

Pelletheart

A prototype of a hybrid rule reasoner for ontologies.

Description

Integrating classic forward chaining rule reasoning implemented by [HeaRT](#) with the [Pellet](#).

Concept by [G. J. Nalepa](#) and [W. T. Adrian](#) (de domo Furmańska), prototype implementation by W. T. Adrian.

Idea

- **Conceptual level:** Integration of *Attribute Logic with Set Values over Finite Domains* (ALSV(FD)) and *Description Logics (DL)* (research papers on integration: [here](#) and [here](#))
- **Implementation level:** Integration of Pellet ontology reasoner and HeaRT rule inference engine (research paper on architecture proposal: [here](#), poster: 

Integration Proposal

- Attributes in AL correspond to Concepts in DL
- model of a system stored in HeaRT, rule conditions checked by Pellet, execution of rules by HeaRT
- communication: DIG or command line

Implementation

Top-down overview

There are 2 aspects of the integration of Pellet and HeaRT:

1. Communication channel
 1. command line
 1. sending RDF/XML (dedicated translators from HML/R to RDF/XML)
 2. DIG interface
 1. sending DIG message (dedicated translators HML/R to DIG)
2. Inference scenario
 1. rule precondition checked with *consistency checking* DL task
 2. rule precondition checked with *realisation* DL task

What has been done

```
%%%%%%%%%%%%%
% Reasoning with HeaRT-Pellet: %
% 1. Build TBox: definitions of types and attributes %
%   a) build additional statements: 'allDifferent' for individuals %
% 2. Call any inference mode you wish (GDI, TDI etc.) %
% 3. In each state build an ABox representing this state %
% 4. Whenever you check a rule preconditions: %
%   a) build rule axioms (temporary TBox), %
%   b) ontology = definitions TBox + rule axioms TBox + state ABox %
%   c) send the ontology to Pellet to check its consistency %
% 5. Interpret the result, carry on as usual %
%%%%%%%%%%%%%
```

```
%%%%%%%%%%%%%
% Reasoning with HeaRT-Pellet - Alternative version: %
%
% 1. Build TBox: definitions of types and attributes %
%   a) build additional statements: 'allDifferent' for individuals %
% 2. Call any inference mode you wish %
% 3. In each state build an ABox representing this state %
% 4. Whenever you check a rule preconditions: %
%   a) build rule axioms (ABox statements) %
%   b) definitions TBox + rule axioms aBox + state ABox %
%   c) send to Pellet to check realization the rule conditions %
% 5. Interpret the result, carry on as usual %
%%%%%%%%%%%%%
```

Following the inference scenario:

1. HeaRT can be started with additional parameter in the gox predicate:

```
%%%%%%%%%%%%%
% gox(StateIn,T,Mode,ExternalReasoner) %
%   ExternalReasoner - the one used to check the rules preconditions %
%
% Augmented version of Heart - additional variable for an ext.reasoner %
%
%%%%%%%%%%%%%
```

2. Translating parts of the HMR model to RDF/XML

```
%%%%%%%%%%%%%
% DAAL prototype translator. %
% -----
%
% Translates attributes into concepts,
% attribute values into instances and
% rule preconditions into T-Box like axioms. %
%
% Supported operators: 'in', 'eq'.
% Supported attributes: 'symbolic'.
```

```

%
% Basic predicates:
%   owl_xml_gen/0 - translate HMR file into DAAL representation (ontology).
%   owl_xml_gen/1 - translate HMR file into DAAL representation (ontology)
%           and write it to the file given as the argument.
%   owl_xml_attr_gen/0 - translate the attribute definitions
%   owl_rulp_gen/0 - translate the rules preconditions
%   owl_rulp_gen/1 - translate the given rule preconditions
%   owl_stat_gen/0 - translate the states statements
%   owl_stat_gen/1 - translate the given state statement
%
%%%%%%%%%%%%%

```

3. Sending partial ontologies from HeaRT to Pellet

4. Interpreting the Pellet answers by HeaRT

Technically

- `heart-pellet.pl` - Extended version of HeaRT (works with the standard HeaRT distribution): additional parameter in gox predicates for the external reasoner to use
- `heart-daal-translator.pl` - predicates

Papers

- G.J. Nalepa, W.T. Furmańska: [Proposal of a New Rule-Based Inference Scheme for the Semantic Web Applications](#), New Challenges in Computational Collective Intelligence. Studies in Computational Intelligence, 2009, Vol. 244/2009, 15-26.
- G.J. Nalepa, W.T. Furmańska: [Pellet-HeaRT - Proposal of an Architecture for Ontology Systems with Rules](#), KI 2010: Advances in Artificial Intelligence. LNCS, Vol. 6359/2010, 143-150.
- G.J. Nalepa, W.T. Furmańska: [Integration Proposal for Description Logic and Attributive Logic - Towards Semantic Web Rules](#), TRANSACTIONS ON COMPUTATIONAL COLLECTIVE INTELLIGENCE II, LNCS, Vol. 6450/2010, 1-23.

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