JAIST Repository
https://dspace.jaist.ac.jp/

Title	記述論理における概念の類似性とエージェントの選好：理論と応用
Author(s)	Racharak, Teeradaj
Citation	
Issue Date	2018-06
Type	Thesis or Dissertation
Text version	ETD
URL	http://hdl.handle.net/10119/15429
Rights	
Description	Supervisor:東条　敏，情報科学研究科，博士

JAIST
JAPAN
ADVANCED INSTITUTE OF
SCIENCE AND TECHNOLOGY

Japan Advanced Institute of Science and Technology

Abstract

Concept similarity measure, as investigated in this thesis, aims at identifying a degree of commonality of two given concepts and is often regarded as a generalization of the classical reasoning problem of equivalence. That is, any two concepts are equivalent if and only if their similarity degree is one. We formally investigate this notion in Description Logics (DLs). Its results provide a basis for computational methods of identifying the commonalities and the discrepancies between two concepts. Our methods of concept similarity measure are proven to be tractable. To this end, they are thereby restricted to the DLs which do not provide all Boolean operators such as $\mathcal{FL}_0$ and $\mathcal{ELH}$ to avoid inheriting NP-hardness from propositional logic.

Similarity judgment used by human beings often involve preferences and needs in practice. More specifically, when two concepts are not logically equivalent or totally similar, they may rely on subjective factors *e.g.* the agent's preferences. Here, we formally define a formal notion of concept similarity under such subjective factors called *concept similarity measure under preference profile* and identify a set of its desirable properties. These properties relate to the question "what could be good preference-based similarity measures?". To exemplify the developments, we suggest computational techniques for $\mathcal{FL}_0$ and $\mathcal{ELH}$, and also, prove their inherited properties. Two algorithmic procedures for our developed measure sim^{π} are introduced for the top-down and bottom-up implementations, respectively, and their computational complexities are intensively studied. We also discuss the usefulness of our proposed developments to potential use cases.

Analogical reasoning is a complex process based on a comparison between two pairs of concepts or states of affairs (*aka.* the source and the target) for characterizing certain features from the source to the target. To exploit our results of concept similarity measure, we investigate such kind of reasoning that analogical conclusions can be derived from the similarity between DL concepts. Two approaches for the implementation of analogical reasoning are explored. Each is formulated from the study of philosophical understanding called *argumentation schemes* where patterns of non-deductive reasoning are analyzed. Finally, we demonstrate that the analogical argument used in the case of Silkwood v. Kerr-McGee Corporation is reconstructible from the proposed formalisms.

Keywords: Concept Similarity Measure, Semantic Web Ontology, Preference Profile, Description Logics, Analogical Reasoning