MediGrid Ontology for Description of Biomedical Algorithms

Jan Vejvalka[a], Petr Lesný[a] , Tomáš Holeček[b], Kryštof Slabý[a], Hana Krásničanová[a] , Adéla Jarolímková[c], Helena Bouzková[d]

[a] *Faculty Hospital Motol and 2nd Faculty of Medicine, Charles University, Prague, Czech Republic*
[b] *Faculty of Humanity Studies, Charles University, Prague, Czech Republic*
[c] *CESNET, z.s.p.o., Prague, Czech Republic*
[d] *National Medical Library, Prague, Czech Republic*

Abstract and Objective

Algorithms and recommended guidelines are one of the traditional tools for representation of knowledge in biomedicine. Using retrospective analysis of algorithms represented in medical literature and transformed into computer applications, we constructed a domain ontology of medical algorithms. This ontology is based on a phenomenological description of data processed by algorithms as indicators, which are transformed into other indicators.

Keywords:

Medical algorithms, Knowledge base, Biomedical ontology.

Introduction

Medical algorithms, represented in the form of computable formulae or as recommended guidelines, are traditionally used to represent medical knowledge. Some of the possible tools currently used for documentation of medical algorithms are biomedical ontologies, which allow to add new functionalities to classical archives of medical algorithms and to medical software that represents the algorithms: functionalities that make it possible to use these algorithms within the strict rules of evidence-based medicine.

Methods

We analyzed the largest database of published algorithms - MEDAL. For usability analysis, we took into account the following biomedical ontologies: SNOMED, ON9.2, UMLS, MeSH, FMA, BFO, Gene Ontology and the SNAP/SPAN ontologies.

Results

In the traditional biomedical ontologies (as mentioned above), the individual concepts that are needed for documentation of algorithms are not always clearly documented; their semantic descriptions are - even with respect to the magnitude of these ontologies - incomplete and often not clearly related to supporting evidence. Furthermore, mechanisms for user-driven extensions of these ontologies are missing. We developed the MediGrid ontology, that can be applied for description of medical algorithms and that conceptually follows the modern domain ontologies, including e.g. the OpenEHR initiative. The key elements of the proposal are as follows: The ontology is described by relations of several identified archetypes. These archetypes are logically organized into three layers as seen in Table 1.

Table 1-Layers of archetypes

Implementation layer (topmost)	**Implementations** of the algorithms **Validation** of data
Algorithm description layer (middle)	**Indicator class** **Transformation** of indicators **Context** in which transformation occurs
Knowledge sources (basal)	**User** **Citation**

The phenomenological approach offers an explanation of the observed limited use of "traditional" ontologies for description of biomedical algorithms: the algorithms often address very specific functional relations of data at the lowest levels of any general hierarchies / classifications.

Conclusions

The Medigrid ontology for description of biomedical algorithms offers a useful tool for description of more general relations between data than those represented by "traditional" ontologies. The described ontology has been successfully used within the MediGrid project to document algorithms from several domains (pneumology, growth medicine, cardiology).

Acknowledgement

Supported by the MediGrid project: Czech National Research Programme 1ET202090537 and METABO.