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FHIROntopOHDSI: A Semantic Web-based Data Access Framework with the OHDSI Data Repositories Using FHIR

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Abstract

The Interoperability between the Observational Health Data Sciences and Informatics (OHDSI) Common Data Model (CDM) and the HL7 Fast Healthcare Interoperability Resources (FHIR) has become an important research topic. The objective of the study is to develop a Semantic Web-based data access framework using FHIR to enable answering semantic queries over the OHDSI CDM-based data repositories. We leverage the FHIR metadata vocabulary and an open-source Ontology-based Data Access (OBDA) system known as Ontop to demonstrate the feasibility of our approach.

Introduction

The Observational Health Data Sciences and Informatics (OHDSI) Common Data Model (CDM) has been increasingly used to build a large-scale international data network in support of observational studies [1]. The HL7 Fast Healthcare Interoperability Resources (FHIR) is emerging as a next generation standards framework for facilitating health care and electronic health records (EHR)-based data exchange [2]. There is a critical need to build the FHIR-based data access and query on existing relational data sources to facilitate standards-based semantic data integration, sharing and discovery in broader scientific research communities [3].

The system comprises four layers: an input layer, a transformation layer, a semantic query layer and an application layer. We leverage the FHIR metadata vocabulary in the Semantic Web Ontology Language (OWL) and an open-source Ontology-based Data Access (OBDA) system known as Ontop [4] to demonstrate the feasibility of our approach. We created the mappings for 7 OHDSI CDM tables. We successfully created the SPARQL query templates that can identify patient cohorts using a single concept code or its descendants (i.e., demonstrating inference capability) from different domains (i.e., Condition, Medication Administration, and Observation). Our ongoing next steps include: 1) building a set of robust mappings between FHIR and OHDSI CDM through a community-based consensus approach (e.g., the OHDSI FHIR Workgroup); 2) enhancing the Ontop OBDA model to handle blank nodes which are required for the FHIR canonical RDF representation; 3) producing a library of SPARQL query templates for complex cohort identification logic; and 4) enabling federated queries across the OHDSI data repositories and beyond. **Acknowledgements:** This study is supported in part by NIH grants U01 HG009450, U01 CA180940, and R01 GM105688.

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