



Source: Own elaboration

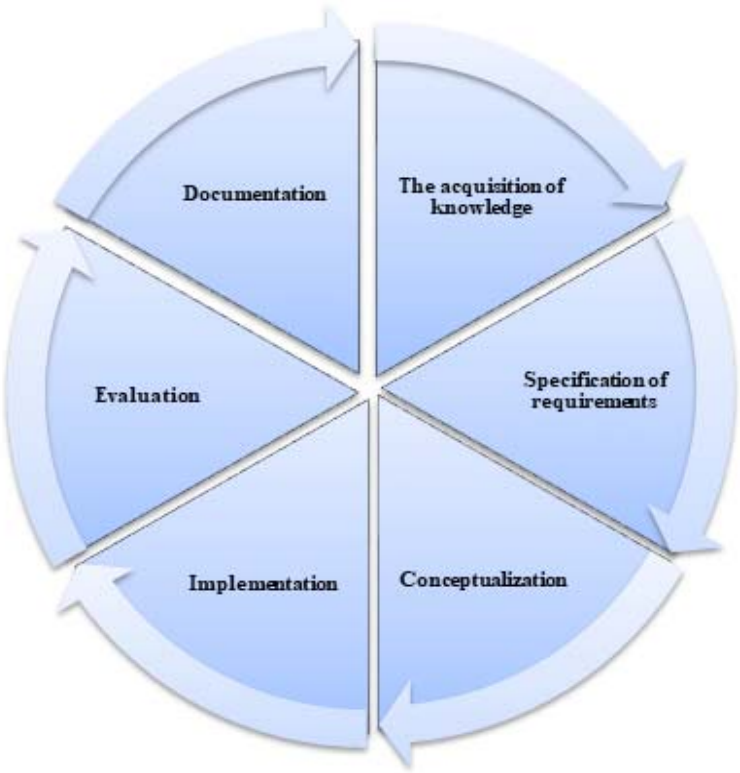
Most resources are characterized by beneficial language for understanding or processing their content. The language can be:

- Naturally, used by man in spoken dialogue or texts;
- Annotation;
- Knowledge representation;
- Programming.

At the moment, XML is established as a universal annotation and communication language on the web, in which all types of resources mentioned above can be coded.

The activity of building an ontology is complex and involves the research of the domain in detail, so the researches on the methodologies of building the ontologies are representative in this direction (Corcho, 2003, p. 65). In the works of A. Gomez-Perez (1998) the phases of building an ontology are presented, as follows.

Figure no. 3 Phases of building an ontology



Source: Own elaboration

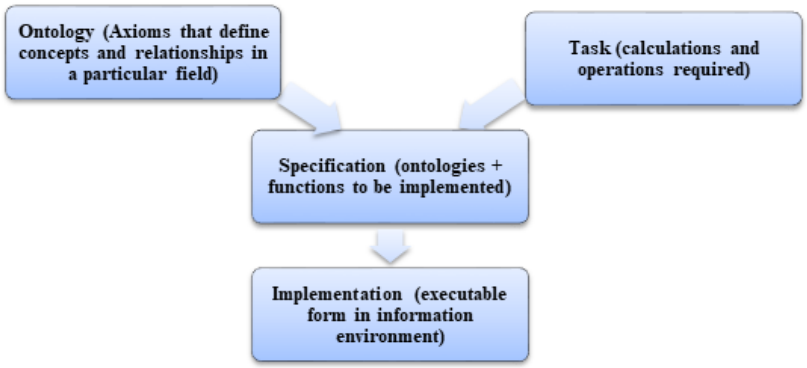
Ontological engineering, also called ontological construction, is a sub-domain of knowledge engineering that deals with the study of the methods and methodology for the construction of ontologies (Kaplan, 2018, p.325). In the field of enterprise architecture, an ontology is a sketch or schema used to structure objects, attributes and relationships in a constant manner. It can be said that the reuse of an ontology is, however, far from automation and requires a major effort from the systems developer. The process of applying an ontology requires transforming the specification from the knowledge level into an adaptable implementation. This operation is time consuming and requires consideration of:

- The context, the intention of the use and the representational language, respectively of the implementation language
- The specific task of the current IT application.

In general, the process of implementing ontologies is "open-source" and based on community involvement, but there are also ontologies developed by a small group of researchers for certain purposes. Moreover, current trends for developing ontologies are characterized by a high level of automation. Thus, we can talk about automatic or semi-automatic construction methodologies. These methodologies are based on: "data mining", "text mining" or collaboration between users (Smith, 1997, p.68).

The implementation takes place according to the diagram in the following figure no. 4:

Figure no. 4 Implementation scheme



Source: Own elaboration

4. Steps of ontological representation

The main steps that we must follow in the process of constructing the ontology are presented below and can be grouped into the following categories:

STEP 1: Constructing the ontology

A. Defining and understanding the ontology environment This section requires a top-down approach, from general to particular.

1. UNDERSTANDING THE DOMAIN - the area of interest for the development of the specific ontology.

2. UNDERSTANDING THE SECTOR - part of the area modeled by the ontology.

3. DATA UNDERSTANDING - the data available, the business logic and the way in which data can be processed in a semi-automatic approach.

B. Classification of data

4. CLASSIFICATION OF DOCUMENTS BASED ON TASKS - based on data available identifies the tasks and attempts to establish links between data and tasks. This can be achieved by applying a document classification algorithm.

C. Applying semantic similarity to the existing ontology

5. Enriching the ontology by adding additional semantic relationships based on a semantic matching algorithm presented in the next section.

Therefore, steps B and C represent the process of extracting information, this extraction of information will be implemented by using a method of measuring semantic similarity. This method is a combination of the following:

• edge counting - the use of a function that measures the path length between concepts within a semantic network

• Measurement of informational content - this refers to measuring the difference in informational content between two terms depending on their probability of occurrence.

This class of methods guarantees that the volume of the informational content of each term is less significant than the informational content of the summing terms.

STEP2: Refining Ontology

6. Refining is performed under the supervision of an expert in the field of ontology

7. Intelligent agents also overdee the entire process and record previous experiences in a knowledge base.

The first phases must be monitored by human experts in order to obtain a better quality of the ontology. Moreover, these phases require a high level of human intervention. Phases 4, 5 and 6 can be implemented automatically, at the same time must be supervised by experts.

5. Conclusions

Following the analyzed and presented, I support the idea that ontology structures knowledge and captures the meaning of the concepts specific to a particular domain, a fact demonstrated in the ontology we created. Therefore, any artificial intelligence program or general object-oriented program must include a reality design, an ontology.

With the rise of the volume of information available on the Web, it has been proposed to extend from the classical to the semantic Web because the classical Web is defined as a set of resources designed and processed only by human users compared to the semantic one, which allows the exploitation. by both human beings and cars. Due to the semantic representation of the content of information, through the semantic Web you can add features to the existing information for service automation, discovery, connection and deduction of knowledge. Therefore, the Semantic Web uses knowledge engineering to transpose knowledge representation tools and specifically focuses on ontology.

In other ideas, it is worth noting that the ontology is considered to be a body of knowledge, considering also rules of inference and logistics that refer to certain fields of activity. Moreover, ontologies must be conceived as a reusable model to form a common basis across the domain.

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