Pellet System Description

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The description logic $\mathcal{SHOIN}(\mathcal{D})$ has attracted considerable interest as the foundation of the W3C standard Web Ontology Language variant, OWL-DL. Pellet is a sound and complete tableau reasoner for $\mathcal{SHOIN}(\mathcal{D})$ and incorporates a number of key features such as conjunctive ABox query, axiom pinpointing, rules, $\mathcal{E}$-connection reasoning, and novel optimizations for nominals. In this paper we summarize Pellet's features and special capabilities.

Novel Optimizations Pellet implements most of the state of the art optimization techniques provided in the DL literature, e.g. *absorption*, *dependency-directed backjumping*, etc. In addition, there are also many novel optimization techniques implemented in Pellet especially to deal with nominals and large ABoxes. See [3] for details about these techniques.

Axiom pinpointing Axiom pinpointing is a non-standard DL inference service that provides a *justification* for any arbitrary entailment derived by a reasoner from an OWL-DL knowledge base. Given a KB and any of its logical consequences, the axiom pinpointing service determines the premises in the KB that are sufficient for the entailment to hold. The justification is useful for understanding the output of the reasoner, which is key for many tasks, such as ontology debugging, design and evolution. See [2] for more details about axiom pinpointing service in Pellet.

Conjunctive ABox query Query answering is yet another important feature for Semantic Web. Pellet includes a query engine that answers conjunctive ABox queries. In the presence of *non-distinguished variables*, the well-known "rolling-up" technique is used to answer tree-shaped queries. If there are only distinguished variables then every query atom can be answered in isolation and arbitrary shaped queries can be handled. See [4] for an explanation of the *query simplification* and *query reordering* techniques implemented in Pellet.

$\mathcal{E}$-Connections $\mathcal{E}$-Connections are a framework for combining several families of decidable logics. In [1] we have proposed tableau algorithms for different $\mathcal{E}$-Connection languages involving Description Logics so that an ontology can be refer to another ontology without fully importing the contents of that ontology. Pellet has been extended with tableau-based decision procedures for $\mathcal{E}$-Connection languages involving combinations of $\mathcal{SHOIN}(\mathcal{D})$ ontologies [1].

Rules Pellet has support for $\mathcal{AL}$-log (Datalog + $\mathcal{SHOIN}(\mathcal{D})$) via a coupling with a Datalog reasoner. It incorporates the traditional $\mathcal{AL}$-log algorithm and a new precompilation technique that is incomplete but more efficient. Pellet also has an experimental implementation of a direct tableau algorithm for a DL-safe rules extension to $\mathcal{SHOIN}(\mathcal{D})$ [5]. Preliminary empirical results have been encouraging and we think that the DL-safe implementation is practical for small to mid-sized ontologies esp. when the full expressivity of $\mathcal{SHOIN}(\mathcal{D})$ is needed.

Usability Pellet provides many different interfaces. Pellet has a command line interface, an interactive web form, DIG protocol support, and programmatic interface with bindings to Jena and OWL-API libraries. It is used in conjunction with ontology editors Swoop, Protege, and TopBraid Composer.

See the Pellet Web page at `http://www.mindswap.org/2003/pellet` for downloads and more detailed information about the system including the performance evaluation and comparison with other systems.

References

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