

Automated Ontology Design Pattern Substitution

Background

Foundational ontologies (FOs) are used to specify high level, domain independent concepts and relations with which to model a domain. The use of FOs results in higher quality modelling, and enables interoperability between ontologies. The application of ontologies to real-world problems often involves verbalising the knowledge represented within an ontology in natural language. FO use tends to clutter natural language output, obscuring the intended meaning. The ability to simplify ontologies which use an FO, changing the semantic representation to a more intuitive representation would be useful in closing this gap.

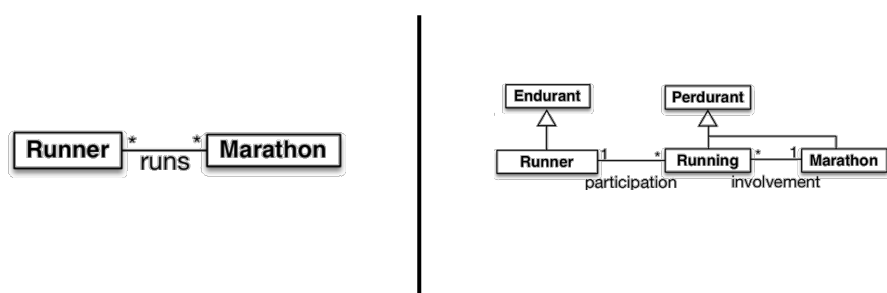
Related Work

- Pattern Alignments
 - Keet & Fillottrani – Design Pattern Alignments
 - Guarino et al – Reification and Truthmaking
- Modularisation & Module Extraction
- Automatic Ontology Generation
- Pattern Mining
- Heterogeneous Toolset (HETS)
 - Conversion and proof between logics

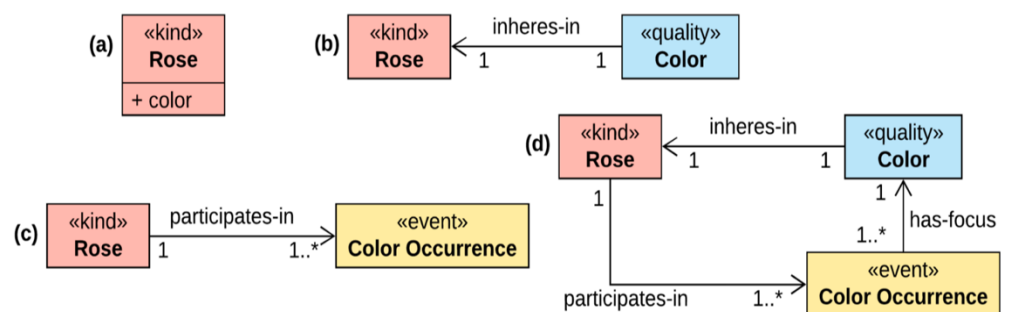
Keet & Fillottrani Pattern Alignments:

- Class vs Object Property
- Perdurant Class vs Object Property
- Class vs Data Property
 - Qualities vs Data Properties
- Representing Roles
- Class-role-attribute
- Vocabulary Alignment

Perdurant Class vs Object Property Example:



Reification & Truthmaking Example:



Verbalisation Output Approximation:

- a) Each Rose has a color (instance).
- b) Each Color (instance) inheres-in exactly 1 Rose.
- c) Each Rose participates-in at least 1 Color Occurrence.
- d) Each Rose participates-in at least 1 Color Occurrence, and each Color Occurrence has-focus exactly 1 Color (instance), and each Color (instance) inheres-in exactly 1 Rose.

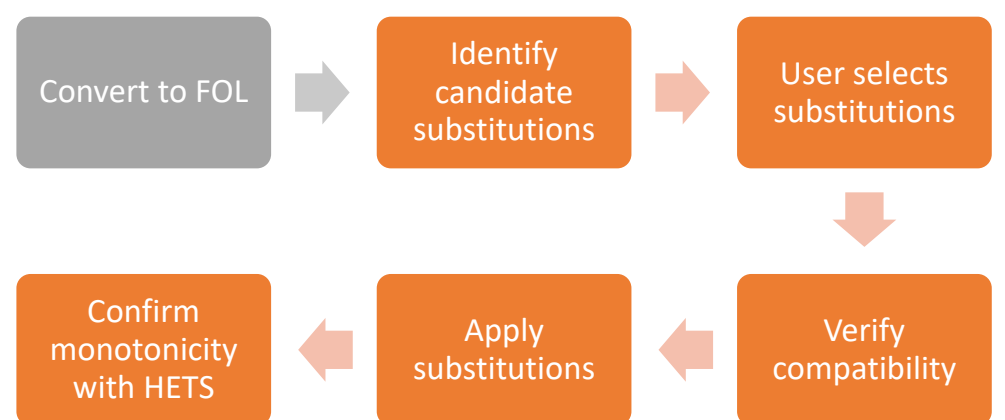
Problem Statement

There are six pattern alignments that have been identified, however no algorithm exists to perform the substitution.
 RQ 1: What is the frequency of occurrence of the identified patterns in synthetic and selected real-world ontologies?
 RQ 2: Can the six design pattern alignments' foundational ontology form be automatically substituted?

Design

The theory component is modelled as transformations based on pattern matching over an ontology. Key concerns include proving monotonicity, that no new deductions are possible after the transformation, and making sure that selected substitutions don't interfere with one another.

Process:



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