

RIO: The Regularities Inspector for Ontologies Plugin for Protégé-4

Eleni Mikroyannidi^{1*}, Luigi Iannone¹ and Robert Stevens¹

¹School of Computer Science
The University of Manchester
Oxford Road
Manchester, UK

ABSTRACT

Syntactic regularities are repetitive structures of axioms in the asserted form of an ontology. In this paper, we present a Protégé-4 plugin based on the RIO (Regularities Inspector for Ontologies) framework, which detects such regularities in ontologies using cluster analysis. The RIO plugin is an open source tool for visualising syntactic regularities in ontologies; the user can load them in Protégé-4 and view clusters of similar entities, generalisations describing the clusters and abstracting axioms. The RIO plugin can be used for gaining an intuition about the embedded patterns in ontologies and deviations from these patterns.

Availability: the RIO plugin is available for download from <http://riotool.sourceforge.net/>.

1 DESCRIPTION

A *syntactic regularity* is defined as a set of axioms with reoccurring (regular) syntactic structure. A regularity can be expressed with a *generalisation*, which is an axiom that allows for variables to replace entities. For example, given the following axioms from the AminoAcid ontology¹:

A *SubClassOf* hasSize **some** Tiny

I *SubClassOf* hasSize **some** Large

E *SubClassOf* hasSize **some** Small

Then the syntactic regularity of these axioms can be given by the following generalisation:

?AminoAcid *SubClassOf* hasSize **some** ?Size

where ?AminoAcid is a variable holding the amino acids in the axioms {A, I, E} and ?Size is a variable holding the corresponding sizes {Tiny, Large, Small}. Such a framework can be used when authoring an ontology, in order to pinpoint repetitive information. RIO was presented in Mikroyannidi *et al.* (2011) where further detail may be found about RIO and its application to SNOMED.

In this paper, we present the RIO plugin; a Protégé-4 plugin for inspecting syntactic regularities in ontologies. It can be useful for revealing parts of an ontology which have been developed in the same way. Moreover, it can be useful for gaining an intuition about the construction of the ontology.

*mikroyannidi|iannone|stevens@cs.manchester.ac.uk

¹ <http://www.co-ode.org/ontologies/amino-acid/2006/05/18/amino-acid.owl>

The RIO framework uses cluster analysis for the detection of syntactic regularities. The purpose of cluster analysis is to partition data into groups (clusters) that are meaningful, useful, or both Tan *et al.* (2005). Thus, the computation of the clusters is based on the similar usage of entities in axioms. Finally, generalised axioms express the syntactic regularities, which are a synthetic view of all the axioms that contribute to the generation of an entity cluster.

The RIO plugin is an open source project. Its implementation is based on OWLAPI². A standalone Java tool is used for the regularities' computation, which are then saved in an XML file. The user can load and visualise the regularities in Protégé-4 using the RIO plugin.

Figure 1 shows one of the main views of the RIO plugin in Protégé-4. The cluster view shows the name of every cluster and the number of entities in the cluster. The Cluster member list view shows the list of entities in a cluster. The generalisation view shows information about the regularities that are captured for every cluster. In the generalisation view, every generalisation can be unfolded to show the axioms that are abstracted (instantiations) and metrics about the variables. The metrics that are shown are the number of instantiations, and the number of entities that are covered by each variable. In principle, the union of the generalisations in the view describes a cluster, but a single generalisation is not necessarily applicable to all members of a cluster.

The recognition of syntactic regularities should be helpful in understanding the composition of an ontology, as it can reveal parts of the ontology that were designed in similar ways. This should help the user to complete tasks, such as extensions of the ontology, its integration with other ontologies, quality assurance and so on.

REFERENCES

- Mikroyannidi, E., Iannone, L., Stevens, R., and Rector, A. (2011). Inspecting regularities in ontology design using clustering. *The Semantic Web-ISWC 2011*, pages 438-453.
- Tan, P.-N., Steinbach, M., and Kumar, V. (2005). *Introduction to Data Mining*. Addison-Wesley.

² <http://owlapi.sourceforge.net>

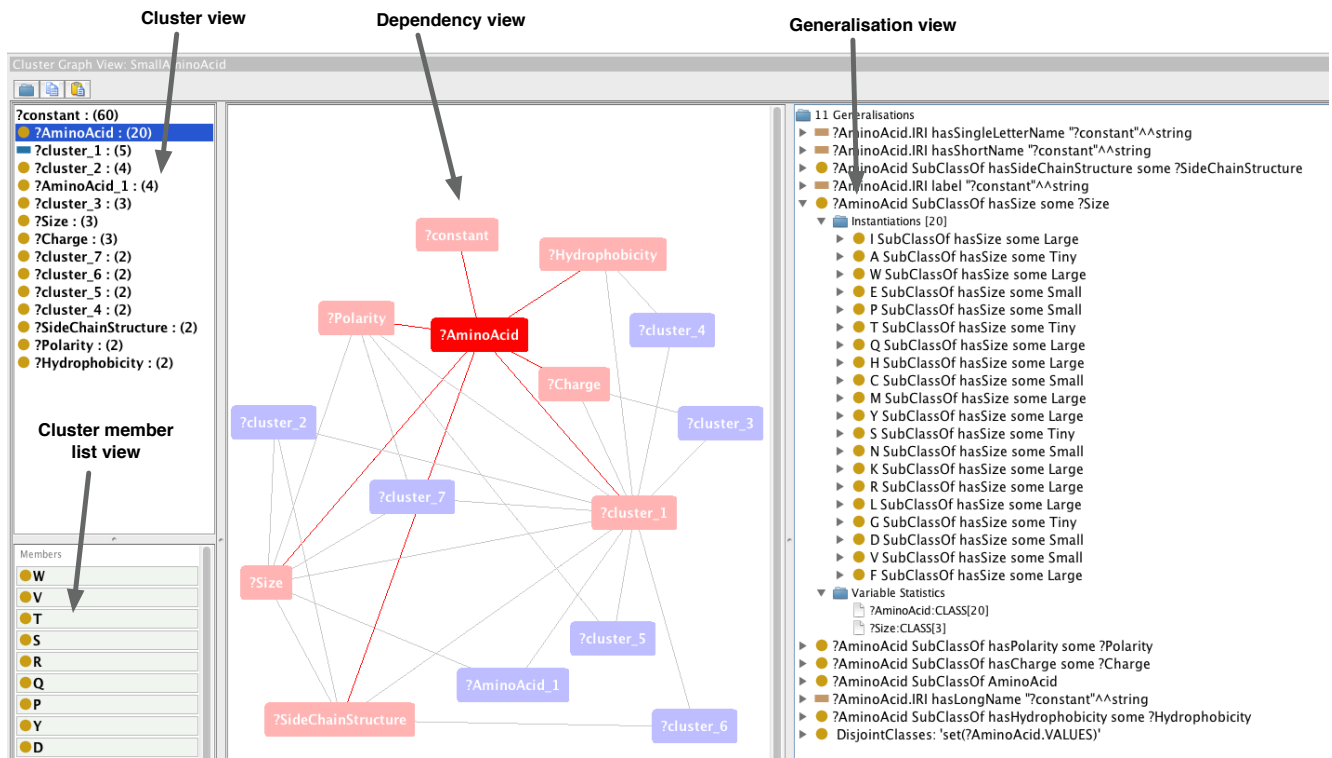


Fig. 1. RIO plugin view for Protégé-4