Custom Views of Reference Ontologies

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Generating "views" over reference ontologies allows them to be customized for use within specific application contexts. In this project we investigated the operations necessary to generate one such custom ontology view. We catalogued the involved operations as a first step in defining the requirements of a formal view definition language.

Reference ontologies, such as the University of Washington's Foundational Model of Anatomy (FMA), are intended to support the domain knowledge requirements of multiple disparate applications. They are often too large or too complex, however, for any specific application. In addition, the "world view(s)" provided by such reference ontologies may not match exactly the views required by particular applications. In order to utilize reference ontologies, therefore, applications often require custom ontology views tailored for use within their specific context. In this study we began to catalog the operations needed to generate such customized views by creating a view of the FMA that resembles as closely as possible the structure of NeuroNames (NN). Such a catalog will eventually be useful in creating a formal view definition language (VDL).

Both the FMA and NN represent anatomy: the former represents structures throughout the human body, while the latter represents brain structures of both human and non-human primates. Because NN informed the construction of the neurological component of the FMA, we anticipated and found a marked correspondence between the names of the human neuro-anatomical structures represented by these two sources. However, producing a NN view from the FMA also required that we derive the NN organization from the relationship networks present in the FMA.

The NN hierarchy is based on a principle of nested structures. If structure B is spatially contained within the confines of structure A, then structure B is represented as a descendent of A in the NN hierarchy. A similar relationship, *regional part* exists in the FMA.

A first pass attempt at an FMA view to resemble NN was generated via a transitive closure operation, over the *regional part* relationship, starting from the entity "Brain". Figure 1 reveals the similarity, at least at the top level, of the NN organization and that of this simple FMA view.

As we descend further down the trees in Figure 1 the hierarchies begin to deviate. To improve these results we applied additional rules to the view definition. For example, the NN hierarchy contains the pleural term "Basal ganglia", with individual ganglion listed as its children. In the FMA this is not a *regional part* relationship, but a *has member* relationship between a set and its members. We therefore augmented our view definition to stipulate that, for FMA set classes, include all *member* classes as direct descendents in the hierarchy.

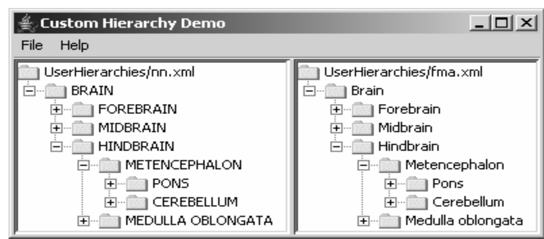

Figure 1: NeuroNames hierarchy (left) and FMA view (right)

Although the application of a set of such general rules produced an approximation of the intended view, it also revealed cases which required rules specific to a single class or relationship instance. For example, in NN "Cerebral cortex" is a direct descendent of "Telencephalon", but in the FMA there are intervening partitions (e.g. "Cerebral hemisphere"). No general rule specifies where such inconsistencies will occur.

For true flexibility, a VDL must also allow for the addition of entities or relationships relevant to the view but not contained in the reference ontology. These may be omissions from the reference ontology or simply items outside of the reference ontology scope (for example non-human primate structures relevant to NeuroNames).

We conclude that, while general ontology traversal rules provide an effective primary content filter, a flexible VDL must allow for the addition of new content, and the inclusion of specific corrections. Further case studies will expand this initial catalog of necessary rule and operation types.