Building a Radiation Therapy Ontology

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Abstract

This poster reports on our ongoing work to develop a Radiation Therapy Ontology (RTO) designed according to OBO Foundry principles. This work aims to produce an ontology describing the domain of radiation therapy concerned primarily with the processes and equipment used to deliver therapeutic radiation in a clinical setting.

Currently in radiation oncology, around 3% of patients are enrolled in clinical trials. Major hurdles to involving more patients include the work required to identify potential enrollees, collecting the data, and transforming data to meet protocol requirements. Axiomatically rich ontologies are uniquely positioned to serve as a bridge between the precision needed in clinical trials and the reality of electronic health records. This work is also motivated by the recent push for standardization in radiation oncology, and the realization that progress in clinical practice requires better access to clinical data.

RTO aims to be useful in bridging institutional and clinical practice differences. The proliferation of standard terminologies can be at odds with each other and with existing data labels. Currently, nearly all patient data are in relational databases with no overall uniformity with respect to schemas, tables, column names and value sets. The structure of these databases is most often controlled by the vendors, and in those cases where institutions tailor the names and variables, there are no fixed standards. The upshot is that one must expect that for nearly every application, some transformation of the data will be needed.

In modeling this domain, RTO uses terms from existing ontologies, including the Chemical entities of Biological Interest; Ontology for General Medical Science; Ontology for Biomedical Investigations; and more.

One aspect of the RTO is its inclusion of classes describing medical imaging devices and techniques. In radiation therapy, these are used to assist in the planning, evaluation, and delivery of RT. A solid description of these processes and devices is very important for the RT domain.

Another key area for RTO is defining, connecting, and distinguishing between, plan specifications for radiation therapy and processes such as the delivery of radiation therapy. The Information Artifact Ontology has been indispensable for this.

A challenge has been the lack of precise consensus definitions for some critical concepts in RT, caused by the rapid evolution of the field over the last few decades and the widespread medical propensity for multiple, overlapping terms and practices. An example is Intensity-modulated radiation therapy (IMRT), where defining characteristics of the technique can vary, from the type of algorithm used, the number of beams, the motion of the radiation therapy device and whether the RT is delivered during surgical resection. Institutional classifications, historic preferences and billing protocols can also result in differences regarding which technique label is used for a given radiation therapy. In defining the IMRT class, we focused on necessary criteria, including the use of at least one control point and the use of a multi-leaf collimator, allowing for the possibility that users of the ontology may develop more detailed definitions as part of a site-specific application ontology.

We will submit RTO for consideration as an OBOF candidate once a 1.0 release is complete.

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