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Classifying Problem in Inference Engine for Different Version Based Ontology

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Abstract — **an ability of reasoning capability of inference engine is useful to derive new & useful information from existing knowledgebase. Classifying algorithms is use to classifying an ontology which improves quality of search on web. Currently Inference engines are able to classify the small ontology completely. For Large and complex version based ontology size is been increase practically. The main aim of paper is necessary to evaluating the performance of inference engine which focus on classification parameter for large and complex version based ontology for different domain. Result might be useful to select inference engine for practically on version based ontology for different domain.**

***Keywords*— Inference Engine, Classified Time, OWL-DL, Performance.**

INTRODUCTION

The Semantic Web is "an extension of the current web, in which information is given well-define meaning, better enabling computers and people to work in cooperation [1]". Ontologies are critical pieces of the semantic web jigsaw-puzzle, and are already used in various forms to capture knowledge in machine understandable language [11].DL reasoner such as Pellet, FacT++, Hermit is used to infer useful and new knowledge from existing knowledge. There have been many important parameters use in reasoning capabilities in terms of Data size, Classified time, Axioms, Classes, Data property, Object properties, Individual [5, 6]. Classification of an ontology is used to capture subsumption hierarchies for the classes and its properties. Classification is one of the main and important task for OWL DL based reasoners. It is not easy to analysing an inference engine for large version based ontology. The main aim of this paper is to generate some statistics and evaluate that how inference engine satisfy classified time and its classes, properties, individuals, etc. We adopt different version based ontologies such as university LUBM adapted from the original Lehigh benchmark, LUBM [7], WINE, VICODI. Practically ontologies version is been changed, so our aim is to study and generate statistics for most suitable inference engine for such scenario. Three most DL Reasoner is considered based on their reasoning mechanisms.

INFERENCE ENGINES

A. PELLET

Pellet is an open-source Java OWL DL reasoner. It support expressivity of SROIQ(D). It supports SWRL rules. It can be used in conjunction with both Jena and OWL API libraries and also provides a DIG interface. It can be used in conjunction with both Jena and OWL API libraries. Pellet API provides functionalities to see the species validation, check consistency of ontologies, classify the taxonomy, check entailments and answer a subset of RDQL queries. It supports the full expressivity OWL DL including reasoning about nominal's.

B. HERMIT

HermiT is a new OWL reasoner based on a novel "hyper-tableau" calculus [2]. Hermit reasoner employs reasoning on SHIQ (D). It is available free for non-commercial usage. Takes OWL file as input and perform various reasoning tasks like consistency checking, identify subsumption relationships between classes and more. It also computes partial order of classes occurring in OWL. It is different from other reasoner like Pellet and FaCT such a way that it implements hyper-tableau reasoning algorithm that is much less deterministic than existing tableau algorithm.

C. FACT++

FaCT++ [8] an improved version of FaCT [9] employs tableaux algorithms for SHOIQ(D) description logic and implemented in C++ but has very limited user interface and services as compared to other reasoner. It not supports for rules. The strategies followed are absorption, model merging, told cycle elimination, synonym replacement, ordering heuristics and taxonomic classification.

EVALUATE THE PERFORMANCE

D. About version based ontology

Analyzed performance of inference engines in different version based ontologies; our focus is to major classification of ontology and classifying time issue of inference engine. For that considered extensional dataset of the LUBM [9], WINE and VICODI ontologies.

LUBM ontology:

The Lehigh University Benchmark (LUBM) [3] was explicitly designed for OWL benchmarks. We have modelled scenarios based in a major university such as LUBM adapted from the original Lehigh benchmark, LUBM. It is a university database where the number of universities, departments, and students can vary and its own a-box generator and set of benchmark query. It include version of LUBM_0, LUBM_1, LUBM_2, LUBM_3.

WINE ontology:

WINE ontology is benchmark for OWL DL ontology. We use three benchmark query based on a-box [4]. It describes class of wine and restriction between them. The following three A-Box queries. It include version of WINE_0 to WINE_10.

VICODI. **Ontology:**

The main goal of VICODI ontology is to enhance human understanding for digital content over internet. It's give environment which provide search management for digital content [12]. It include version of VICODI_0, VICODI_1, VICODI_2, VICODI_3, VICODI_4.

E. Result: Statistics table based on evaluated result

This test is executed on a Intel(R) core(TM)2 duo cpuT6400@2GHz,with 3 GB RAM ,running on Windows Vista, Java SE 1.6, Protege_4.1.For the performance evaluation on large version based ontology, we placed our focus on classification of an ontology and its time issue. We considered 3 different sets of version based Ontology Benchmark [9].

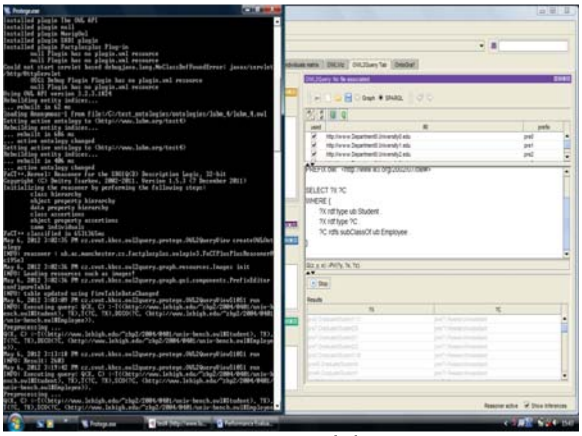

Fig. 1 Protégé GUI

By evaluating the performance of generate output of few parameters for different version based ontologies is given below. We consider Classified Time for different version of ontology of various domains set. Fig. 2 compares the classified time of LUBM ontologies for all inference engines. Fig. 3 compares the classified time of WINE ontologies for all inference engines. Fig. 4 compares the classified time of VICODI ontologies for all inference engines.

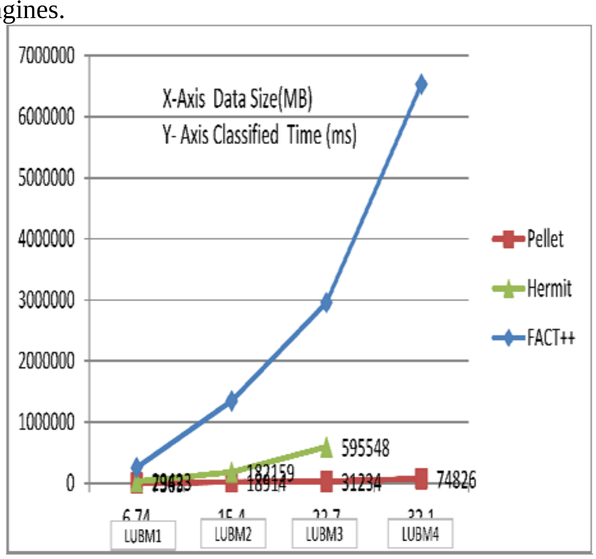

FIGURE – 2 CLASSIFIED TIMES FOR DIFFERENCE VERSION OF LUBM ONTOLOGY FOR VERIETY OF INFERENCE ENGINE

As shown in figure.2 above, observed that, classified time is been almost same for earliest version of dataset for variety of inference engine. But When data size is been increase, pellet reasoner take less time compare to other reasoner.

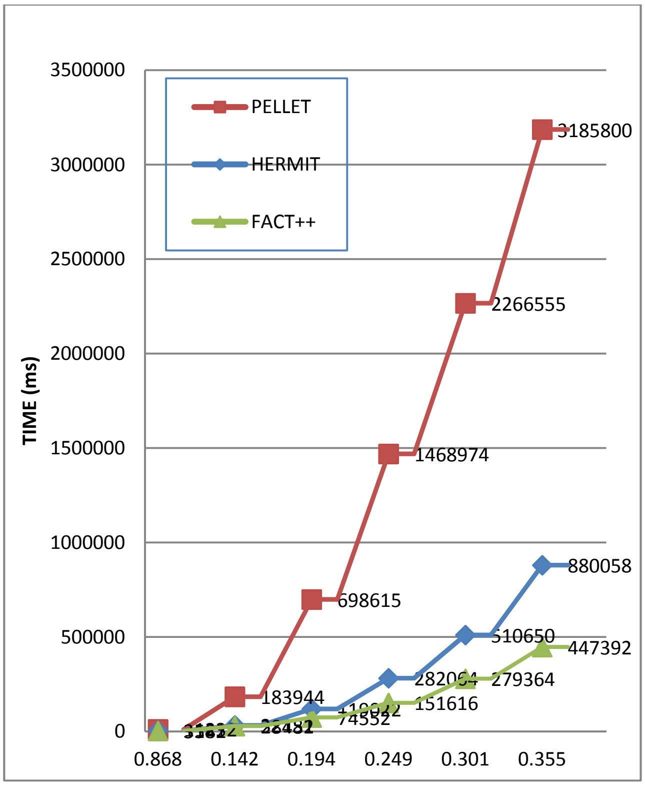

FIGURE –3 CLASSIFIED TIMES FOR DIFFERENCE VERSION OF WINE ONTOLOGY FOR VERIETY OF INFERENCE ENGINE

Fig. 3 compares the results for classification time. As shown in figure 3, observed that, classified time is been almost same for earliest version of dataset for variety of inference engine. But When data size is been increase, Fact++ reasoner take less time compare to other reasoner. None of reasoner is able to load all large set of ontologies.

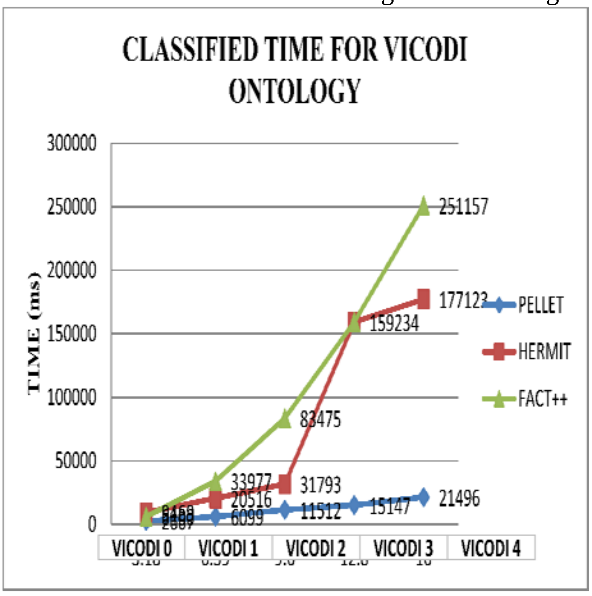

FIG. 4 QUERY RESULT FOR DIFFERENT BENCHMARK QUERY FOR DIFFERENT VERSION OF VICODI ONTOLOGY FOR DIFFERENT INFERENCE ENGINE

Fig. 4 compares the results for classification time. As shown in figure 4 above, observed that, classified time is been almost same for earliest version of dataset for variety of inference engine. But When data size is been increase, pellet reasoner take less time compare to other reasoner.

CONCLUSION

The semantic web is a next generation of web which uses web resources efficiently to improve quality of web search. Classification is an important parameter for infer new knowledge implicitly for DL reasoners. In this paper, inference engine performance is evaluated in which focus on classification parameter of large version based ontology for different domain. For earlier and small version based ontology, inference engine performing well. For large and version based ontology is inconsistence. As per Fig. 2, 4 and Table-1, we conclude that pellet gives better performance compare to other reasoner. In general, no clear win for any inference engine. These results can be useful to choose an inference engine in semantic web application.

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TABLE I
GENERATE OUTPUT FOR FEW PARAMETER IN DIFFERENT VERSION BASED ONTOLOGY FOR DIFFERENT DOMAIN

INFERENCE ENGINE	DIFFERENT VERSION OF ONTOLOGIES	DATA SIZE(MB)	DOMAIN	CLASSIFIED TIME	A/C/OP/DP/I
PELLET	LUBM1	6.74	University	7363ms	100786/43/25/7/17174
	LUBM2	15.4	University	18914ms	230304/43/25/7/38334
	LUBM3	22.7	University	31234ms	337370/43/25/7/55664
	LUBM4	32.1	University	74826ms	478028/43/25/7/78679
HERMIT	LUBM1	6.74	University	29423ms	100786/43/25/7/17174
	LUBM2	15.4	University	182159ms	230304/43/25/7/38334
	LUBM3	22.7	University	595548ms	337370/43/25/7/55664
	LUBM4	32.1	University	OutOfMemoryError	478028/43/25/7/78679
FACT++	LUBM1	6.74	University	256968ms	100786/43/25/7/17174
	LUBM2	15.4	University	1345942mss	230304/43/25/7/38334
	LUBM3	22.7	University	2958020ms	337370/43/25/7/55664
	LUBM4	32.1	University	6531365ms	478028/43/25/7/78679
PELLET	Wine_0	0.868	WINE	11232ms	930/142/13/0/162
	Wine_1	0.142	WINE	183944ms	2037/242/13/0/483
	Wine_2	0.194	WINE	698615ms	3145/141/13/0/805
	Wine_3	0.249	WINE	1468974ms	4253/141/13/0/1127
	Wine_4	0.301	WINE	2266555ms	5361/141/13/0/1449
	Wine_5	0.355	WINE	3185800ms	6469/141/13/0/1771
	Wine_6	0.628	WINE	Undefined Time	12009/141/13/0/3381
	Wine_7	1.14	WINE	Undefined Time	23089/141/13/0/6601
	Wine_8	2.2	WINE	Undefined Time	45249/141/13/0/13041
	Wine_9	4.35	WINE	Undefined Time	89569/141/13/0/25921
	Wine_10	8.67	WINE	Undefined Time	178209/141/13/0/51861

INFERENCE ENGINE	DIFFERENT VERSION OF ONTOLOGIES	DATA SIZE(MB)	DOMAIN	CLASSIFIED TIME	A/C/OP/DP/I
HERMIT	Wine_0	0.868	WINE	3541ms	930/142/13/0/162
	Wine_1	0.142	WINE	32151ms	2037/242/13/0/483
	Wine_2	0.194	WINE	119022ms	3145/141/13/0/805
	Wine_3	0.249	WINE	282064ms	4253/141/13/0/1127
	Wine_4	0.301	WINE	510650ms	5361/141/13/0/1449
	Wine_5	0.355	WINE	880058ms	6469/141/13/0/1771
	Wine_6	0.628	WINE	Undefined Time	12009/141/13/0/3381
	Wine_7	1.14	WINE	Undefined Time	23089/141/13/0/6601
	Wine_8	2.2	WINE	Undefined Time	45249/141/13/0/13041
	Wine_9	4.35	WINE	Undefined Time	89569/141/13/0/25921
	Wine_10	8.67	WINE	Undefined Time	178209/141/s13/0/51861
FACT++	Wine_0	0.868	WINE	3182ms	930/142/13/0/162
	Wine_1	0.142	WINE	28482ms	2037/242/13/0/483
	Wine_2	0.194	WINE	74552ms	3145/141/13/0/805
	Wine_3	0.249	WINE	151616ms	4253/141/13/0/1127
	Wine_4	0.301	WINE	279364ms	5361/141/13/0/1449
	Wine_5	0.355	WINE	447392ms	6469/141/13/0/1771
	Wine_6	0.628	WINE	Undefined Time	12009/141/13/0/3381
	Wine_7	1.14	WINE	Undefined Time	23089/141/13/0/6601
	Wine_8	2.2	WINE	Undefined Time	45249/141/13/0/13041
	Wine_9	4.35	WINE	Undefined Time	89569/141/13/0/25921
	Wine_10	8.67	WINE	Undefined Time	178209/141/13/0/51861
PELLET	Vicodi_0	3.18	VICODI	2667ms	54080/194/10/0/16942
	Vicodi_1	6.39	VICODI	6099ms	107733/194/10/0/33884
	Vicodi_2	9.6	VICODI	11512ms	161386/194/10/0/50826
	Vicodi_3	12.8	VICODI	15147ms	215039/194/10/0/67768
	Vicodi_4	16	VICODI	21496ms	268692/194/10/0/84710
HERMIT	Vicodi_0	3.18	VICODI	9469ms	54080/194/10/0/16942
	Vicodi_1	6.39	VICODI	20516ms	107733/194/10/0/33884
	Vicodi_2	9.6	VICODI	31793ms	161386/194/10/0/50826
	Vicodi_3	12.8	VICODI	159234ms	215039/194/10/0/67768
	Vicodi_4	16	VICODI	85410ms	268692/194/10/0/84710
FACT++	Vicodi_0	3.18	VICODI	6100ms	54080/194/10/0/16942
	Vicodi_1	6.39	VICODI	33977ms	107733/194/10/0/33884
	Vicodi_2	9.6	VICODI	83475ms	161386/194/10/0/50826
	Vicodi_3	12.8	VICODI	159234ms	215039/194/10/0/67768
	Vicodi_4	16	VICODI	251157ms	268692/194/10/0/84710