

An E-Learning Tool for Parsing-as-Deduction

Anika Westburg¹

Abstract: This paper presents the CL-Taskbox, an e-Learning tool for learning and teaching parsing-as-deduction, which is a specific approach to parsing. The tool provides parsing tasks the user solves with the help of constant visual feedback of the tool. The CL-Taskbox generates simple random tasks or allows to solve custom tasks, which the user can share and bookmark. The implementation is available online and anybody can use it with any common web browser.

Keywords: Computational Linguistics, e-Learning, context-free grammar, formal grammar, Parsing

1 Introduction

The CL-Taskbox is an e-Learning tool for parsing-as-deduction, which is a formalized approach to parsing with formal grammars in general [Pe83]. This approach formalizes parsing as a derivation. It defines the items that represent a step and the deduction rules which state how new items are generated from existing ones. It does not care about implementation details - the control structures are always the same, while the set of deduction rules defines the applied parsing algorithm. The tool makes the parsing-as-deduction approach observable and thus allows for general understanding how parsing works and how the different algorithms relate to each other. The tool is interesting for students of computational linguistics and computer science when they learn about parsing, compiler construction or similar.

2 Features

The CL-Taskbox is a web-based implementation that anyone can access via a common web browser from every device with internet access without the need to install additional software. Under guidance of the tool the user solves parsing-as-deduction tasks that the tool randomly generates on-the-fly. For instance the user requests a random task for the Shift-Reduce algorithm for context-free grammars and the tool generates a grammar with production rules "N0 -> t1, N0 -> t0 N0, N0 -> t0, S1 -> N0" and start symbol "S1" to parse the input "t0 t1" with.

¹ Heinrich-Heine-Universität, Allgemeine Sprachwissenschaft, Universitätsstr. 1, 40225 Düsseldorf,
anika.westburg@hhu.de

The exams of a parsing course might include similar tasks, hence the user can prepare for that as much and often as they want. At the moment the tool only generates simple grammars. On the other hand the user can insert a custom grammar and input and the URL reflects the task's data, so users can bookmark and share their favorite tasks or a lecturer can prepare tasks they want to show in a lesson or give their students to solve.

The user combines table items and production rules with the deduction rules to generate new table items. The tool highlights changing elements in green if the user can combine the element with the deduction rule or red if they cannot. Also the taskbox includes an automatic help system. The user can request that the taskbox uncovers the next step, solves the complete task or evaluates the result and says how many items out of all items the user generated. The tool Exorciser of ETH Zürich inspired the help system and the automatic task generation [Ts04].

Currently the CLTaskbox supports the following context-free parsing algorithms: Top-Down, Shift-Reduce, Left-Corner, Earley, CYK.

3 Outlook

The current implementation is a work in progress where the features named above have already been implemented, however, there is much more planned. The main feature to come is the generation of random tasks of several difficulty levels. As part of a dissertation the measurement of the difficulty of a task will be researched and the tool will collect usage data for analysis and evaluation.

More tasks for context-free grammars are to come: Left-Corner as Chart Version and Earley with passive items. Also tasks for tree-adjointing grammars and linear context-free rewriting systems will be implemented, concretely CYK and Earley for each. Also to make the tool widely available accessibility and mobile support are considered.

The tool is online hosted and accessible at [Da19].

Bibliography

- [Da19] Daleh, S.: CL-Taskbox, <http://samyadaleh.de>, Stand: 13.06.2019
- [Pe83] Pereira, F. C. N.; Warren, D. H.: Parsing as Deduction. In 21st Annual Meeting of the Association for Computational Linguistics, S. 137-144, 1983.
- [Ts04] Tschertner, V.: Exorciser - automatic generation and interactive grading of structured exercises in the theory of computation, ETH Zurich, 2004.