AIF-EL - An OWL2-EL-compliant AIF ontology

Cerutti, Federico; Toniolo, Alice; Norman, Timothy J.; Bex, Floris; Rahwan, Iyad; Reed, Chris

Published in:
Computational Models of Argument - Proceedings of COMMA 2018

DOI:
10.3233/978-1-61499-906-5-455

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

Computational Models of Argument
S. Modgil et al. (Eds.)

doi:10.3233/978-1-61499-906-5-455

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

Federico CERUTTI [a], Alice TONIOLO [b], Timothy J. NORMAN [c], Floris BEX [d], Iyad RAHWAN [e] and Chris REED [f]

[a] *Cardiff University, UK*
[b] *University of St. Andrews, UK*
[c] *University of Southampton, UK*
[d] *University of Utrecht, NL*
[e] *MIT, USA*
[f] *University of Dundee, UK*

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

Keywords. argumentation, AIF, OWL2

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, $\mathcal{N}_I \cup \mathcal{N}_S = \mathcal{N}$ and $\mathcal{N}_I \cap \mathcal{N}_S = \emptyset$, where information nodes represent claims, premises, data, etc., and scheme nodes capture the application of patterns of reasoning belonging to a set $\mathcal{S} = \mathcal{S}^R \cup \mathcal{S}^C \cup \mathcal{S}^P$, $\mathcal{S}^R \cap \mathcal{S}^C = \mathcal{S}^C \cap \mathcal{S}^P = \mathcal{S}^P \cap \mathcal{S}^R = \emptyset$. Reasoning patterns can be of three types: rule of inference $\mathcal{S}^R$; criteria of preference $\mathcal{S}^P$; and criteria of conflicts $\mathcal{S}^C$.

The relation $\mathsf{fulfils} \subseteq \mathcal{N}_S \times \mathcal{S}$ expresses that a scheme node instantiates a particular scheme. Scheme nodes, moreover, can be one of three types: rule of inference application nodes $\mathcal{N}_S^{RA}$; preference application nodes $\mathcal{N}_S^{PA}$; or conflict application nodes $\mathcal{N}_S^{CA}$, with $\mathcal{S} = \mathcal{N}_S^{RA} \cup \mathcal{N}_S^{PA} \cup \mathcal{N}_S^{CA}$, and $\mathcal{N}_S^{RA} \cap \mathcal{N}_S^{PA} = \mathcal{N}_S^{PA} \cap \mathcal{N}_S^{CA} = \mathcal{N}_S^{CA} \cap \mathcal{N}_S^{RA} = \emptyset$.

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[1] and, to date, it is the only version available. However, the OWL profile checker[2] reports 4 errors due

[1] `http://www.arg.dundee.ac.uk/wp-content/uploads/AIF.owl` (on 13 Apr 2018)
[2] `https://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 `haxException_desc` and `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 `Scheme_Application or Statement` that becomes `Node`; `NegativeConsequences_Inference or PositiveConsequences_Inference or PracticalReasoning_Inference` that becomes `Consequential_Inferrence`; and `ExpertOpinion_Inference or PositionToKnow_Inference` that require the definition of a new superclass, namely `Testimony_Inference`.

References

[1] Carlos Iván Chesnevar, Jarred McGinnis, Sanjay Modgil, Iyad Rahwan, Chris Reed, Guillermo R. Simari, Matthew South, Gerard A. W. Vreeswijk, and Steven Willmot. Towards an argument interchange format. *The Knowledge Engineering Review*, 21(04):293, 2006.

[2] Peter Patel-Schneider, Boris Motik, and Bijan Parsia. OWL 2 web ontology language structural specification and functional-style syntax (second edition). W3C recommendation, W3C, December 2012. http://www.w3.org/TR/2012/REC-owl2-syntax-20121211/.

[3] Iyad Rahwan, Bita Banihashemi, Chris Reed, Douglas Walton, and Sherief Abdallah. Representing and classifying arguments on the semantic web. *The Knowledge Engineering Review*, 26(4):487511, 2011.

[4] Iyad Rahwan and Chris Reed. The Argument Interchange Format. In *Argumentation in Artificial Intelligence*, pages 383–402. Springer US, Boston, MA, 2009.

[5] Zhe Wu, Boris Motik, Ian Horrocks, Bernardo Cuenca Grau, and Achille Fokoue. OWL 2 web ontology language profiles (second edition). W3C recommendation, W3C, December 2012. http://www.w3.org/TR/2012/REC-owl2-profiles-20121211/.

[3] `https://osf.io/rhjcb/download` (on 13 Apr 2018). Released under CC-BYv4. Demonstration available at `http://www.visualdataweb.de/webvowl/#iri=https://osf.io/rhjcb/download` (on 28 Jun 2018).