

Dynamic Description Logic based on DL-Lite

Na Zhang, Liang Chang, Zhoubo Xu, Tianlong Gu

Guangxi Key Laboratory of Trusted Software, Guilin University of Electronic Technology,
Guilin 541004, China

zhnamengluo@163.com, {changl, xzbli_11, cctlgu}@guet.edu.cn

Abstract. Description logics offer considerable expressive power for describing knowledge about static application domains while reasoning is still decidable. The dynamic description logic DDL is a family of dynamic extensions of description logics for representing and reasoning about knowledge of dynamic application domains. In order to provide effective reasoning mechanisms, systems of DDL investigated in the literatures assume that there is no general concept inclusion(GCI) contained in the knowledge base. In this paper, we build a system of dynamic description logic based on the tractable description logic DL-Lite_R^{pr}, in such a way that all the knowledge described by DL-Lite_R^{pr} is supported by our system. A decision algorithm is provided for our system DDL-Lite_R^{pr}. Termination and correctness of the algorithm are proved.

Keywords: description logic, dynamic description logic, action theory, satisfiability, tableau algorithm

1 Introduction

With the rapid development of the Semantic Web, description logics [1] are playing an important role in it, which are recommended by W3C as the basis of Web Ontology Language OWL [2]. About static application domains, they provide considerable expressive power and decidable reasoning mechanisms [3]. But they can't directly deal with knowledge of dynamic application domains which are characterized by actions.

For this limitation, Shi et al. [4] put forward a dynamic description logic DDL based on a combination of description logic ALC, dynamic logic and action theory. Based on DDL, a family of dynamic description logics named DDL($X^{\textcircled{a}}$)[5] was proposed for representing and reasoning about actions, where the minimal change semantics[6] were used to define the semantics of atomic action definitions. But all the current decision algorithms for dynamic description logics are all restricted to requiring that TBoxes of description logics don't include GCIs any more. The DL-Lite family [7] is a family of DLs tailored to capture conceptual modeling constructs while keeping reasoning.

Based on [5], in this paper, we first of all propose a dynamic description logic DDL-Lite_R^{pr} and give its syntax and semantics. And we adopt model-based semantics $\mathcal{L}_{\subseteq}^a$ [8] of ABox update to define the semantics of atomic action definitions. Then a

