

## Doctoral Thesis Defense

|                      |   |
|----------------------|---|
| Speaker:             | Xi Deng   |
| Supervisors:         | Dr. V. Haarslev, N. Shiri   |
| Examining Committee: | Drs. T. Fevens, C. Lam, R. Soleymani, G. Weddell  |
| Title:               | Explanation and Diagnosis Services for Unsatisfiability and Inconsistency in Description Logics |
| Date:                | Thursday, September 16, 2010  |
| Time:                | 10:00 a.m.  |
| Place:               | EV 1.162  |

### ABSTRACT

Description Logics (DLs) are a family of knowledge representation formalisms with formal semantics and well understood computational complexities. In recent years, they have found applications in many domains, including domain modeling, software engineering, configuration, and the Semantic Web. DLs have deeply influenced the design and standardization of the Web Ontology Language OWL. The acceptance of OWL as a web standard has reciprocally resulted in the widespread use of DL ontologies on the web. As more applications emerge with increasing complexity, non-standard reasoning services, such as explanation and diagnosis, have become important capabilities that a DL reasoner should provide.

This research work presents our solution for providing explanation and diagnosis services for DL reasoners. We firstly propose a framework based on resolution to explain inconsistency and unsatisfiability in Description Logics. A sound and complete algorithm is developed to generate explanations for the DL language ALCHI based on the unsatisfiability and inconsistency patterns. We also develop a technique based on Shapley values to measure inconsistencies in ontologies for diagnosis purposes. This measure is used to identify which axioms in an input ontology or which parts of these axioms need to be repaired in order to make the input consistent. In addition, we investigate optimization techniques to compute the inconsistency measures based on particular properties of DLs. Based on the above theoretical foundations, a running prototype system is implemented to evaluate the practicability of the proposed services. Our preliminary empirical results show that the resolution based explanation framework and the diagnosis procedure based on inconsistency measures can be applied in the real world.