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) \cite{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, \( N_I \cup N_S = N \) 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 \( \text{fulfils} \subseteq N_S \times S \) expresses that a scheme node instantiates a particular scheme. Scheme nodes, moreover, can be one of three types: rule of inference application nodes \( N_S^{RA} \); preference application nodes \( N_S^{PA} \); or conflict application nodes \( N_S^{CA} \), with \( S = N_S^{RA} \cup N_S^{PA} \cup N_S^{CA} \), and \( N_S^{RA} \cap N_S^{PA} = N_S^{PA} \cap N_S^{CA} = N_S^{CA} \cap N_S^{RA} = \emptyset \).

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 released\footnote{http://www.arg.dundee.ac.uk/wp-content/uploads/AIF.owl (on 13 Apr 2018)} and, to date, it is the only version available. However, the OWL profile checker\footnote{https://github.com/stain/profilechecker (on 13 Apr 2018)} reports 4 errors due...
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{haxException_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 \texttt{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


