

Fuzzy Knowledge Bases Integration Based on Ontology

Maksym Ternovoy, Olena Shtogrina

Abstract – the paper describes the approach for fuzzy knowledge bases integration with the usage of ontology. This approach is based on metadata-base usage for integration of different knowledge bases with common ontology. The design process of metadata-base is described.

Keywords – fuzzy knowledge base, linguistic variable, metadata-base, ontology.

I. INTRODUCTION

The intelligent systems usage increase operational efficiency in the organizations. The base of such systems is knowledge, which is given by problem domain experts. As usual experts use not only quantitative but also qualitative information for describing different features of objects in the problem domain. Because of this knowledge has to be described with the help of fuzzy logic and fuzzy rules can be storing in the fuzzy knowledge base (FKB) [1].

In some cases it is necessary to do logical inference based on several knowledge bases. For this purpose it is needed to use special approach for knowledge bases integration. Existing approaches designed for special knowledge bases integration are not scalable and depend on problem domain [2]. The ontologies, by contrast, are made for describing relationships between originally independent concepts.

Nowadays ontologies find a wide application in different spheres [3]. Ontologies contain basic concepts of problem domain and relations between these concepts. The ontology usage allows users and program agents to use data mutually, to make hypotheses and to analyze problem domain dependences, gives the opportunity for knowledge reusing [4].

That is why ontology based integration of knowledge bases makes possible to design unified interaction interface with different knowledge bases. Based on ontology usage approach for integration is proposed in the paper.

II. MAIN PART

For integration different knowledge bases it is needed to set correspondence between fuzzy knowledge bases and ontology. The main idea of the approach is to use special metadata-base (MDB) for this purpose. It is needed to define the data, which metadata-base must contain and after that design metadata-base scheme. The problem statement is described below.

Given:

1. $FKB = \{FKB_l | l = \overline{1, m}\}$ – set of FKB, which mathematical model is described in [1];
2. $O = \langle E, R \rangle$ - ontology, where

2.1. $E = \{E_i | i = \overline{1, L}\}$ - set of concepts, which define objects and processes of problem domain;

2.2. $R = \{R_j | j = \overline{1, M}\}$ - set of relations between concepts, e.g. Is-A, Part-Of etc.

Find:

Metadata-base V scheme.

There are defined required parts of MDB V on the basis of FKB mathematical model and ontology description. First of all MDB must contain the list of all fuzzy knowledge bases, which can be used during logical inference with special information needed for access to them. Additionally the correspondence between linguistic variables (LV) and ontology concepts must be stored in MDB. For this purpose MDB must contain records of such type: $\{\{FKB_k, X_i, E_q\}\}$, where FKB_k - FKB identifier, X_i - LV identifier, E_q - ontology concept which corresponds to LV.

To increase inference velocity MDB must contain description of LV dependencies. This information can be represented by oriented graph, which is built based on rules from FKB. The graph vertices correspond to linguistic variables, the graph oriented edges correspond to dependencies between linguistic variables. The edge orientation shows whether LV is in the left or right part of the rule.

III. CONCLUSION

The ontology based approach for fuzzy knowledge bases integration is proposed. The main idea of this approach is to use special metadata-base, which consists of fuzzy knowledge bases list, dependencies between linguistic variables and ontology concepts, description of oriented graph showing dependencies between linguistic variables.

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Maksym Ternovoy, Olena Shtogrina - National Technical University of Ukraine “Kyiv Polytechnic Institute”, Institute of Telecommunication Systems, Industrialnyy Al., 2, Kyiv, 03056, UKRAINE, E-mail: ternovoy@its.kpi.ua, L_Shtogrina@mail.ru