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Decomposing and Rewriting Semantic Product Data Model Based on the Expressive Language ALCNHR*K(D) and Description Logic

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Abstract: To represent the fully developed semantic product knowledge model, ALCNHR+K(D)expressive language has been acquainted. The expressive language is not only a simple language for represent knowledge about constraints and real domain but it is a rich with rules and reasoning, which help in hypothesis model in closed world of semantic. The decomposing and rewriting semantic product data model based on the expressive language has been investigated. In this paper decomposes the complete knowledge base automatically has been presented with constraints solver and description logic. In this paper, researchers point of view there are two different decidedly aspects. First, the capability of dominant representation of complex description logics has lack successful reasoning ability. Second aspect is how effectively and efficiently reason with various reasoner..

Keywords: Product knowledge base, Description Logic, Expressive Language, Reasoner, Constraint Solver, Ontology

1. INTRODUCTION

The lifecycle knowledge of product data model is extensively disseminated and stored in a variety of structures. Computer Aided Design (CAD), Standard for the Exchange of Product model data(STEP), Standard for the Exchange of Product data-compliant Numerical (STEP-NC) and rule base for process and planning are the best example for represent product data model. for assembles and manufactures various types of products. Searching from beginning to end enormous quantity of commercial inheritance data and catalogs for existing solutions is an irritating experience which can be customized to solve innovative problems, in view of the fact that there is no any efficient approach for reasoning and representing the lifecycle knowledge of product . Contemporary repositories of product data revolve to utilize HTML, XML, RDF, OWL semantic web (PATHAN, 2013) and ontology technology are best tools for product knowledge representation. From the perspective of Semantic web in the conceptual level the product knowledge (Peng, 2009) is represented as a product ontology's. Construction, evolution and integration of product ontology is significantly depend on the accessibility of a influential reasoning tools and well-defined semantics.

Description logics are languages from the family of knowledge representation languages (Li, 2006). The Description logics can be used in an application field to represent product knowledge (Mei Zhongyi, 2008)in a properly, well understood and controlled way. The description logic is operational with recognized and logic based semantics.

The Idea of role such as binary relation and concepts such as unary predicate are used by description logics to prepare the product knowledge domain application. Various constructor are defined with a complex concept definitions, unambiguous semantic, axioms and uniform syntax can be build from straightforward apparatus. Consequently, description logics are principally engaging both to reason with description logic and to represent ontological knowledge.

Unfortunately the natural complication with the product knowledge, the significant power is required to model multipart real-world product ontologies. The realistic product ontology is required to represent constraints roles and concrete domain. Furthermore to represent abstract concept in the application realistic product ontology is also required. However in some prospect procedural rules are required to be measured such as expert system. From many years some researchers are committed for the improvements of more influential representation system in the family of Description logic. Although the variety of their representations is based on expressive successor SHIQ and ALC. Most of representations are based on algorithm in various ways and extended innovative scene. Generally it has been proved that with concrete domains, reasoning with reference to extensions of ALC is very difficult. Therefore, that problem could be alleviated if appropriate constraints were introduced in the technique of joining concept constructors. The systems with identical deduction algorithms are called homogenous systems for reasoning. These systems have

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meet the various complexity of searching the correct trade of between computational complexity and expressiveness. So taking benefit of the flexibility and reputation of description logic in the environment of ontology and semantic web, researchers argue that reliable description logic pattern representation is required. However because of reasoning capability the product ontology decomposition is required. Therefore various reasoning prototypes could be used in cooperation.

In this paper, the decomposing and rewriting semantic product data model based on the expressive language and partition has been proposed in section 2. The product knowledge architecture for reasoning have been discussed in section 3 and finally conclusion has been summarized in last section.

2. MATERIAL AND METHOD

The decomposing and rewriting semantic product knowledge base model in Partitions based on the expressive language ALCNHR$^+$K(D).

"K" operator eliminate product ontology after applying rules. Concept and definitions which are included in knowledge base could be decomposed in Atomic, Abstract and Hybrid concepts. These concepts are mentioned below.

2.1 Atomic Concepts.

Modeling ontology, ground constructs are defined in atomic concepts. In information system, objects which responding to atomic concepts are executed by necessary data structure openly. Semantic level and data level in the knowledge representations hierarchy would be connected by atomic concepts.

Such as in **(Fig. 1)** the concept " Hard Disk 1" is a part of computer configuration which possess an "Storrage_Area" an attribute. "Storage_ area has been inherited from the concept of father and it has an integer value. Therefore "Storage_Area" is a real concept.

2.2 Abstract Concept.

Abstract concept is a thought. Object and particular instances are not associated with abstract concept. Abstract concepts are probably could be useful to numerous objects or situations. Understanding abstract concept often is a problem with those people who have cognitive deficit.
Abstract concepts are defined by the attributes/relationships affirmations with hybrid and abstract concepts. For example "Hard_Dsik"

2.3 Hybrid Concepts

Hybrid concepts are defined by the attributes/relationships affirmations with atomic ,hybrid or abstract concepts Like "Hard_Dsik1".
The undecidable inferential problems which are fetched by hybrid concepts and concrete domain for decomposition into image concept and abstract concept are avoided. The undecidable inferential problems merely includes constraints and concrete concepts for projection which come from main source of hybrid concept.

The association involving abstract concept and image concrete concept would be utilized via name of concrete concept's image. Therefore express language ALCNHR+K(D) product knowledge base which has been represented by ΠP_{KB} has been separated into partitions like $\Pi_{DL.}$ Therefore Description Language oriented set of statements could not surpass significant supremacy of the preferred Π_{CS} and description logic based system. As set of statements which are non description includes real filtered knowledge exposed to from Π_{DL}.

Consequently exclusive constraint reasoning inferential services will be offered by description logic based system as an alternative of reasoning services with restrictions directly. Concept definition's complete information will be erased which is associated with concrete domain. Therefore, merely the appropriate constructors based on description logic will remain left which are acknowledged via the preferred description logic based inferential engines. **(Fig. 1).**

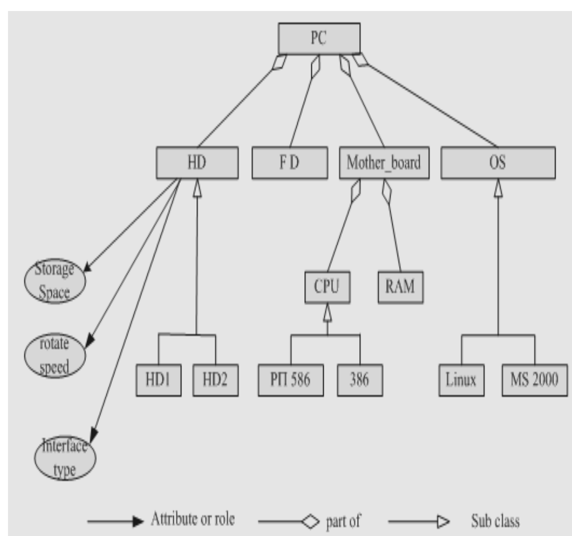

Fig. 1: Product Knowledge Base Model for Personal Computer

For example the required storage space of "Hard_Disk1" would be greater than 200 GB and the required storage space for "MS 2000" have 20 GB than the hybrid concept will be decomposed as given in expression below:

$$Hard\_Disk1 \subseteq Hard\_disk \cap \forall storage\_space.storage\_space_{Hard\_Disk1}$$

$$MS\_2000 \subseteq OS \cap ssr.storage\_space\_requirement_{operation\_system}$$

The Constraint "Storage Space" in the above expression has been changed by "Storage_Space" as an atomic concept. The expression has the similar name which is a attribute name. However atomic concept comes from where has been represented in attribute name's subscript. For the time being, the restrictions on the hybrid concept's constraints has been given below:

$$storage\_space_{HD1} \geq 20 \times 2^{30}$$

$$storage\_space\_requirement_{operation\_system} \geq 2 \times 2^{30}$$

At present, constraints and definition of concept has been divided into two parts by normalizing the product knowledge base. First, the entire hybrid concepts are replaced with the wrapper concepts. Than simply modifying hybrid concepts by the attribute or relation with abstract concepts new atomic concepts will be added. Like description logic parts will be replaced "storage_space_Hard_Disk1" Second, the entire image concrete concepts performing as restriction variables. Than these variable will be stored in default domain together with non description parts. Like

$$storage\_space_{HD1}$$
$$type: integer$$
$$domain: \geq 20 \times 2^{30}$$
$$storage\_space\_requirement_{operation\_system}$$
$$type: integer$$
$$domain: \geq 2 \times 2^{30}$$

Data types are acceptable as a range in domain field by default. The statements which are mentioned above will be interpreted into Cooperative inferential engine. The cooperative inferential engines are basically modeling languages.

Consequently, CPL inferential engines and DL inferential engines will be loaded by interpreted statements. On the basis of the results which are taken from CPL inferential engines and DL inferential engines hybrid concept's hierarchal structure will be created by reasoning coordinator. Than through the atomic axioms concept, hybrid concept's hierarchal structure are introduced into Description logic's definition. In this scenario new partial order will be acquired from external restrictions solver after loading non part of atomic axioms concept.

$$storage\_space\_requirement_{operation\_system} \subseteq storage\_space_{HD1}$$

The original part of description logic's knowledge base will be joined back by sending such information has been used by description logic reasoner directly. Finally it has been concluded that from set of feasible restrictions "Linux" could be installed on personal computer as an operating system if type of hard disk in computer is a " Hard Disk1".

3. System architecture for Product data reasoning

The ISO 10303 standard of STEP is a major global standard for the interchange, management and definition of product knowledge base. Many industries at world level are using ISO 10303 such as oil & gas, aerospace, power generation and shipbuilding, etc. Product knowledge base model's fundamental standard are mentioned in ISO 10303-11 EXPRESS modeling language. The ideas of object modeling concepts are achieved from the family of entity-attribute-relationship. Huge amount of industries are used to satisfy the huge amount of composite and complicated constraints. To express sophisticated information of product, dominant expressing constructs are available in the EXPRESS language. The EXPRESS language has been used to put together family of time tested and robust standard application procedures. These robust standard procedures will be put in action by good number of Product Data Model and CAX systems.

A conversion procedure has been which has rewrite product knowledge based with EXPRESS language into description language. Therefore the infrastructure of product knowledge base reasoning has been in arranged in three parts as shown in **(Fig. 2).**

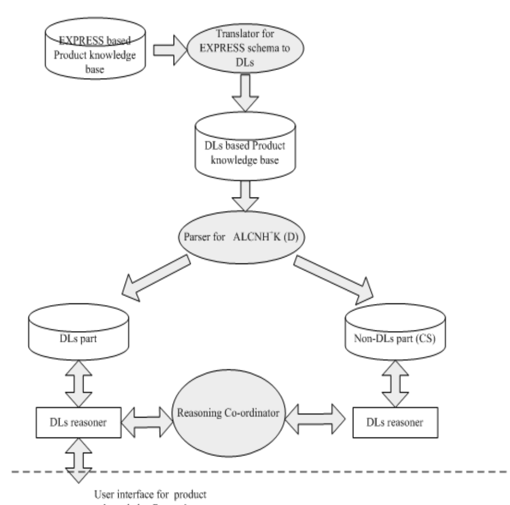

Fig. 2 The Architecture for Product Knowledge Reasoning

3.1 The translator for EXPRESS schema to DLs. In this part the EXPRESS based Product knowledge base has been converted with the translator of EXPRESS schema in to description logic based product knowledge base.

3.2 Parser for ALCNHR^{+}K(D). Parser has divided description logic based product knowledge base into two parts, DL and non-DL parts. Description logics is described with concrete domain to Π_{DL} and non-DL is described with constrains which is represented by Π_{CS} sub knowledge base.

3.3. Reasoning Co-coordinator. Reasoning co-coordinator is the association among Constraint satisfaction reasoner and description logics reasoner. The reasoning co-ordinator has been based in two analysis. First all reasoning problems are processed by description logics reasoner through satisfy ability algorithms based on tableau. These algorithms required repetitive reasoning regarding relationships and concept. Secondly with the help of restriction solver achieve quasi-ordering.

The collective process of reasoning is given as follow:

1. Parse EXPRESS schema as input and convert into expressive description logic based language ALCNHR+K(D).
2. Parse the product knowledge base based on description logic and real image concepts extract from hybrid concepts. Than decompose product knowledge base into standardized components such as DL and non-DL components. Non DL components means constraints value and concrete value.

Confirm the reliability of restrictions and transmit them as complete path of consistency will be maintained by decreasing the set of feasible values related with all restricted variable. With the quasi-ordering update description based representation among the image concepts and corresponding atomic concepts for all variables. Finally Latest product knowledge base classify and update with the descriptions of description logic.

4. CONCLUSIONS

In section 3 architecture on product knowledge for reasoning has been presented. Originally Express Schema has been captured in this architecture as input. Consecutively the expressive Language ALCNHR+K(D) has been initiated to confine the complete semantic of problematical product knowledge model. Therefore the knowledge about restriction and actual domain could be easily represented in the product knowledge model. Furthermore this model has also represent statutes in various good judgment of congested universe semantic model and hypothesis. The undecidable inferential problems which are fetched by the Product Knowledge model's extension has been avoided and reasoning approach based on partition has been proposed. Description Logic reason engine is a central part for solving many reasoning problems like concept subsuming by combining various reasoning systems.

Description logics languages has been proposed in many models to represent product knowledge. The decomposing and rewriting semantic product data model based on the expressive language AlCNHR*K(D) and description logic has taken concrete variable and atomic concept. The concrete variable and atomic concept method for mapping for semantic co-operation directly reduce the rewriting procedure accordingly.

For Semantic Web society theory of description logic is ubiquities ontology modeling language. As description logic could be easily transferred onto the platform of semantic web and straight forwardly translated into OWL language. Within Web resources, product knowledge could be effortlessly embedded by using existing semantic web technology. One characteristic of its competence is that many data resources are voluntarily offered for utilization by a diversity of Semantic Web community. The decomposing and rewriting semantic proposed product knowledge could be elegantly support to Semantic directory services and semantic Web search engines . In future for acclimatize various application areas would be optimized by the hybrid reasoning systems.

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