The Knowledge-Data Ontology Mapper (KDOM): a Tool for Mapping Clinical Guidelines to EMRs

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Abstract. Creating computer-interpretable guidelines (CIGs) requires much effort. This effort would be leveraged by sharing CIGs with more than one implementing institution. Sharing necessitates mapping the CIG's data items to institutional EMRs. We developed a framework called Knowledge-Data Ontological Mapper (KDOM) that enables bridging the gap from abstractions used in CIGs to specific electronic medical records (EMRs). Bridging the gap involves: (1) using an ontology of mappings, and an optional reference information model, to map an abstraction gradually into EMR codes, and (2) automatically creating SQL queries to retrieve the EMR data. We will demonstrate the KDOM framework using a GLIF3-encoded guideline which we mapped into an EMR using the mapping ontology and the SQL generator.

Keywords: clinical guidelines, EMR, ontology, mapping, SQL

1. Introduction

Defining mappings between a CIG's patient data items and EMR fields involves many challenges, including (1) mismatch in data model and terminology combinations [1], (2) use of abstractions by guideline authors, including (a) terms which need to be defined in terms of EMR fields (e.g., "malalignments of the foot" that abstracts from raw data about particular malalignment types of the right/left feet), (b) terminology abstractions (e.g., Rafapen is a penicillin), and (c) temporal abstractions, and (3) differences in units of measurements and time granularities [2].

Knowledge-Data Ontology Mapper (KDOM) addresses the first two of these challenges using declarative query mapping and a common data model, based on the HL7 RIM as the basis for connecting and integrating the guideline and the EMR using Global-as-View data integration; we map the medical terms/abstractions of a CIG to RIM views of simple EMR data (e.g., Charcot = malalignment and redness and swelling. We create direct linkage between the guideline data items to the RIM views and not to the real tables, allowing reuse of the mappings from CIG abstractions to RIM views. Changing of EMR data structure will not affect the original linkage of the CIG to the EMR view. We evaluated KDOM by mapping a GLIF3-encoded guideline into two different EMR schemas and by using the mapping ontology to define mappings from 15 GLIF3 CIGs and one SAGE CIG into our common data model.

2. Mapping Classes and SQL Query Generator

We defined a set of mapping classes using the Protégé tool (protege.stanford.edu), including direct one to one mapping, logical mapping (using and, or, not operators), classification hierarchy mapping, temporal abstraction mapping, and prior mapping, used to nest mapping instances in order to create complex mapping functions. Figure 1 shows the mapping classes and an instance of temporal abstraction mapping.

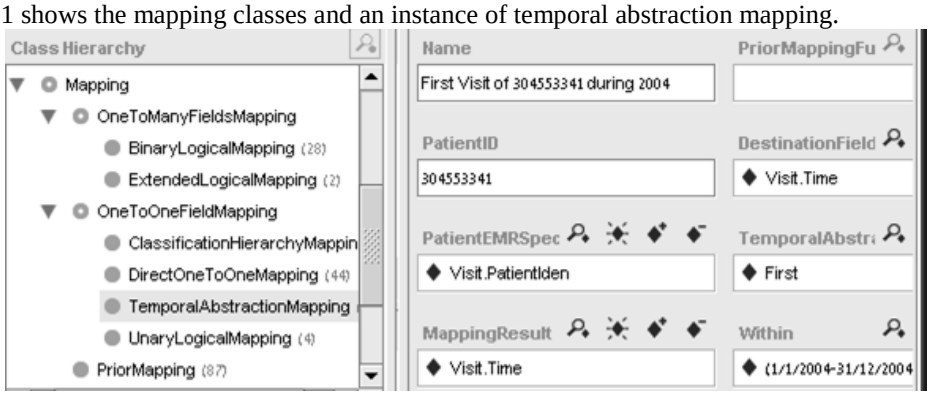

Figure 1. Mapping classes (left) and TemporalAbstractionMapping instance (right). The slots on the right of the mapping instance are inherited from class Mapping.

In the mapping instance shown in Figure 1, the guideline referred to the first visit of a patient during a certain year. Using this information the SQL query generator, which we implemented in Java, generated the following SQL query:

```
SELECT Min(Visit.Time) AS TemporalResult
FROM Patient, Visit
WHERE Patient.PatientID=304553341 AND
        (Patient.PatientKey=Visit.PatientIden) AND
        Visit.Time>='01/01/2004' And Visit.Time<='31/12/2004';
```

3. Discussion

When using the mapping ontology, the CIG encoding may state a simple expression (e.g., first visit in the past year, Charcot=T) while mapping instances may be created to map these expressions to simple fields in a RIM view representing one EMR, or to a logical combination of several fields, in a second EMR. This enables us to write the CIG's decision criteria in the most abstract terms (Charcot) and reuse a mapping instance that defines the Charcot abstraction when mapping to several EMRs.

References

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