FAKULTÄT FÜR MATHEMATIK
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Einladung zur öffentlichen Defensio von

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Thema der Dissertation:

Dynamic Generalized Parsing and Natural Mathematical Language

Abstract: he dynamic generalized parser DynGenPar and its applications will be introduced. The parser is aimed primarily at natural mathematical language. It was also successfully used for several formal languages. DynGenPar is available at https://www.tigen.org/kevin.kofler/fmathl/dyngenpar/. The DynGenPar algorithm combines the efficiency of Generalized LR (GLR) parsing, the dynamic extensibility of tableless approaches, and the expressiveness of extended context-free grammars such as parallel multiple context-free grammars (PMCFGs). In particular, it supports efficient dynamic rule additions to the grammar at any moment. The algorithm is designed in a fully incremental way, allowing to resume parsing with additional tokens without restarting the parse process, and can predict possible next tokens. Additionally, it handles constraints on the token following a rule. These allow for grammatically correct English indefinite articles when working with word tokens. They can also represent typical operations for scannerless parsing such as maximal matches when working with character tokens.

Several successful applications of DynGenPar will be presented. DynGenPar is a core component of the Concise project, a framework for manipulating semantic information both graphically and programmatically, developed at the University of Vienna. DynGenPar is used to parse the formal languages defined by Concise, specifying type systems, programs, and record transformations from one type system to another. Other formal languages with a DynGenPar grammar are a modeling language for chemical processes, a proof-of-concept grammar for optimization problems using dynamic rule additions, and a subset of the AMPL modeling language for optimization problems, extended to also allow intervals wherever AMPL expects a number. DynGenPar can import compiled grammars from the Grammatical Framework (GF) and parse text using them. A DynGenPar grammar also exists for the controlled natural mathematical language Naproche. The use of dynamic rule additions to support mathematical definitions was implemented in a grammar as a proof of concept. There is work in progress on a grammar for the controlled natural mathematical language MathNat. Finally, there is also a well-working DynGenPar grammar for LaTeX formulas from two university-level mathematics textbooks. The long-term goal is to computerize a large library of existing mathematical knowledge using DynGenPar.

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