AIF-EL – An OWL2-EL-Compliant AIF Ontology

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Abstract. This paper briefly describes AIF-EL, an OWL2-EL compliant ontology for the Argument Interchange Format.

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1. The Argument Interchange Format and its Current OWL Version

The Argument Interchange Format (AIF) [1,4,3] is the current proposal for a standard notation for argument structures. It is based on a graph that specifies two types of nodes: information nodes (or I-nodes) and scheme nodes (or S-nodes). These are represented by two disjoint sets, $N_I \cup N_S = \mathcal{N}$ and $N_I \cap N_S = \emptyset$, where information nodes represent claims, premises, data, etc., and scheme nodes capture the application of patterns of reasoning belonging to a set $S = S_R \cup S_C \cup S_P$, $S_R \cap S_C = S_C \cap S_P = S_P \cap S_R = \emptyset$. Reasoning patterns can be of three types: rule of inference $S_R$; criteria of preference $S_P$; and criteria of conflicts $S_C$.

The relation fulfills $\subseteq N_S \times S$ expresses that a scheme node instantiates a particular scheme. Scheme nodes, moreover, can be one of three types: rule of inference application nodes $N_{S_R}^A$; preference application nodes $N_{S_P}^A$; or conflict application nodes $N_{S_C}^A$, with $S = N_{S_R}^A \cup N_{S_P}^A \cup N_{S_C}^A$, and $N_{S_R}^A \cap N_{S_P}^A = N_{S_P}^A \cap N_{S_C}^A = N_{S_C}^A \cap N_{S_R}^A = \emptyset$.

Nodes are connected by edges whose semantics is implicitly defined by their use. For instance, an information node connected to a RA scheme node, with the arrow terminating in the latter, would suggest that the information node serves as a premise for the inference rule.

In 2012 an OWL version of the AIF was released1 and, to date, it is the only version available. However, the OWL profile checker2 reports 4 errors due

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2https://github.com/stain/profilechecker (on 13 Apr 2018)
to illegal redeclaration of entities, where the same URI is used both for a Data Property and an Annotation Property [2]. In addition, when checked against the OWL2 profiles, it returns 277 violations for OWL2-EL profile.

2. AIF-EL

AIF-EL\(^3\) is a fully OWL2-EL [5] compliant version derived from the previous AIF OWL version. The OWL 2 EL profile is designed as a subset of OWL 2 that is particularly suitable for applications employing ontologies that define very large numbers of classes and/or properties; captures the expressive power used by many such ontologies; and for which ontology consistency, class expression subsumption, and instance checking can be decided in polynomial time. In addition, some commercial triple stores systems come equipped with an OWL2-EL reasoner.

In this version we solved the issues behind all the violations mentioned above: redefinitions between annotation properties and data properties have been unified into data properties to enable reasoners to properly handle them; cardinality requirements on object properties have been removed, as they raise the complexity of reasoning activities; removal of universal quantification in defining classes, but adding such pieces of information to the definition of the range of the object properties, notably \texttt{hasException\_desc} and \texttt{hasPresumption\_desc}.

Moreover, there has been the need to remove all the disjunctions used in the definition of the various classes. The notable examples are \texttt{Scheme\_Application} or \texttt{Statement} that becomes Node; \texttt{NegativeConsequences\_Inference} or \texttt{PositiveConsequences\_Inference} or \texttt{PracticalReasoning\_Inference} that becomes \texttt{Consequential\_Inference}; and \texttt{ExpertOpinion\_Inference} or \texttt{PositionToKnow\_Inference} that require the definition of a new superclass, namely \texttt{Testimony\_Inference}.

References


