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Analysis of Law Sentences based on Rhetorical Structure

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The IT technology is being applied in various fields of social life, and the age of an electronic society comes now. On the other hand, it is expected that we are damaged due to imperfection and defects of information systems, which are implemented based on the present technological level. To solve such problems, Katayama et al. proposed that they model electronic social systems and confirm whether the systems satisfy trustworthy conditions by proving logically or by simulating them. From this point of view, it is expected to examine and verify whether a law is made appropriately according to its purpose, there are no logical contradictions, it is consistent with related laws, and it is altered, added, deleted consistently for the revision. Law sentences are regarded as a kind of specifications which define information systems. We call such examination and verification Legal Engineering. As a research of Legal Engineering, we are conducting the research for translating legal sentences into logical representation.

Among researches which treat legal sentences, Tanaka reported that a legal sentence can be divided into a legal condition part and a legal effect part [Tanaka 1998]. For translating legal sentences into logical forms, [Ejiri et al. 2006, Kitada et al. 2006, Nobuoka et al. 2007, Nakamura et al. 2007] implemented a system which analyzes a legal sentence and translates it into the first-order logical representation with modal operators. This early system converts a sentence into a logical expression by analyzing surface information. However, logical structures of some sentences cannot be correctly captured only by surface information.

In this research, we consider rhetorical relations between clauses of a sentence. Rhetorical relations were originally studied for representing discourse structures [Mann & Thompson 1988]. Here, we adopt the idea to represent a semantic structure of a sentence. A sentence is divided into multi-units, semantic relations between units are viewed as rhetorical relations such as condition, purpose and justify, and a logical frame is derived from the unit structure. A final logical expression is obtained by applying the early system to each unit.

We linguistically investigate legal sentences (100 articles 296 clauses 347 sentences) of the National Pension Law. Rules for analyzing rhetorical structure were made from the investigation. First set of rules is used to divide a law sentence into multi-units. Second set of rules is used to decide a rhetorical relation according to language features. Third

set of rules is used to analyze a logical frame from rhetorical relations and a dependency structure of multi-units.

A unit is determined based on features such as particles, auxiliary verbs, predicates, and meaning classes of words. New rhetorical relations are added to analyze law sentences in addition to relations used by the rhetorical structure theory. A logical frame based on units shows a logical structure of a sentence. Each unit composing the logical frame is applied to the logical translation system and the final logical expression is obtained.

We experimented on unit segmentation, rhetorical relation analysis and logical frame analysis for National Pension Law (25 articles) and Income Tax Law (25 articles), which are not used to make rules. It is assumed that the input of each processing were correct. As a result, the precision of unit segmentation is 0.79, the precision of rhetorical relation analysis is 0.61, the precision of logical frame analysis is 0.73.