Hozo: Treatment of "Role", "Relationship" and Dependency Management *

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Abstract

We have developed an environment for building/using ontologies, named Hozo. Since Hozo is based on an ontological theory of a role-concept, it can distinguish concepts dependent on particular contexts from so-called basic concepts and contribute to building reusable ontologies. We present an outline of the features of Hozo and demonstrate its functionality.

1 Introduction

Building an ontology requires a clear understanding of what can be concepts with what relations to others. Although several tools for building ontologies have been developed to date, few of them were based on enough consideration of an ontological theory. We argue that a fundamental consideration of these ontological theories is needed to develop an environment for developing an ontology [Sowa, 1995; Guarino, 1998]. We have developed an environment for building/using ontologies, named Hozo, based on both of a fundamental consideration of an ontological theory and a methodology of building an ontology. The features of Hozo are: 1) it can distinguish concepts dependent on particular contexts from so-called basic concept, 2) it can manage the correspondence between a wholeness concept and a relation concept, 3) it supports distributed ontology development based on dependency management between component ontologies. We present an outline of the features of Hozo and demonstrate its functionality.

2 Hozo

2.1 The architecture of Hozo

We have developed an integrated ontology engineering environment, named "Hozo ", for building/using task ontology and domain ontology based on fundamental ontological theories[Kozaki et al., 2000; 2002]. "Hozo" is composed of "Ontology Editor", "Onto-Studio" and "Ontology Server" (Figure.1). Ontology Editor provides users with a graphical interface, through which they can browse and modify ontologies by simple mouse operations

(Figure.2). Onto-Studio is based on a method of building ontologies, named AFM (Activity-First Method) [Mizoguchi et al., 1995]. The building process of ontologies using Onto-Studio consists of 12 steps and it helps users design an ontology from technical documents. Ontology Server manages ontologies and models which are built in Hozo. The ontology and the resulting model are available in different formats (Lisp, Text, XML/DTD, DAML+OIL) that make it portable and reusable.

2.2 The features of Hozo

Hozo has been designed based on a fundamental consideration of ontological theories, and it has following remarkable features:

1. Clear discrimination among a role-concept (e.g. teacher role), a role-holder (e.g. teacher) and a basic concept (e.g. man) is done to treat "Role" properly.
2. Management of the correspondence between a wholeness concept (e.g. brothers) and a relation concept (e.g. brotherhood).
3. Distributed ontology development based on dependency management between component ontologies.

What is a role? : Basic concept, role concept and role holder

When an ontology is seriously used to model the real world by generating instances and then connecting them, users have to be careful not to confuse the Role such as teacher, mother, front wheel, fuel, etc. with other basic concepts such as human, water, oil, etc. The former is a role played by the latter. To deal with the concept of role appropriately, we identified three categories for a concept. That is, a basic concept, a role-concept, and a role holder.
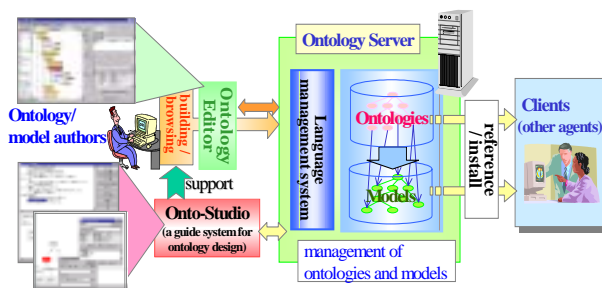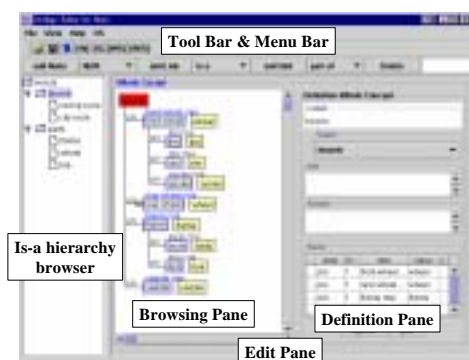

Figure.1 The architecture of Hozo

Figure.2 The snapshot of Ontlogy Editor

A role-concept represents a role which a thing plays in a specific context and it is defined with other concepts. On the other hand, a basic concept does not need other concepts for being defined. An entity of the basic concept that plays a role such as teacher role or wife role is called a role holder. A basic concept is used as the class constraint. Then an instance that satisfies the class constraint plays the role and becomes a role holder. For example, when a man plays a role as a teacher ("a teacher role") in a school which is defined as a role-concept, he is called "a teacher" which is role holders. Hozo supports to define such a role concept as well as a basic concept.

Wholeness concept and relation concept

There are two ways of conceptualizing a thing. Consider a "brothers" and a "brotherhood". "The Smith brothers" is a conceptualization as concept, on the other hand "brotherhood between Bob and Tom" is conceptualized as a relation. On the basis of the observations that most of the things are composed of parts and that those parts are connected by a specific relation to form the whole, we introduced "wholeness concept" and "relation concept". The former is a conceptualization of the whole and the latter is that of the relation. In the above example, the "brothers" is a wholeness concept and the "brotherhood" is a relation concept. Because a wholeness concept and a relation concept are different conceptualizations derived from the same thing, they correspond to each other. Theoretically, every thing that is a composite of parts can be conceptualized in both perspectives as a wholeness concept and a relation concept. Hozo can manage the correspondence between these two concepts.

Distributed ontology development based on dependency management

Hozo supports development of an ontology in a distributed manner. By a distributed manner, we mean an ontology is divided into several component ontologies, which are developed by different developers in a distributed environment. The target ontology is obtained by compiling the component ontologies. To support such a way of ontology development, Ontology Editor allows users to divide an ontology into several component ontologies and manages the dependency between them to enable distributed development of an ontology. We introduced two dependencies: super-sub relation (is-a relation) and referred-to relation (class constraint). The system observes every change in each component ontologies and notifies it to the appropriate users who are editing the ontology which might be influenced by the change. The notification is done based on the 16 patterns of influence propagation analyzed beforehand. The notified users can select the countermeasure among the three alternatives: (1)to adapt his/her ontology to the change, (2)not to do adapt to the change but stay compliant with the last version of the changed ontology and (3)neglect the change by copying the last version into his/her ontology[Sunagawa et al., 2003].

3   Conclusion and Future work

We outlined our ontology development system, Hozo. The system has been implemented in Java and its ontology editor has been used for 6 years not only by our lab members but also by some researchers outside [Mizoguchi et al., 2000; Kitamura et al., 2003]. We have identified some room to improve Hozo through its extensive use. The following is the summary of the extension:

- Ontological organization of various role-concepts.

- Augmentation of the axiom definition and the language.

- Gradable support functions according to a user's level of skill.

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