A Survey on Ontology Modification Matrix using Three Dimensions to Calculate Cost & Complexity

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Abstract— Ontology is nothing but the simple way of sharing knowledge via a machine-readable format in order to facilitate the reuse of the knowledge. In order to fulfil the new requirement of knowledge sharing in Ontology is expected to be modified in order to be accommodated with addition, deletion or updating knowledge/data. Generally, rather than describing a given ontology as being functional or not we assume the work related with identify and quantitatively measuring the characteristics that reflect the knowledge expression elements. To calculating efforts and complexity within hierarchy of any class and object it can assist in estimating ontology modification efforts and tracking the ontology development process. In Ontologies, there have basic fundamental elements that must be used in order to model simple structure of ontology. These are nothing but classes and relationships of object. A class intimates a set of individuals that able to share the same characteristics. Relationships authenticate describing concepts such as properties relationships. Ontology is expected to be modified in order to be accommodated with addition, deletion, or updating knowledge/data in order to complete new requirements.

Key words: Ontology Matrix, Symantec web language, Knowledge Representation, Relationship Richness (RR), Size of Vocabulary

I. Introduction

Ontology is an important materializes control that has huge possibilities to improve information organization, management and understanding. An approach to handle complex system there might have many other options but ontology is the best way to manage it. Using three dimensions to handle or manage the complex system is well known with term of structural complexity management and design structural management.

To find the cost and complexity of existing system ontology modification is necessary. It has a necessary role to play in enabling content-based access, interoperability, communications, and providing qualitatively new levels of services on the next generation of Web transformation in the form of the Semantic Web. Rate at which Relationship Richness (RR) metric in large scale software application, web application and others grows it dumps complex relation within classes and object.

Modification of existing data/information in large application make it more complex so, users are looking for relevant and simple way to find themselves presented with an excessive amount of available data relationship. While finding the final solution of hierarchical data in huge system it should be arranged in well structure pattern. JENA and OWL are the API which are very useful while implementing simple ontology in ontology web language.

In order for this aspect to be realized, easy way of standards for representing and interpreting data must be formulated and imposed. These formal standards are going to include machine understandable ontologies Ontology Web Language (OWL). Semantic Web vision provides the current Web with required infra technologies, Semantic Web is an extension of the current web and number of research papers employed information for current Web to learn ontologies as in existing ontology. Ontology allows the sharing of a structured understanding of knowledge among user and application agents, and allow for the reuse of domain knowledge [1] [2] [5].

In our web based ontology structure we are trying to implement to the relationship richness and size of vocabulary with number of children in the hierarchical data structure. Jena API is useful than other API in java programming interfaces. Assessment of ontology during construction and development allows improving the overall quality of ontology. For example, it authenticates ontology individual or developer to estimate complexity, enhancing quality of product, and reduce future maintenance cost. In ontology, there have some basic fundamental elements that should be used in order to norm the specific ontology structure. They are classes, objects and their relationships. Classes and objects are used to represent idea or terms in a domain. A class have to shares some attributes and relationship richness with its subclasses within ontology. For example class of "Vehicle System" would describe all vehicle categories. A class describes a set of characteristics that allotment the same features. Classes and objects are the most important elements when representing the knowledge that allow specifying the things [1]. Relationships allow describing notion such as properties relationships and characteristics that allow the describing of some internal properties about the concepts [1], [2]. For example, product type, manufacturer, efficiency, etc are properties relationships for the "vehicle" concept. Subclass is special form of the relationships in hierarchy that define the set of classes and allow for more control on a class and their object. In ontology objects and classes are well organized in many classifications. Subclass is very important in ontology because it shows inheritance relationships from the super class to the sub class. It allows more particular classes to be represented than the super class or other class presented in hierarchy. For example, the "CAR (4 wheeler)" class could have a TATA Nano and BMW as subclasses.

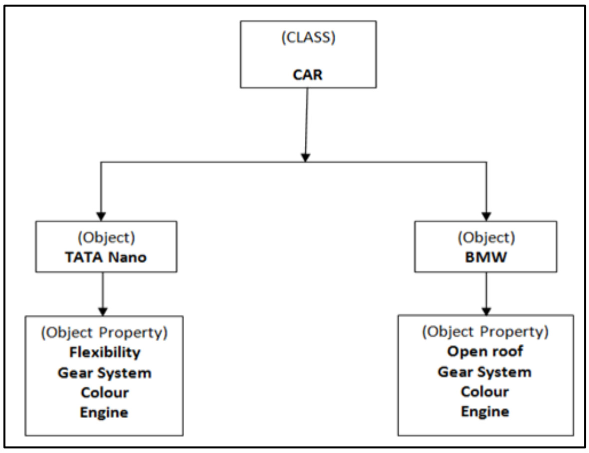

Fig. (A.1): Ontology structure for CAR-Vehicle

As given in above fig (A.1) shows that the class and their relationship with object property. The same way ontology structure have the relationship richness with parent-child relationship. It mentioned with Class, object and their property. Given that the addressing the complexity is a major work, and that's why this work is explorer these major foundation posts as an attempt to relatively indicate the complexity and cost of ontology at any level of relationship richness [6].

A. *Three Dimensions matrix in ontology modification:*

Using three dimensions matrix provides very fast way to decide about the ontology structure. Also it gives better understanding of the overall ontology.

No of research paper have proposed some metrics in regard to understand some characteristics Relationship Richness (RR) metric [Size of Vocabulary (SOV)], Number of Children (NOC) It allows for the automated measurement of ontology. Below is the metric (I) that has been proposed for measuring the (RR), where (P) is the number of properties relationships, and (SC) is the number of inheritance relationships.

RR = IPI/ISCI + IPI ……… (I)

Below metrics consider some ontology characteristics such as size and structural characteristics. They claim that the larger the metric result, the more effort that is required to understand and maintain the ontology. They proposed Size of Vocabulary (SOV) metric, as shown in equation (2) below, is an attempt to quantify how large an ontology is

SOV = INnl + Ipnl………… (II)

Where (Nn) represents classes and individuals, and (Pn) represents user-defined properties. From the above, these research papers have attempted to measure and understand about a given ontology

Based on the three dimensions ontology modification matrix, it can be estimated whether a given ontology is costly to modify or not. As described we have estimated cost of modification of Ontology based on below mentioned parameters:

1) Classes
2) Subclasses Relationships
3) Properties Relationships

Below figure describes the Three Dimensional Matrix approach which we have used:

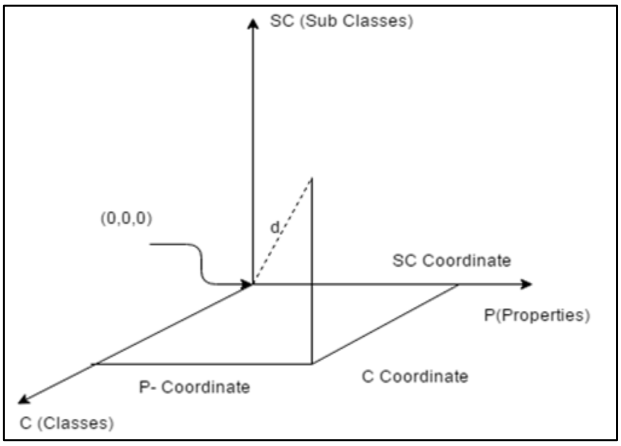

Fig. (A.2): three Dimensional matrixes in Ontology

Now suppose if as given in below figure we have created ontology where no. of classes, subclasses relationship and properties relationship are 14, 13 and 2 respectively.

Let's, we are going to calculate modification cost of the given ontology. For that we need to calculate distance (d) between given ontology to origin co-ordinates (0, 0, 0).Please see figure (A) for your reference. Formula for calculating the distance (d) is as given below:

$$d = \sqrt{(x2 - x1)^2 + (y2 - y1)^2 + (z2 - z1)^2}$$

Where, x1, y1, z1 = coordinates for classes, subclasses relationships and properties relationship respectively.

x2, y2, z2 = Origin coordinates (0, 0, 0)

Now calculate d1 for our ontology described in above figure:

d1=√((0-14)^2+(0-13)^2+(0-2)^2)
d1=√369
d1=19.209

Now consider some complex ontology where we have no of classes, subclasses relationships and properties relationship are (132, 151, 8) respectively and calculate distance d2 with respect to origin coordinates (0, 0, 0).

$$d1 = \sqrt{(0 - 14)^2 + (0 - 13)^2 + (0 - 2)^2}$$
$$d1 = \sqrt{369}$$
$$d1 = 19.209$$

From above two results for d1 and d2 we can conclude that these three factors will illustrate the cost of the modification and level of complexity of specific ontology. Distance d from the origin coordinates defines the associated efforts for the modification of ontology.

Generally, 3 dimensions ontology modification matrix approach is employing three points (A,B,C) elements to understand the effort of modification has been given ontology at schema level as an attempt relatively indicate the complexity of the given ontology structure. It's simple that allows to the end-user who doesn't have any experience in ontology engineering. They are able to better understand and make a decision about ontology. So knowledge transfer and domain transfer is very easy and simple to understand for fresher user. As shown in fig (A) there have three co-ordinates which should be represent in ontology program so that it will be easy to implement. Coordinates are classes, subclasses and properties of it

II. Ontology Representation

Ontology plays increasingly important role in cloud computing, data mining and other platforms. To representing ontology there have major entities. Few of them mentioned below:

1) API-OWL
2) Modularization
3) Knowledge Base(KB)
4) Classification of object(Type classification)

There have some API to easily represent the ontology. OWL (Ontology Web Language) it generally write as a Web Ontology Language. Mainly there have three types of OWL which are OWL-Lite, OWL-DL and OWL-Full. OWL - Lite is the simplest sentence construction of sub-language. It is intentional to be used in situation where only a simple and complex class hierarchy and constraints are needed. It also provide quick migration path for existing ontology system. OWL - DL is nothing but the more expressive version of OWL - Lite which is based on the description logics are the decidable couples of first order logic. There have most of possibilities to automatically calculate the classification in ontology hierarchy. OWL - Full is most effective language compare to other two languages. Mostly it used when verifying the high expressiveness is more important than being to guarantee the decidability of the language. In our work we build some uses of Ontology web language.

Generally, ontology is nothing but the meaning of relationship in hierarchy and concept of domain knowledge transfer. There have some interactive process to represent hierarchy which is modularization. The interactive process of modularization where the user has the possibility to extend the current module by choosing the option in the new starting point of the traversal algorithm within the boundary classes of the module. Most of the papers concerning modularization technique don’t give any indication about the performance of the employed method. Performance is the most important element to be considered when using a modularization technique for the purpose of any web or other application.

Ontology is the coherent entity and any one of the change in one component may lead to incompatibility on ontology. Classification and the semantic components that propagate its impact on system components. This process is nearly correlated to the change of the knowledge domain [8]. An approach that evaluates spreading the ripple effects to the ontology changes based on the affected nodes labeling. Some of examples are:

Example 1: Consider ontology O1 on the auto mechanics defied as follows:

C = {truck, vehicle (4 wheeler), engine, box, door, wheels, cylinder, petrol, radiator, water, diesel}

R = {is_composed, is_formed, carry_away, turns, consumes, cools}

A = {cost}

T = {strings}

Shc= {Hc(truck, vehicle), Hc(diesel, petrol)}

Scr = { cr(vehicle, is_composed, box), cr(vehicle, is_composed, doors), cr(vehicle, is_composed, box), cr(vehicle, is_composed, engine), cr(vehicle, is_composed, wheels), cr(engine, isjormed, cylinder), cr(engine, is_formed, radiator), cr(box, carry_away, engine), cr(engine, consumes, petrol), cr(engine, consumes, water), cr(water, cools, radiator), cr(engine, turns, wheels)}

ScA= {cr(diesel, costs, |105 rupees|)}

A. Definition 1. Ontological Graphical representation:

An ontological graph is a pair G = (E, T) where E is a set of entities that can be concepts, relationships, attributes or types, and T an application from E to P(E), where P(E) contains all the set included in E.

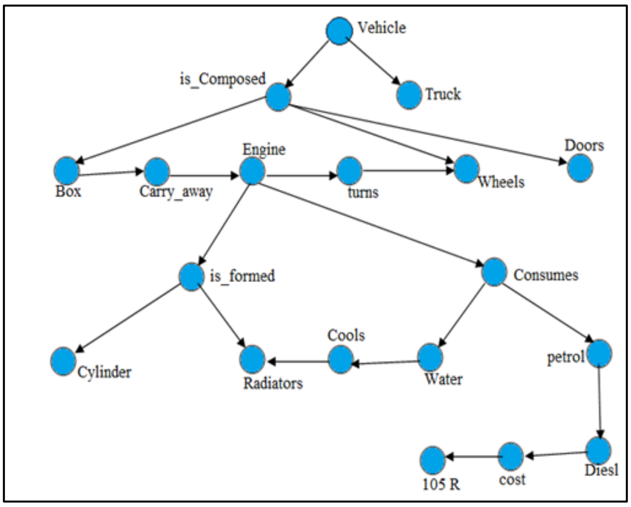

Fig. (A.3): Ontological graph representation

B. Definition 2. Free Subset:

let’s, consider K as (KB) knowledge base. We have defined K as the set contains the formula in K that was not involved in any incompatibility.

C. Definition 3. Ontology classified Community:

As per the given ontology O1, we consider that each relationship richness regardless in the nature (associative relationships cr or attribute relationships cr.) Such a way it defines community.

Basic algorithms in Ontology to differentiate ontological classification

Ontology and their classes with property.

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Algorithm 1: Identifying class and object
Input: G = (E, r) a ontological graph
Output: C a set of class
1) C= Θ
2) For each x in E
3) if x in {Hc, cr, ca} then
4) C= C Ụ{x};
5) end if
6) end for
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Type Classification Approach is also one of the important part in ontology. The concept of type classification approach focuses on concept of prioritization and determines the concept similarities obtained in ontology hierarchy structure. At the end it verify the concepts that can be considered for matching. The concept type classification approach is based on the principles which mentioned here. Some are based on the characteristics of concepts present in the ontology. Determination of intersection importance, based on the concept type classification mode. Novel concept importance considering the individual concept importance of concepts, inter section is the apart from inter ontology concept importance. The concept importance score is being calculated by considering the total number of attributes that considered for matching rather than considering the maximum number attributes appeared in the super concepts. In same way 'similarity matchers' which gives the best results has to be considered. The following section explains about the proposed work for identifying the important concepts of ontology classification.[7]

III. Related Work and Praposed Plan

The proposed work is employing classes, subclasses relationships, and properties relationships. It shows a quantitative perspective. It presents three dimensions ontology modification matrix, which facilitates understanding about ontology. Estimate the effort of modifying a given ontology through these elements. This work is taking into consideration and employing these characteristics in order to scale the effort of modifying a given ontology. Modules in the system are mentioned below:

- GUI
- Create Ontology Repository (Database)
- Create Ontology relationship
- Calculate estimated efforts for ontology modification based on three dimensions ontology modification matrix

1) GUI

Login from which provide the initial stage of getting started to compute ontology complexity and cost. Ontology repository from is nothing but the database for ontology to specific records. Third part in GUI is Display Ontology Relationship Form which shows the exact relationship richness in hierarchical structure. Computing all efforts in any application would be mention in Ontology Modifications Efforts Display Form. And final and important factor in GUI of ontology module system is Update Ontology efforts Form.

2) Create Ontology Repository (Database)

In this module, we are going to create database using one of the database server like MS Access, MySQL, and Oracle for Ontology. This database contains Ontology relationship, keywords, and frequencies for each keyword.

3) Create Ontology Relationship

In this module, we are going to create system which will accept input from user to create ontology relationship. We are going to use Jena API’s OR OWL for creating ontology relationship

IV. Conclusions

The proposed work is employing classes, subclasses relationships, and properties relationships which have been designed using Jena API’s and OWL (Ontology Web Language). Creating ontology structure to easily understand the concept of ontology. One metric is not enough to identify the cost of modifying ontology. Based on the three dimensions ontology modification matrix, it can be estimated whether a given ontology is costly to modify or not. This work provides fast way to decide about ontology and gives better understanding of overall ontology.

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