Karin Harbusch, Wolfgang Wahlster (editors)

Tree Adjoining Grammars
1st. International Workshop on TAGs:
Formal Theory and Applications

Dagstuhl-Seminar-Report; 2
15. - 17.8.1990 (9033)
Das Internationales Begegnungs- und Forschungszentrum für Informatik (IBFI) ist eine gemeinnützige GmbH. Sie veranstaltet regelmäßig wissenschaftliche Seminare, welche nach Antrag der Tagungsleiter und Begutachtung durch das wissenschaftliche Direktorium mit persönlich eingeladenen Gästen durchgeführt werden.

Verantwortlich für das Programm:
- Prof. Dr.-Ing. José Encarnação,
- Prof. Dr. Winfried Görke,
- Prof. Dr. Theo Härdter,
- Dr. Michael Laska,
- Prof. Dr. Thomas Lengauer,
- Prof. Ph. D. Walter Tichy,
- Prof. Dr. Reinhard Wilhelm (wissenschaftlicher Direktor).

Gesellschafter:
- Universität des Saarlandes,
- Universität Kaiserslautern,
- Universität Karlsruhe,
- Gesellschaft für Informatik e.V., Bonn

Träger:
- Die Bundesländer Saarland und Rheinland Pfalz.

Bezugsadresse:
- Geschäftsstelle Schloß Dagstuhl
  Informatik, Bau 36
  Universität des Saarlandes
  W - 6600 Saarbrücken
  Germany
  Tel.: +49 -681 - 302 - 4396
  Fax: +49 -681 - 302 - 4397
  e-mail: office@dag.uni-sb.de
First International Workshop
on
Tree Adjoining Grammars:
Formal Theory and Applications

organized by:
Karin Harbusch (DFKI, FRG)
Wolfgang Wahlster (DFKI, FRG)

Wednesday, August 15 - Friday, August 17
1990
Overview

Karin Harbusch, Wolfgang Wahlster

The topic of the workshop was a grammar formalism - the Tree Adjoining Grammars (TAGs) - which has interesting formal properties (e.g., mild context-sensitivity) as well as a wide range of application domains, especially in the field of natural language processing. Thus, it was very fruitful for the discussions to bring together researchers from both areas of interest in TAGs.

TAGs were introduced in 1975 by Joshi, Levy and Takahashi ([Joshi et al. 75]). To get a first intuition of the formalism - for a good introduction see [Joshi 85] - one can think of TAG rules as combined context-free rules building a context-free derivation tree. These trees are called initial trees. A second class of rules - the auxiliary trees - which are necessary for describing arbitrary large TAG-derivation trees - are characterized by a special nonterminal leave - the foot node) - in the context-free derivation tree which carries the same label as the root node. The adjoining operation replaces a nonterminal node in an initial tree (which can be modified by former adjoinings) by an auxiliary tree. This means that the incoming edge in the root node will end in the root node of the auxiliary tree and all outgoing edges of the eliminated node will start in the foot node of the auxiliary tree. Obviously a derivation tree results again.

To get an idea of such a grammar Figure 1 describes a fragment of a natural language grammar. The initial tree α can produce sentences like, e.g., “Children play” where “Children” is a lexical entry with the terminal category N and “play” is of category V. The auxiliary trees β1, β2 and β3 modify the NP node by a determiner, adjectives and relative clauses, respectively. The auxiliary trees β4 and β5 modify the verbal complex (VP) by a prepositional object (e.g., “with balls”) or a direct or indirect object (e.g., “tennis”).

The similarity with context-free grammars can lead to the conclusion that TAGs are simply an equivalent description for context-free grammars. But one important property of TAGs is that they are more powerful than context-free grammars (e.g., there exists a TAG for a^n b^n c^n or the copy language ww). This additional power is called mild context-sensitivity because not the complete set of context-sensitive languages is covered by TAGs (e.g., the languages a^n b^n c^n d^n e^n or the copy language www).

The TAG formalism was introduced as an adequate formalism for encoding natural language grammars referring to the property of mild context-sensitivity. There is strong evidence in the linguistic community that this is the right complexity for natural language description.

The workshop dealt with various problems in the formal area, e.g., extensions for the pure TAG formalism, automata models for the grammar representation or efficient parsing algorithms. Most investigations were motivated by specific applications (e.g., natural language parsing and generation, help systems).

In this interdisciplinary field of computer science, computational linguistics and
initial tree $\alpha$ :  

 auxiliary tree $\beta_1$ :  

 auxiliary tree $\beta_2$ :  

 auxiliary tree $\beta_3$ :  

 tree $\gamma$, which contains all adjoinings below the NP node of $\alpha$, is an intermediate state during incremental generation :  

 auxiliary tree $\beta_4$ :  

 auxiliary tree $\beta_5$ :  

 Figure 1: Example for adjoinings with the resulting sentence fragment 'The adjusting screw, which is under the cover, ...'
psycholinguistics the talks found interesting feedback and a lot of very fruitful discussions went on during the three days.

References


Acknowledgements

We want to thank the International Conference and Research Center for Computer Science (IBFI) for the financial support and the IBFI stuff for their assistance with arranging the workshop.

We want to thank the German AI Center (DFKI) for additional funding of our workshop. This made it possible to support people from overseas to attend the workshop.
List of Participants

Anne Abeillé, University of Paris 7 - Jussieu, France
Tilman Becker, University of Pennsylvania, USA
Bela Buschauer, DFKI, FRG
Jerome Chiffaudel, University of Paris 7 - Jussieu, France
Sharon Cote, University of Pennsylvania, USA
Koenraad DeSmedt, NICI - University of Nijmegen, Netherlands
Yonggang Guan, Universität des Saarlandes, FRG
Wolfgang Finkler, DFKI, FRG
Karin Harbusch, DFKI, FRG
Günter Hotz, Universität des Saarlandes, FRG
Mark Johnson, Brown University, USA
Aravind Joshi, University of Pennsylvania, USA
Gerard Kempen, NICI - University of Nijmegen, Netherlands
Anthony Kroch, University of Pennsylvania, USA
Bernard Lang, INRIA, France
David McDonald, Content Technologies, Inc., USA
Michael Palis, University of Pennsylvania, USA
Peter Poller, DFKI, FRG
Beatrice Santorine, University of Pennsylvania, USA
Yves Schabes, University of Pennsylvania, USA
Anne Schauder, DFKI, FRG
Stuart Shieber, Harvard University, USA
Kuniaki Uehara, Kobe University, Japan
K. Vijay-Shanker, University of Delaware, USA
Wolfgang Wahlster, DFKI, FRG
Program

Wednesday, August 15:
Welcome by Reinhard Wilhelm (IBFI) and Wolfgang Wahlster (DFKI)

Formal Properties of Synchronous Tree-Adjoining Grammars, S. Shieber
TAGs with Unification, B. Buschauer, P. Poller, A. Schauder, K. Harbusch
Metarules in Tree Adjoining Grammars, T. Becker
Multicomponent TAGs, D. Weir - Talk given by K. Vijay-Shanker
Embedded Pushdown Automata, K. Vijay-Shanker
TAGs by Interpreting Context Free Tree Languages, Y. Guan, G. Hotz

Thursday, August 16:
The systematic construction of Earley Parsers: Application to the production of an
$O(n^3)$ Earley Parser for Tree Adjoining Grammars, B. Lang
The Valid Prefix Property and Parsing Tree Adjoining Grammars, Y. Schabes Parallel TAG Parsing on the Connection Machine, M. Palis, D. Wei
Tree Adjoining Grammar, Segment Grammar and Incremental Sentence Generation, G. Kempen, K. DeSmedt
Incremental Natural Language Generation with TAGs in the WIP Project, W. Finkler
Implications of Tree Adjoining Grammar for Natural Language Generation, D. McDowland, M. Meteer

Friday, August 17:
Features in a Lexicalized TAG for English, Sharon Cote
A TAG analysis of the Third construction in German, Anthony Kroch, Beatrice Santorini, Aravind Joshi
French and english determiners: Interaction of morphology, syntax and semantics in Lexicalized Tree Adjoining Grammars, Anne Abeillé
Japanese Tree Adjoining Grammar and its Application to On-Line Help System NeoAssist, Kuniaki Uehara
Coordination in TAG in the manner of CCG (Combinatory Category Grammars): Fixed vs Flexible Phrase Structure, Aravind Joshi