Descriptive Comparison of Visual Ontology Change Summarisation Methods

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Abstract. The ontology evolution lifecycle is crucial for usability of ontologies across applications. Changes that are applied to ontologies need to be communicated comprehensively to ontology users and engineers. Change visualisation is a simple, yet powerful way of explaining ontological changes, and different methods come with different shortcomings. This paper introduces and analyses the predominant methods of ontology change visualisations. As there exists no one-fits-all solution, we provide simple guidelines for which visualisation to use.

1 Introduction

To help ontology engineers in the engineering process, it is not only important to have a comprehensive visualisation of the ontology but also of its *changes*. These changes are often difficult to manage and communicate.Some existing approaches are widely used by the ontology community [1,4]. While these have proven their worth in specific application domains, they often fail in other domains with different application constraints.

This poster presents three predominant methods of visualisations for ontology change: **graphical notation** represented by OntoDiffGraph (ODG) [2], **list visualisations** represented by Visual Description Delta (VDD) [5] and **abstraction networks**, specifically the Diff Partial Area Taxonomy (DPAT) [6]. To compare the methods, we present mock-up visualisations where we applied changes to the Pizza ontology[3] which were previously used in a user study [7].

2 Ontology Change Visualisation Methods

OntoDiffGraph. ODG [2] is an extension of the Visual Notation for Owl Ontologies (commonly abbreviated as VOWL) [3] for the purposes of highlighting differences between versions of an ontology. The mock-up visualisation shown in Figure 1 is adapted from its original to only represent entities which are directly affected by the applied changes, instead of visualizing the entire ontology. The ODG uses a graphical notation to present atomic changes and at the same time explicitly represents the ontology's organisation.

[3] https://protege.stanford.edu/ontologies/pizza/pizza.owl

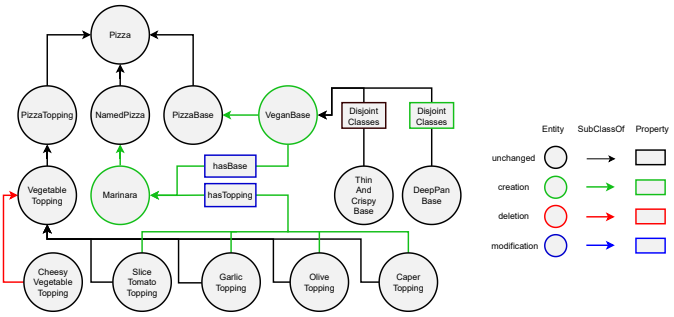
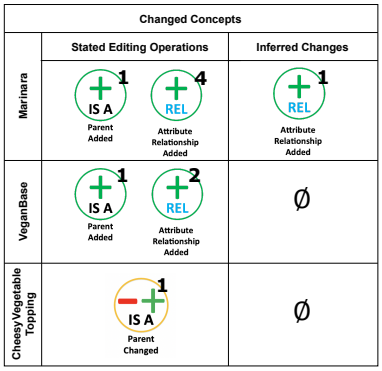


Fig. 1: ODG [2] mock-up visualising changes applied to the Pizza ontology.

Visual Descriptive Delta. The VDD is one (of two) component of the Visual Semantic Delta proposed by Ochs [5] to analyse structural changes to biomedical ontologies. It has the objective to concisely communicate a large number of change concepts into a single notation. The icons use a common colour scheme to connote different editing operations. The affected concepts are listed on the left-hand side ordered in descending order of the number of complex changes. It allows a user to quickly identify where the most relevant and impactful changes occurred. The VDD communicates contextual information concisely by presenting complex changes in a visually aided list.

Diff Partial-Area Taxonomy. The DPAT is based upon the original "abstraction network" [1], and is proposed by Ochs [6] to visualise the *overall impact* of a set of changes. The visualization, shown in Figure 3 is based upon grouping similar concepts into diff partial-areas. This similarity is defined as the set of relations associated with the concept. These sub-hierarchies come in four states which are: introduced, removed, modified and unchanged, and these are represented by the highlight of their borders. The DPAT's utilisation of sub-hierarchies and



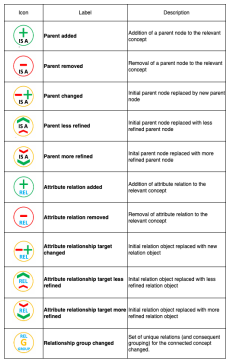


Fig. 2: The VDD [5] mock-up and legend visualising the PizzaOntology changes.

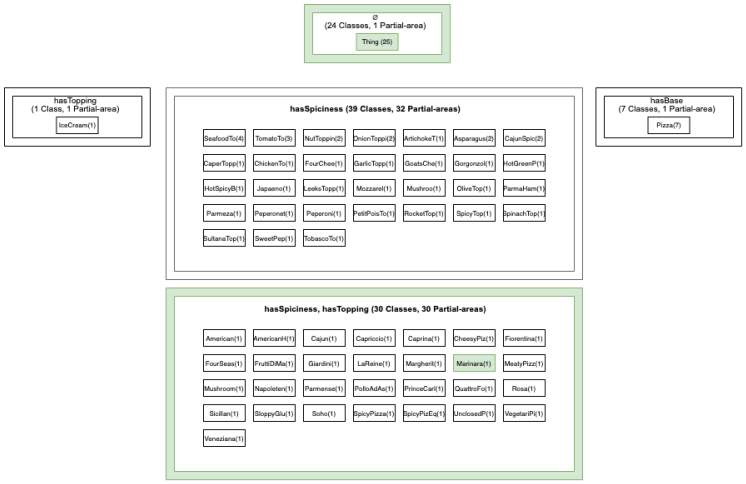


Fig. 3: The DPAT [6] mock-up visualising changes applied to the Pizza ontology.

diff-partial areas enables it to be particularly proficient at highlighting the global impact of changes to the ontology.

3 Analysing Change Visualisation Methods

We will compare the visualisations according to three criteria, representation, scalability and informativeness.

Change representation is achieved through the use of a basic colour scheme for differentiation of states (introduced, removed, modified and unchanged) is a trait identified across all visualisations. Additionally, ODG reflects changes in a hierarchical manner, the DPAT contains a similar hierarchy of concepts based on their similarity or set of unique relations, and the VDD represents changes in descending order in terms of influence. Choosing a visualisation for the individuals needs means here a decision between showing atomic changes on class and individual level(ODG), complex/aggregated changes without ontology context (VDD) or the impact of changes (DPAT).

Scalability in visual representations are a known challenge. The ODG provide visual intuitiveness at the cost of scalability. Storey et al. [8] have observed that the use of edges (or arcs in other studies) becomes difficult to interpret when the number of relations are too high. Additionally, the scalability of each method is heavily dependent on whether the visualisation provides a representation of the entire ontology, or exclusively the set of applied changes. As such, we identified that the DPAT and the VDD mock-ups have good scalability, because of the characteristic of aggregating atomic changes. Considering scalability when choosing a visualisation method, VDD and DPAT are clearly superior because of their summarizing characteristic, in comparison to ODG who's visualisation only increases with the number of changes applied.

Contextual informativeness is tackled differently in each visualisation. The VDD conveys context primarily through the set of complex change concepts. With the ODG, there is an absence of complex changes, which is supplemented by its representation of the ontology's hierarchical structure. The DPAT takes a different approach in grouping similar entities into sub-hierarchies to convey the overall impact of changes. Conclusively, contextual informativeness remains a challenge as we see each visualisation taking a different approach with its own advantages and disadvantages. Each method provides contextual information in a different way, where intuitively the ODG would be most suitable for novice engineers or users of the subject ontology, as it provides the largest amount of context to the changes.

4 Conclusion

ODG has a hierarchical structure representation but has a major trade-off in scalability, the explored complex changes in the VDD lack general ontological concepts that could be versatile, and the DPAT sub-hierarchy aggregation makes this visualisation hard to interpret when not familiar with the domain. We did not consider the changes to Abox axioms, however, only ODG would be capable of displaying them. To conclude, not any one visualization method alone satisfies all needs. An in-depth study is required to assess the above criteria as well as other ones. We hope to include a visualisation method in the Protégé plugin ChImp [7] in the future.

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