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A Critical Appraisal Multiaspect Investigation on the Concept of Ontological Cognitive Maps

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Abstract

Retrieving information depends on the extent of its organization, and we need information in all aspects. Hence the need to find structured tools that help us access the information we need. With the development of the World Wide Web and the development of Web 2.0 and its applications, new concepts, terms, and tools. This study has reviewed the concept of cognitive maps (ontology) in terms of its use and significance, objectives and advantages mentioned types of ontology, languages, and the statement of the structure of knowledge maps, then select and build knowledge maps axes. Accordingly, the most prominent of the findings of the study is that most of the search engines and different web environments depend on ontologies as systems of terms, definitions, and relationships between them that are used to explain a particular field and the more general the term, the greater number of fields that can be applied to these ontologies, which provide a map of the semantic relationships between them, which also acts as a common language between the environments and engines. The current study has concluded a set of recommendations, notably using ontology in organizing web pages because of its effectiveness in finding semantic relationships between terms and concepts.

Disciplinary: Computer Science, Data Science, Information Technology, Information System.

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1 Introduction

Operational the issue of organizing knowledge on the website, the specialists in the fields of computers, information, and communication networks tried to address them by creating tools that help the users to attempt and retrieve the information and knowledge which are available to the

most convenient ways in the shortest time, and at the same time at applicable in the web environment, which made it possible for users to access a hundred of objective evidence, or using search engines in various types, such as catalogs, bibliographies, indexes, and also using other tools that provided on the overall recovery of the sources, as well as retrieving the content of these sources. Website organization specialists have relied on the knowledge and specialized tools, thesauruses, and plans metadata, which were originally for use in a web environment, or other traditional tools developed by librarians or others for use in the traditional field of information after the introduction of modifications of web environment.

With the development of the World Wide Web and the development of Web 2.0 and its application environment, the concepts and terminology, and new tools in line with these changes were showed to a specialist the terms of Ontology, Taxonomy, and Folksonomy including free classification, social labeling intellectual production, and social tagging, which allows network users in a web environment appeared 2.0 and its applications do the classification or indexing free from their point of view without relying on taxonomic systems, schemes, or the lists of topics prepared by librarians or others.

The number of applications being developed that require access to knowledge about the real world has been increasing rapidly over the past two decades. Domain ontologies, which formalize the terms being used in a discipline, have become essential for research in many areas such as machine learning, the internet of things, robotics, and natural language processing because they enable separate systems to exchange information. The quality of these domain ontologies, however, must be ensured for meaningful communication. Assessing the quality of domain ontologies for their suitability to potential applications remains difficult, even though a variety of frameworks and metrics have been developed for doing so. This article reviews domain ontology assessment efforts to highlight the work that has been carried out and to clarify the important issues that remain (McDaniel & Storey, 2019).

This work talk about the term ontology (cognitive maps), which means identifying ranges of knowledge and definition of the concepts associated with these ranges according to the hierarchical structure of interest to the classification and definition of these concepts and defining the relations between them and determining the association with these concepts and interdependence of words.

2 The Concept of Knowledge Maps (Ontology)

The Semantic Web concept of trying to specialists through web conversion than just a store of information to a massive global database where the concepts have been understood by the machine know, one can understand all the interrelationships between concepts, analyzing and indexing of knowledge varieties; to become the machine greater part in the implementation of the search process (Mustafa, 2009).

According to Hamid (2007), the knowledge-based mapping provides these meanings in a bodysuit that left untouched the terms and concepts in the form of structural blocks (Structure blocks for Web semantic). It is also the link between the various factions based on the meanings

that can be reflected by the term, or based on terms that lead to the same meaning as contexts contained therein.

Ontology, a word came from the Greek language, means studying science assets and trying to gain access to assets continuing to prove their existence and their representation in reality (Ontology Language, 2013).

With the advent of the Internet and the Semantic Web, and as a result of the explosion of information, cognition takes this branch of the science to great importance in the exchange of information and data featured. It is important in the definition of concepts and represents a unified format contributing to increase the ability of information systems to organize and exchange knowledge, and ease of handling and dissemination.

The ontology means to determine ranges of knowledge and definition of the concepts associated with these ranges according to the hierarchical structure of interest to the classification and definition of these concepts and defining relations between them and determining association with these concepts and interdependence of words.

Knowledge maps have been defined (Ontology) several definitions. What came in Wikipedia that this phrase comes to meaning and significance in philosophy is "being". Ontology and metaphysics are beyond the metaphysics of nature, they are a study of the existence of the science which is close to the study of fact or assets relationship (Wikipedia ontology, 2013).

According to Encyclopedia Alshami (2013), the term ontology comes with several meanings depending on science, in philosophy: the study of the nature of existence, in computer science: the study of the concepts and relationships, in the information system: It is in the concept of a family tree classification.

Alhadim (2009) explained that ontology in computer science and information science is the official representation of a set of concepts within a particular field as well as the relationships between these concepts.

We can define ontology as a way or method to classify the concepts been structural, entrepreneur explains meanings and relationships equipped with the necessary data that makes them more visible and therefore easy to understand and study.

We focus the ontology mainly on the classification of concepts and meanings and not classifying words, but it is focused on the multiplicity of meanings of words where it can be every word more than any meaning, and it can be associated with more than one meaning.

This means that knowledge maps are based on the order of the concepts and the relationship between them in a clear framework and a hierarchy from the most general to the least general to assist the beneficiary of understanding these concepts and knowledge of the relationships.

3 Uses Knowledge Maps (Ontology)

Ontology is used in several areas such as artificial intelligence, the Semantic Web, systems engineering, library science, and information construction as a form of knowledge representation about the world or part of it (ST, 2010).

And it may be as simple as a thesaurus definition or maybe a division or rated hierarchically more complex concepts and categories or as a technology-based solution to the problems on the significance of information sharing (Bataiwil, 2012),

The importance and objectives of knowledge maps (Ontology) are submitted as the following (ST, 2010):

- Identifying the concepts, terminology, and categories in a particular area and the integration of the relationships between them.
- Making the conceptual and semantic ambiguities the minimum in the information environment and technology.
- Enhancing interoperability between operating systems in different fields of knowledge, or creating an intelligent agent who can perform certain acts for the Semantic Web purposes.
- Contributing to the organization, and retrieval of documents. These reflect the use of language vocabulary for communicating, linguistic ontology, which included questions, semantics, and syntax, etc.

4 Knowledge Maps Features (Ontology)

Ontology is characterized into several features (Bataiwil, 2012), including:

1. Posting a common understanding about the information structure between humans and also between computer systems.
2. Allowing the use of knowledge in a particular area according to a common understanding.
3. Putting the specific and explicit assumptions about the knowledge within a particular area.
4. Facilitating knowledge between different languages and exchange regimes.
5. A knowledge base, and integration with a common human concept.

5 Types of Knowledge Maps (Ontology)

There are two types of ontology based on the application (Alhadi, 2009):

The first type is the ontology field schedule; the specific meanings of terms are also applied in this field including this kind of dictionary objective terms.

The second type is the general ontology, which represents the extended knowledge across fields, a model of public things that are generally applicable across a broad range of field ontologies.

An example of ontology is the Unified Medical Language System (UMLS). This system calls itself ontology, and it has many characteristics that distinguish between ontologies and thesauri or differentiate between them.

6 Languages Knowledge Maps (Ontology)

Language knowledge maps (ontology) (Noy & McGuinness, 2001):

1. Inference ontological OIL Language (Ontology Interface Language)

It aims to provide semantic environmental operating between the available sources on the Web which has been developed by the European Union through the project (knowledge).

2- DAML language (Agent Markup Language DARPA)

It aims to develop the language of coding, gaining computers the ability to interpret the meanings and connotations of information sources on the Web. It has been developed by Semantic

Web innovative. It was offered in 2000 through a project by Defense Advanced Research Projects Agency.

3- Web ontology language OWL (Web Ontology Language):

It aims to provide the possibility of knowledge representation of how the user deems appropriate in accordance with the restrictions and controls at every level. It is the Semantic Web languages that are designed to offer tremendous knowledge about objects and relations between them. The use of computers is based on calculation and logic. It is part of Web technology, which includes a stack (RDF, SPARQL, and RDFS), and others.

Ontology information, such as information of properties, classes, and their superclasses, is typically encoded in an ontology graph and often accompanied together with knowledge graphs (Jiang et al., 2019).

7 The structure of Knowledge Maps (Ontology)

Ontology structure consists of the following elements (Holsapple & Joshi, 2004):

(A) Entities: It is the basis of the ontology structure that has been referred to as the term of vocabulary (Individuals).

(B) Ideas: defines the categories (Classes), a second component in the structure of knowledge maps or ontology. It refers to the basic classification in the area which contains a category on a group of entities (entity or vocabulary collected by prescription) or shared qualities that make them belong to the category group. It includes sub-categories to form a master class of the sequential hierarchy.

(C) Characteristics: The so-called features (Attributes), which are classified both categories and vocabulary according to the set for themselves, distinctive from other common characteristics, and determining the type and nature of the relationship between the individual and class category.

(D) Relations: The relationship between characterization and titles, contributes to the empowerment of computers to achieve the integration of knowledge between the different entities.

8 Build Knowledge Maps Axes (Ontology)

The steps of building the ontology are (Humaidan, 2014).

1. Purpose, scope and, collection: a statement of the reason for building the knowledge maps, objectives and specialization, and its borders.

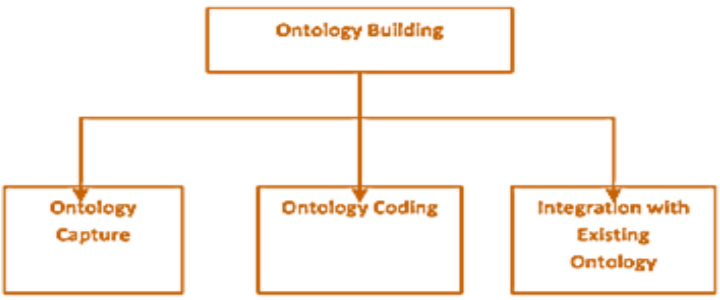

Figure 2: The stages of building ontology.

2. Coding and integration with existing ontology: It is intended to represent concepts that have already been captured clearly and in the official language and abide by the basic terminology used to determine ontology through an analog medium and language coding.

3. Evaluation, and Documentation: This includes a technical judgment on the ontology and programs as well as documentation of the terms of reference.

9 General Ideas to Build Knowledge Maps (Ontology)

There are several ideas and general rules for building ontology, named identify concepts (Concepts in layers) (Noy & McGuinness, 2001) - Classifying appropriately into account of the principle of inheritance among the great group of first-class and sub-categories, Determining the relations between the groups, Identifying traits, Identifying the real elements in the field, and Determining axioms and jobs.

10 Steps to Build Knowledge Maps (Ontology)

Humaidan (2014) summarized the application of systematic knowledge maps in the following point:

First, select the domain, scope, and purpose of the construction of knowledge maps (Ontology):

This section is considered the most difficult in the construction of knowledge maps, which is built to answer the following questions:

1. What is the proposed concept to build knowledge maps?
2. What are the uses planned to take advantage of this ontology (knowledge maps)?
3. Is it necessary to build a sub-knowledge map to make these maps more clear?
4. Who benefits or used for knowledge maps?

The answer to these questions starts to build a solid with a high return on cognitive maps are given (Bermejo, 2007).

Second, identify the sources of information (documents, experts, knowledge maps, etc.) It can be relied on as an expert in your field (Multi build knowledge maps). They were not an expert; you can get more knowledge that can come through:

1. Experts in the field: and you should check that you have applied everything we want to know with trying to make the most of their experience to achieve your goal in building an effective anthology.

2. Sources: literature, documents, references, and technical information specialist in the field.

Third: the design and construction of knowledge maps (Ontology):

Construction of ontology includes several steps as shown in Figure 3.

Census important concepts and terminology:

This step is called the practitioners' narrative terms or glossary "prepare a list of any graphic or tables of names and deeds related revenue", it is important for each name is synonymous with the term described in the natural and determine its type and source and the comments thereon if any. To determine the nature of the name in the list as a concept or trait or condition. The concept is usually the name of the self-contained and features such as names appear. As for the acts they refer to the relations between terms (concepts).

It is not considered a product of the move, but final terms or relationships require to be added to the list may appear. They are frequent steps and pave the way for the practitioner such classification (Bermejo, 2007).

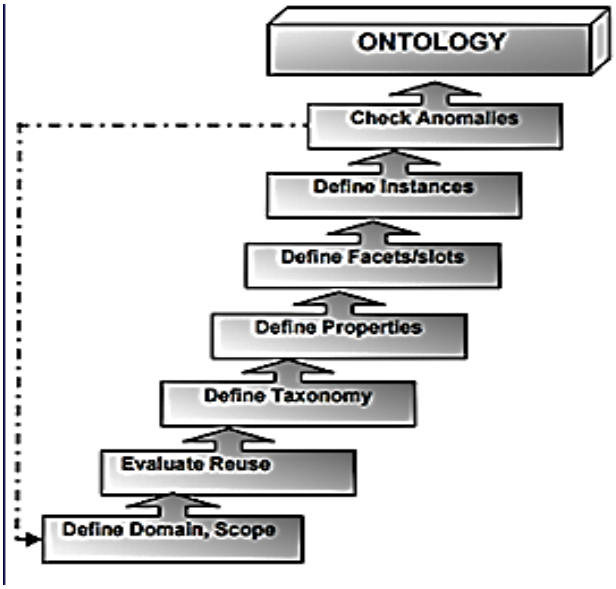

Figure 3: The steps of building an ontology

Classification concepts:

The rating is based on the concepts in the layers of hierarchy with the observation that not all of the concepts will be part of the pyramid, but the concepts are in the list may appear relevant to the main concepts (subclasses) for other superclasses.

The traditional form is customary in descending hierarchical classification of the public to the private to the most privacy or upward from the private to the public to the more general it is possible to combine the two styles. (Prieto-Diaz, 2003).

Determining the relations:

Linking concept relations and the liberalization of these relations in graphs and then the description of each graph to clarify the detailed relations of the concepts contained and the statement of the source and type of relationship, and to clarify the inverse relationships between concepts (Bermejo, 2007).

Identifying features:

At this stage, it is to identify features that are about to describe the terms contained. It attributes to describe the concepts of the categories, which are not transmitted any non-inherited boil subcategory and the synonyms that differ from a synonym for the last attributes.

Identifying examples:

This step requires finding individual examples of the categories in the hierarchy and to identify an individual example of a class requires (a) choose a category, and (b) create an example of individuals of that class, and (c) fill in the values and attributes gap (Bermejo, 2007).

Determine the axioms and rules and functions:

As previously stated that if he was not interested in building up to the stage to represent ontology axioms and rules and the functions of the above is the classification (taxonomy), it is

possible to perform this step before the previous step to find examples of something that is up to the meaning of building ontology (Bermejo, 2007).

In recent years, researchers have proposed a large number of ontology alignment strategies and develop various semi-automated or automated ontology matching systems. However, the existing ontology matching schemes have many drawbacks: the matcher's poor ontology similarity calculation, inefficient extraction of ontology mapping results, etc. (Xue et al, 2021).

11 Discussion

It can be said that ontology, from the perspective of knowledge and information science, is a system for classifying human knowledge according to its objective characteristics and hierarchical relationships through the construction of groupings or clusters bearing common characteristics.

Ontology mainly depends on the classification of concepts and meanings and not classified words, it focuses on the multiplicity of meanings of words where each word can be more than any meaning that can be associated with more than one meaning.

In the digital environment, it is a mechanism for organizing the vast amount of information by achieving complete interdependence between the sub-thematic concepts and their main assets.

Most of the search engines and different web environments depend on ontologies as systems of terms, definitions, and relationships between them that are used to explain a particular field.

The more general the term, the greater the number of fields that can be applied to these ontologies, which provide a map of the semantic relationships between them, which also acts as a common language between the environments and engines.

This study recommends using ontology in organizing web pages because of its effectiveness in finding semantic relationships between terms and concepts, expanding the use of ontology in classifying the pages of all government and private websites on the Internet, using ontology creates learners who are able to invent new things and not repeat what previous generations have achieved, providing training courses for specialists to develop the technical skills needed to use the ontology in classifying web pages, and developing standards, codes, and techniques to help improve the ontology more effectively.

12 Conclusion

The roles of the concept of ontology, its objectives, types, components, languages, and construction steps have been reviewed through a series of studies and scientific research related to the subject. The most prominent of the findings of the study is that most of the search engines and different web environments depend on ontologies as systems of terms, definitions, and relationships between them that are used to explain a particular field and the more general the term, the greater number of fields that can be applied to these ontologies, which provide a map of the semantic relationships between them, which also acts as a common language between the environments and engines. This study also discussed a set of recommendations, notably using ontology in organizing web pages because of its effectiveness in finding semantic relationships between terms and concepts.

13 Availability of Data and Material

Data can be made available by contacting the corresponding authors.

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