Workbench and Wizard: Making Protégé Usable as a Workbench for Encoding Clinical Practice Guidelines

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Overview

- Clinical practice guidelines (CPG) and their use in clinical decision support
- Enhancement to Protégé-2000 for encoding CPGs
  - A knowledge-acquisition wizard
  - A terminology plug-in
  - Validation plug-ins
- Outstanding issues
- Protégé wish list
Decision Support For Guideline Based Care

Patient Data

Guideline Knowledge Acquisition Process

Consider adding an ACE Inhibitor because of a compelling indication (heart failure)
Guideline Knowledge-Acquisition Process

Guideline Model

Source Documents

Conceptualization

External Resources (Terminology)

Access Model and Resources

Validation
Protégé-2000 As a Guideline KA Workbench

- Automatic generation of model-specific user-interface forms allows rapid prototyping
- No guidance for conceptualization and encoding of CPG in KBs
  - Create ‘wizards’ to support KA tasks
- Protégé-2000 is component-based and has an extensible architecture
  - Access to external terminology through slot plug-in
  - Validation through special tab plug-ins
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KA Wizard (1): Explicit Modeling of Guideline KA Process

Scripts define sequence of KA tasks
KA Wizard (2): Creation of Alternative Views of Protégé Forms

Work around Protégé’s 1-class/1-form restriction
KA Wizard (3): Guiding a User through KA Tasks

- Based on specification of KA tasks and mapping of forms, the wizard presents a sequence of KA forms

- Top-down interview (TurboTax metaphor)
- Task-oriented “recipe” of how-to (“Office paper-clip” metaphor)
Accessing External Resources: Terminology Plug-In

- A concept is represented as a terminological class
- A plug-in allows search and selection of terms from an external terminology server (developed by Apelon colleagues)
  - Invoked everywhere that a controlled term is needed
  - “Cache” references to controlled terms in Protégé to support browsing in absence of terminology server

![Image of Apelon DTS Concept View](image.png)

- Presence/absence of a coded concept in selected VMR class within a temporal interval (valid window)
Validation of Guideline KB

- **Integrity constraints**
  - **Local constraints**
    - constraints on slot values (e.g. type, cardinality)
    - shown with red border in Protégé GUI
  - **Global constraints**
    - constraints that span across multiple slots, instances, or classes
    - encoded in Protégé’s PAL constraint language

- **Other types of validation (not done yet)**
  - **Safety rules**
  - Conformance to guideline intentions
  - Correctness of subsumption relationships
Local Constraints: Validation Through Facet-Constraint Tab

- Tab that allows checking of select classes for instances with facet constraint violations

Classes to validate

Classes that has instances with facet constraint violations

Instance with facet constraint violations

Summary of facet constraint violations
Global Constraints: Validation Using PAL Constraints
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Problems in Use of Wizards

- Mapping and synchronization of guideline instances and wizard instances
  - Wizard creates and display wizard-specific forms and instances for mapped instances in guideline KB
  - Easy to partition a guideline instance into multiple wizard instances, difficult to aggregate multiple guideline instances

- Management and automation of domain-specific and book-keeping actions

- Specification of meaningful knowledge-acquisition subtasks
Problems in Use of Terminology

Constraints on allowed terms

Concepts used in guidelines are not always available as terms in existing terminology

- Primitive terms
  - e.g. *haemophilus influenza type b conjugate vaccine*

- Compositional terms
  - e.g. *{Progressive neurological finding isa ‘Neurological finding’ Associated course ‘Progressive’}*
  - e.g. *{Respiratory problems excluding asthma}*
Problems in Use of Constraints

- Insufficient facet constraints
  - e.g. allowed values for Instance type

- Difficulty in extending PAL
  - Not easy to add new predicates to PAL

- Weak constraint checking during editing process
  - Facet constraints insufficient to specify allowed slot values
  - PAL constraints not used for selecting slot values
Wish List

- Standardized terminology and information models
  - Express constraints on legal codes
  - Facilitate definition of new codes

- A plug-in architecture for developing and using ‘wizards’ to perform specific tasks

- A plug-in architecture for defining and using alternative constraints in selecting and setting slot values
  - A variety of constraint types
  - A standardized way to invoke alternative constraint engines for checking legal slot values
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CPG and Their Use in Clinical Decision Support

Clinical practice guidelines
- Statements to assist practitioner and patient in making decisions about appropriate health care in specific circumstances
- Traditionally published as monographs or journal papers

Methods to change physician behavior
- Traditional diffusion model
  - Expects clinicians will change behavior on receipt of information
- Specific strategies rather than passive dissemination
  - opinion leaders
  - performance feedback
  - computer-based decision-support at point of care
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Guideline Decision-Support System

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