Abstract

This thesis investigates the expressive power and parsing complexity of the GRAMMATICAL FRAMEWORK (GF), a formalism originally designed for displaying formal propositions and proofs in natural language. This is done by relating GF with two more well-known grammar formalisms; GENERALIZED CONTEXT-FREE GRAMMAR (GCFG), best seen as a framework for describing various grammar formalisms; and PARALLEL MULTIPLE CONTEXT-FREE GRAMMAR (PMCFG), an instance of GCFG.

Since GF is a fairly new theory, some questions about expressivity and parsing complexity have until now not been answered; and these questions are the main focus of this thesis. The main result is that the important subclass *context-free* GF is equivalent to PMCFG, which has polynomial parsing complexity, and whose expressive power is fairly well known.

Furthermore, we give a number of tabular parsing algorithms for PMCFG with polynomial complexity, by extending existing algorithms for context-free grammars. We suggest three possible extensions of GF/PMCFG, and discuss how the expressive power and parsing complexity are influenced. Finally, we discuss the parsing problem for unrestricted GF grammars, which is undecidable in general. We nevertheless describe a procedure for parsing grammars containing higher-order functions and dependent types.

Keywords: *Grammatical Framework, generalized context-free grammar, multiple context-free grammar, context-free rewriting systems, type theory, expressive power, abstract syntax, linearization, parsing*