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e-mail: *gogerchak.g@gmail.com*.**ANALYZING NATURAL-LANGUAGE KNOWLEDGE
IN UNCERTAINTY ON THE BASIS OF DESCRIPTION LOGICS**

Abstract. The article overviews the means for describing and formally analyzing natural-language text knowledge under uncertainty. We consider a family of classic attribute languages and logics based on them, their properties, problems, and solution tools. We also give an overview of propositional n -valued logics and fuzzy logics, their syntax, and semantics. Based on the considered logical constructions, we propose syntax and set-theoretic interpretation of n -valued description logic $ALCQ_n$ that provides means for describing concept intersection, union, complement, value restrictions, and qualitative and quantitative constraints. We consider the means for solving key problems of reasoning over such logics: executability, augmentation, equivalence, and disjunctivity. As an algorithm for calculating executability degree, we consider an extension of the tableau algorithm often used for first-order logic with solving simple numerical constraints. We prove that the algorithm is terminal, complete, and non-contradictory. We also provide several applications for the provided formal representation in natural language processing, including extending results of machine learning models, combining knowledge from multiple sources, and formally describing uncertain facts.

Keywords: knowledge bases, description logics, fuzzy logics, n -valued logics, natural language processing, knowledge extraction.

1. OVERVIEW OF DESCRIPTION LOGICS

1.1. Knowledge representation. Before proceeding to the description of the knowledge representation system, let us indicate some works related to the subject of this article. Note that there is a large number of works where logic is applied to the analysis of knowledge obtained from natural language texts. Thus, paper [1] presents the application of classical logics, and paper [2] presents fuzzy logics applications. Papers [3] and [4] use the methods of machine learning and computer linguistics. Unfortunately, the authors do not know of works in which multi-valued logics are applied to the analysis of knowledge obtained from natural language texts, and therefore the authors do not claim the primacy of such an application.

We introduce some key basics of the theory of knowledge bases and description logics that will be used below in this article, which is continued [5]. Concepts are a tool for recording knowledge about the subject area to which they apply. This knowledge is divided into general knowledge of concepts and their interconnections and knowledge of individual objects, their properties, belonging to concepts, and relations with other objects. According to this division, knowledge written using the language of description logic is divided into a set of terminal axioms named TBox and a set of facts about individuals named ABox.

Let $CN = \{A_1, A_2, \dots, A_n\}$ and $RN = \{R_1, \dots, R_m\}$ — finite non-empty sets of atomic concepts (concept names) and atomic roles (role names), respectively. Then the syntax of AL -language (attribute language) can be defined in the following way [6].

Definition 1. A set of concepts of an attribute language AL is defined by induction:

— symbols \top (top, universal concept) and \perp (bottom, empty concept) are concepts;