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An Approach for Reengineering Transformation from Relational Database to OWL Ontology

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Abstract

Ontology resources are more important for organizing knowledge. It has become an important task to improve the efficiency of ontology construction. How to generate ontology automatically from database is an emerging task in ontology buliding. In this paper we present a reengineering process that transforms relational databases to ontologies. Our goal is to have a well representation of the domain semantics to create a more complete Ontology...

Keywords: relational databases; software engineering ; ontology;

1. Introduction

Ontology, initially the subject of research in philosophy, is now more widely studied in the field of software and system engineering [1]. Then, Ontology which aims to domain knowledge should have real-world semantics that allow meaning to human connected with the machine processable content, provides explicit meaning for information and data based on consensual terminology not only formal semantics. [2].

Ontologies represent a wide range of domain knowledge and information as one of the key success factors of semantic web. Semantic web provides an explicit meaning to information and data web of the future. One aim is to enable the intelligent search agents to process and interface data from various sources on a conceptual level. However, the current state of development of domain ontology for the Semantic Web is still in its infancy in terms of both quantity and quality. One major issue is the high development costs associated with the acquisition of knowledge ontology construction manuals. Acquire domain knowledge requires a lot of resources and time-consuming [3].

Build an ontology can be manual or semi-automatic which will take time, subjective and prone to error. As might be on a scale that contains billions of Web pages with most of the pages did not even exist until they are created dynamically from a relational database. In addition, the high cost of building an ontology from scratch is another obstacle to semantic explanation. The approach in this paper, an alternative for semantic annotation is the transformation of an automatic or semi-automatic relational database to ontology [4] [5].

Still associated with that, build ontologies can be achieved by two approaches: can start from scratch or can be built with an existing ontology. In both cases, techniques for evaluating the resulting ontology is required. These techniques will not only be useful for ontology engineering process, it can also be useful for end users who need to find the most suitable ontology [6].

2. Research Method

A database is the management and organization of data, while ontology is a different thing with a relational database [7]. A database model defines the logical structure of the database as well as determine where the data in a way can be stored, managed and manipulated [8]. Relational database is a data model based on relational theory [9]. The ontology is the difference to the relational DB schema. `The difference is in ontology there is a set of concepts linked by a set of binary relationships, but in the database there is a set of tables. Instances in ontology are called records in the database. In ontology, only binary relationships exist, but in relational databases, n-ary relations can be found [10].

A relational database is considered to be an implementation of a relational model. This model includes constructs for specifying tables, columns, data types, constraints, and other semantics. However, the relational database does not need to include all constructs of the relational model. An ontology is considered to be an implementation of an ontological model. This model includes constructs for specifying classes, properties, data types, inheritance, restrictions, and other semantics2. However, the ontology does not need to include all constructs of the ontological model [5].

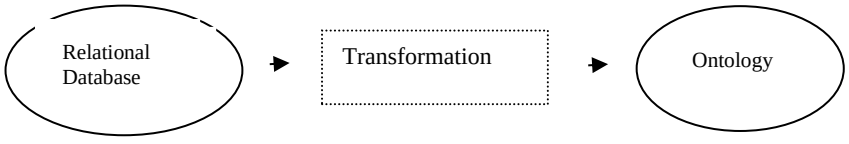

Figure 1. Transformation process

2.1 Rule-based Mapping

Typically, the majority methods for mapping RDB to RDF/OWL are based on the equivalent matching, in which the formal definition are usually neglected. Especially, there are some ambiguity will occur when the multiple mapping rules are utilized simultaneously, proposed a new method for mapping RDB to ontology automatically, this method provides several mapping rules [11] [12].

2.2 Literature Review

Researchers are aware of the significance of building ontology from relational database. Several methodologies have been shown to solve the problem build ontologies from relational databases.

TABLE I. TRANSFORMATION RDB TO ONTOLOGIES

Aproach	***Process***	***Transformation***
Automatic generation of ontology based on data-base [9]	Extracts data from the relational database to develop relational database meta-model Changes over relational database meta-model to ontology meta-model Changes over relational data to Owl ontology	mapping rules
Semantic-Based query in RDB using Third normal form of database is Ontology [13]	Ontology is created from relational database Cient creates Sparql query	SPARQL-SQL conversion
Ontology construction based on RDB [14]	Changing over relational database schema to ontology Expanded by Wordnet to uproot the redundancies and equivalent words	RDB schema to Onlogy expanded by Wordnet
Mapping relational data-base into OWL structure [15]	Rdb is extracted with the help of an algorithm,develop a canonical data model (CDM) , CDMto map the CDM constructs to Owl classes	CDM constructs to Owl classes
Reverse Engineering of Relational Databases to Ontologies [16]	Extraction of structure model schema from Html. Mapping administers are made. Essential concepts of classes are secured in these standards. Data relocation; production of ontological instances,	From HTML, extraction of form mod`el
Learning Highly Structured Semantic Repositories from Relational Database [17]	The methodology helps the client to get a populated ontology	classical schema analysis with hierarchy mining

Aproach	***Process***	***Transformation***
Semantic – Based Querying Using Ontology in Relational Database of Library Management System [13]	In first stage ontology is produced from relational database. For transformation two standards are established. In second stage, client produces SPARQL query, which is changed over to SQL inquiry by applying the tenets given by the creators	Semantic query in RDB

3. Findings

In this section we present our approach of relational databases reverse engineering to ontologies. The architecture of our reverse engineering process shown in figure 2 is divided in three steps: transformation process, enrichment process and data migration.

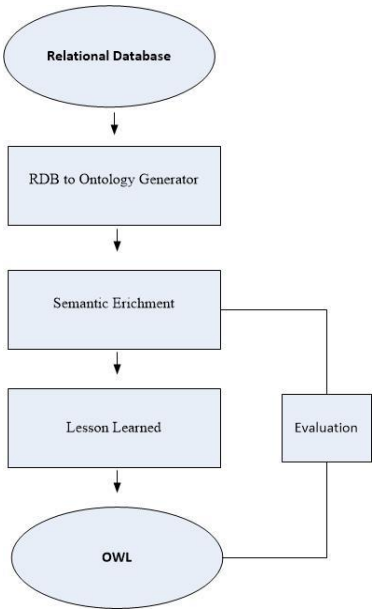

Figure 2. The Proposed Approach

3.2 Research Implementation

The transformation of the database into the ontology provides an alternative solution existing today for the process of developing into a semantic technology. Ontology student payment in this study built for the conversion of a relational database using RDBToOnto Converter and evaluated with OntoQA method.

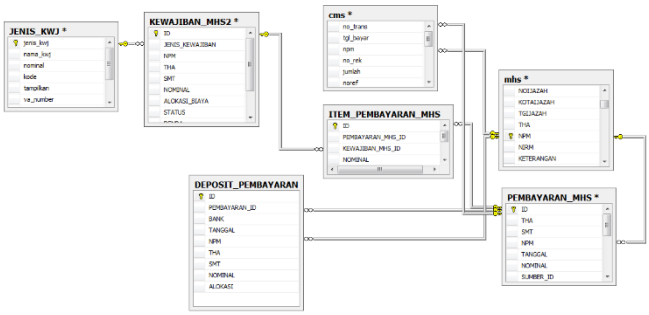

Figure 3. Case Study From Relational Database

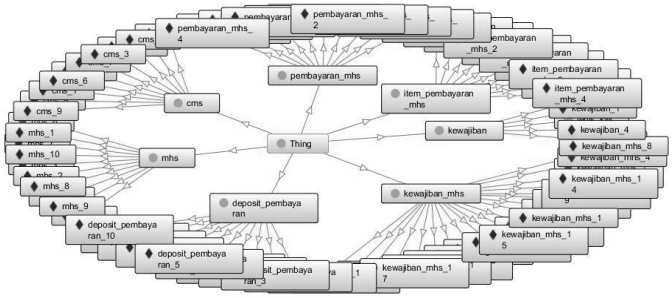

Figure 4. Ontology Visualitation

4. Conclusion

In this paper we have proposed a reengineering process that aims to transform a relational database. We attempt to add additional semantics behind applying the enrichment process. However, there is great disparity in quality between the ontology generated by this system and manual domain ontology.

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