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of the
Association for
Computational Linguistics**

Proceedings of the Conference

**24-27 June 1996
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PREFACE

On behalf of the Program Committee for ACL96 we are pleased to present you with this volume containing the papers accepted for presentation at the 34th Meeting of the Association for Computational Linguistics, June 23-28, 1996, at UCSC, Santa Cruz, California. This volume also contains the papers that were selected by the student program committee for presentation at the student poster session.

We received a gratifyingly large number of papers (many of them electronically without having to resort to subsequent hard-copy backups), and of unusually high quality. This, of course, made the program committee's job that much more difficult because of the number of papers needing to be read (25 - 30 each), but also because of the onerous task of having to choose between many equally interesting and convincing papers. The encouraging response we had to our request in the call for a wider range of papers also resulted in greater demands on the reviewing process, requiring an unusually wide range of expertise. The hard work of the authors and the committee have produced the stimulating document before you, a broad selection of much of the best work in the field.

Special praise goes to our outstanding invited speakers, Mike Tanenhaus and Hiyan Alshawi, who have begun a new precedent by including written versions of their talks in the proceedings. We thank Johanna Moore, the tutorial chair, who put together an excellent slate of tutorial instructors: Alison Cawsey, Larry Fagan, Bonnie Webber, Ido Dagan, Eduard H. Hovy, Kevin Knight, Alex Lascarides, and Ann Copestake, whom we also thank for preparing their alluring and informative tutorials. We are very grateful to Mettina Veenstra and Christy Doran, the student session co-chairs, who ably organized the student poster session. In addition, we are most appreciative of the exemplary job performed by Doug Appelt and Geoffrey Pullum, the local arrangements co-chairs, who have provided us with our delightful "California" experience.

Our hard working program committee and the additional external reviewers cannot be thanked too much for the conscientious and painstaking job they performed in reviewing a prodigious number of papers which covered a wide spectrum of topics. They are also to be commended for the professional judgment that they brought to the program committee meeting in Philadelphia which made it such a pleasant experience. Their names, and the names of the student session reviewers, are listed on the following page. In the interests of including a somewhat larger number of clearly acceptable papers, the committee decided to experiment with a new organization format, namely parallel sessions. The ACL executive committee and the next program chair will be very interested in your feedback on these sessions and their organization as well as on the poster sessions organized by the students.

We are extremely grateful to Trisha Yannuzzi, who is the one person most responsible for handling the myriad tasks associated with the proceedings preparation, including our successful attempt at automating most of the electronic submissions process, the program committee meeting at the University of Pennsylvania, communications with authors and reviewers, and finally the submission of the proceedings itself to the publisher. She has been very ably assisted by Susan Deysher and by Mark-Jason Dominus, the implementer of our automated submission handler, to whom we also owe a debt of gratitude. In addition we thank the Institute for Research in Cognitive Science and the Department of Computer and Information Science at the University of Pennsylvania for providing internal financial support for both administrative and technical tasks related to this conference.

Finally, we would like to express our gratitude to Kathy McKeown and Priscilla Rasmussen, who as usual provided the consistent and efficient support and guidance that we have all come to rely on, and to the ACL Executive Committee.

Welcome to ACL96 at Santa Cruz!

Aravind Joshi and Martha Palmer,
Program Co-Chairs
May, 1996
University of Pennsylvania, Philadelphia, PA

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CONFERENCE PROGRAM

SUNDAY EVENING, 23 JUNE

7:00– 9:00 REGISTRATION

7:00– 9:00 RECEPTION

MONDAY, 24 JUNE

8:30–12:00 Tutorial registration

9:00–12:30 TUTORIAL SESSIONS

NLP for Health Care Applications

Alison Cawsey, Lawrence Fagan, and Bonnie Webber

Bilingual Word Alignment and Lexicon Construction

Ido Dagan

2:00– 5:30 TUTORIAL SESSIONS

Machine Translation

Eduard H. Hovy and Kevin Knight

Lexical Semantics: Where Linguistics Meets the Real World

Alex Lascarides and Ann Copestake

2:00– 6:00 Conference Registration

7:00–10:00 RECEPTION

TUESDAY, 25 JUNE

8:30– 5:00 Conference Registration

8:45– 9:05 OPENING REMARKS AND ANNOUNCEMENTS

9:05– 9:30 *Higher-Order Coloured Unification and Natural Language Semantics*

Claire Gardent and Michael Kohlhase

9:30– 9:55 *A Model-Theoretic Framework for Theories of Syntax*

James Rogers

9:55–10:20 *Noun Phrase Analysis in Large Unrestricted Text for Information Retrieval*

David A. Evans and Chengxiang Zhai

10:20–11:00 BREAK

11:00–11:25 *Morphological Cues for Lexical Semantics*

Marc Light

11:25–11:50 *From Submit to Submitted via Submission: On Lexical Rules in Large-Scale Lexicon Acquisition*

Evelyn Viegas, Boyan Onyshkevych, Victor Raskin and Sergei Nirenburg

11:50–12:15 *Integrating Multiple Knowledge Sources to Disambiguate Word Sense: An Exemplar-Based Approach*

Hwee Tou Ng and Hian Beng Lee

12:15– 1:45 LUNCH (Student Poster Sessions)

1:45– 2:50 INVITED TALK

Using Eye Movements to Study Spoken Language Comprehension: Evidence for Incremental Interpretation

Michael K. Tanenhaus

- 2:50– 3:30 *A Fully Statistical Approach to Natural Language Interfaces*
Scott Miller, David Stallard, Robert Bobrow and Richard Schwartz
- 3:15– 3:40 *A Robust System for Natural Spoken Dialogue*
James F. Allen, Bradford W. Miller, Eric K. Ringger and Teresa Sikorski
- 3:40– 4:20 **BREAK**
- 4:20– 4:45 *Combining Trigram-Based and Feature-Based Methods for Context-Sensitive Spelling Correction*
Andrew R. Golding and Yves Schabes
- 4:45– 6:30 **STUDENT POSTER SESSION AND RECEPTION**
See separate student session program.

WEDNESDAY, 26 JUNE

Parallel Session Ia

- 9:05– 9:30 *Efficient Normal-Form Parsing for Combinatory Categorical Grammar*
Jason Eisner
- 9:30– 9:55 *Another Facet of LIG Parsing*
Pierre Boullier
- 9:55–10:20 *Parsing with Semidirectional Lambek Grammar is NP-Complete*
Jochen Dörre
- 10:20–11:00 **BREAK**
- 11:00–11:25 *Computing Optimal Descriptions for Optimality Theory Grammars with Context-Free Position Structures*
Bruce Tesar
- 11:25–11:50 *Directed Replacement*
Lauri Karttunen
- 11:50–12:15 *Synchronous Models of Language*
Owen Rambow and Giorgio Satta

Parallel Session Ib

- 9:05– 9:30 *Coordination as a Direct Process*
Augusta Mela and Christophe Fouqueré
- 9:30– 9:55 *High-Performance Bilingual Text Alignment Using Statistical and Dictionary Information*
Masahiko Haruno and Takefumi Yamazaki
- 9:55–10:20 *An Iterative Algorithm to Build Chinese Language Models*
Xiaoqiang Luo and Salim Roukos
- 10:20–11:00 **BREAK**
- 11:00–11:25 *Pattern-Based Context-Free Grammars for Machine Translation*
Koichi Takeda
- 11:25–11:50 *A Polynomial-Time Algorithm for Statistical Machine Translation*
Dekai Wu
- 11:50–12:15 *SEMHE: A Generalised Two-level System*
George Anton Kiraz
- 12:15– 1:45 **LUNCH**
- 1:45– 2:50 **INVITED TALK**
Head Automata and Bilingual Tiling: Translation with Minimal Representation
Hiyan Alshawi

- 2:50– 3:30 *Parsing Algorithms and Metrics*
Joshua Goodman
- 3:15– 3:40 *A New Statistical Parser Based on Bigram Lexical Dependencies*
Michael John Collins
- 3:40– 4:20 BREAK
- 4:20– 4:45 *Two Sources of Control Over the Generation of Software Instructions*
Anthony Hartley and Cécile Paris
- 4:45– 5:10 *Chart Generation*
Martin Kay
- 5:10– 5:35 *Evaluating the Portability of Revision Rules for Incremental Summary Generation*
Jacques Robin
- 5:35– 6:30 FREE TIME
- 7:00–10:00 RECEPTION AND BANQUET
Presidential Address: Oliviero Stock

THURSDAY, 27 JUNE

Parallel Session IIa

- 9:05– 9:30 *Compilation of Weighted Finite-State Transducers from Decision Trees*
Richard Sproat and Michael Riley
- 9:30– 9:55 *Fast Parsing Using Pruning and Grammar Specialization*
Manny Rayner and David Carter
- 9:55–10:20 *An Efficient Compiler for Weighted Rewrite Rules*
Mehryar Mohri and Richard Sproat
- 10:20–11:00 BREAK
- 11:00–11:25 *Efficient Tabular LR Parsing*
Mark-Jan Nederhof and Giorgio Satta
- 11:25–11:50 *Magic for Filter Optimization in Dynamic Bottom-Up Processing*
Guido Minnen
- 11:50–12:15 *Efficient Transformation-Based Parsing*
Giorgio Satta and Eric Brill

Parallel Session IIb

- 9:05– 9:30 *Resolving Anaphors in Embedded Sentences*
Saliha Azzam
- 9:30– 9:55 *Functional Centering*
Michael Strube and Udo Hahn
- 9:55–10:20 *Mechanisms for Mixed-Initiative Human-Computer Collaborative Discourse*
Curry I. Guinn
- 10:20–11:00 BREAK
- 11:00–11:25 *A Prosodic Analysis of Discourse Segments in Direction-Giving Monologues*
Julia Hirschberg and Christine H. Nakatani
- 11:25–11:50 *An Information Structural Approach To Spoken Language Generation*
Scott Prevost
- 11:50–12:15 *The Rhythm of Lexical Stress in Prose*
Doug Beeferman

- 12:15–1:45 **LUNCH and STUDENT MEMBER LUNCH**
See separate notice on student member lunch
- 1:45–2:50 **ACL ANNUAL BUSINESS MEETING**
- 2:50–3:30 *An Empirical Study of Smoothing Techniques for Language Modeling*
Stanley F. Chen and Joshua Goodman
- 3:15–3:40 *Minimizing Manual Annotation Cost in Supervised Training from Corpora*
Sean P. Engelson and Ido Dagan
- 3:40–4:20 **BREAK**
- 4:20–4:45 *Unsupervised Learning of Word-Category Guessing Rules*
Andrei Mikheev
- 4:45–5:10 *Linguistic Structure as Composition and Perturbation*
Carl de Marcken
- 5:10–6:30 **FREE TIME**

TUTORIALS

NLP for Health Care Applications

Alison Cawsey, Herriot Watt University; Larry Fagan, Stanford University; and Bonnie Webber, University of Pennsylvania

Health care practitioners and their patients rely on Natural Language. But for health care payers, health care providers' insistence on using Natural Language seems to be a luxury, compared with their using fixed terminologies and non-NL formats. Given the parallel thrusts in health care towards outcomes-based practice and cost reductions, Natural Language may be a luxury that health care payers will reject unless the cost of its use can be reduced.

Efforts to develop and apply NLP techniques to health care delivery have been going on for the past 25 years, many of these efforts initiated and carried out by the health care providers themselves. Over this period, there have been many developments in both computational techniques and NLP research that are applicable to solving the Natural Language needs of health care. This tutorial will provide a review of issues and techniques, including: efforts to codify and link terminologies used in health care; how Natural Language information ("free text") becomes part of a patient's record, and input technology that can support it; symbolic and statistical techniques for extracting information from free text; and efforts to customize health care information to the specific needs of individual patients.

Bilingual Word Alignment and Lexicon Construction

Ido Dagan, Bar Ilan University

Bilingual alignment is the task of identifying corresponding segments in a bilingual pair of parallel texts, where one is the translation of the other. This tutorial will focus on alignment methods that identify correspondences at the word level. The output produced by these methods can be used for searching translation archives and for constructing domain-specific bilingual lexicons of the type needed for human and machine translation and for multi-lingual information retrieval.

The tutorial will include a short review of alignment methods and a detailed description of two practical word-level algorithms: (1) The word align algorithm by Dagan, Church and Gale, which consists of two components. The first learns a probabilistic bilingual lexicon, based on the IBM statistical translation models 1&2. The second finds an optimal alignment using a dynamic programming technique. (2) A version of the pattern-matching DK-Vec algorithm by Fung, which was developed for aligning languages with different alphabets, but is useful for any language pair. The algorithm handles incompatibilities between the two texts, such as skipping sections that appear in one of the texts and are missing in the other.

I will describe simple implementations of both algorithms in AWK, and demonstrate them on a pair of documents taken from the ACL European Corpus Initiative CD-ROM.

Lexical Semantics: Where Linguistics Meets the Real World

Alex Lascarides, University of Edinburgh; Ann Copestake, Stanford University

This tutorial focuses on the representation of lexical semantic information, and the links between this and other knowledge resources that are used during text processing. Our ultimate aim is to examine how words can be interpreted effectively in a discourse context. In particular, we consider how lexical processing should integrate and communicate with more open-ended pragmatic reasoning.

The tutorial will include an overview of several approaches to lexical semantics, including work by Fillmore, Nunberg, Clark, Levin, Pustejovsky, Schütze, Hobbs, and researchers involved in the ACQUILEX project. We concentrate on linguistic phenomena involving polysemy in various guises, since this is central to both theoretical work and also to the problem of building wide-coverage lexicons for practical work in NLP. We will illustrate the need to represent partial regularities in the lexicon, and discuss some approaches to formalizing defaults which allow for exceptions to lexical generalizations. This discussion will be grounded using examples of representations expressed in the LKB typed default feature structure language. We will examine the interrelationship between syntax and lexical semantics within lexicalist linguistic theories and illustrate some ways in which statistical and symbolic approaches can be effectively integrated. Finally, we will critically assess existing proposals for integrating lexical and pragmatic information.

Machine Translation

Eduard H. Hovy and Kevin Knight, USC/Information Sciences Institute

Machine Translation (MT) is one of the oldest large-scale applications of computer science. The need for MT continues to increase: in today's networked world, the need for systems to help humans read documents written in a variety of languages is constantly growing. But despite optimistic predictions in the 60's, and despite the fact that worldwide, over 50 companies perform or sell MT, MT technology is not yet capable of fully automated, high-quality, wide-domain performance. Moreover, evaluating systems and measuring the quality of MT remain problematic issues. Still, MT research continues to push the boundaries of the automation-quality-scope continuum. New techniques, such as statistics- and example-based methods, add new capabilities and possibilities to the older linguistics-based methods and theories. This tutorial covers the issues of MT, taking various perspectives and including both the older and the latest theories, techniques, and technology. Course topics include: the history and development of MT, the theoretical foundations of MT, traditional and modern MT techniques, newest MT research, the thorny questions of evaluating MT systems, current MT systems and technology on the market. The lecturers are actively involved in the construction of MT systems and the ongoing activities of the MT world at large.

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PREFACE TO THE STUDENT SESSION PAPERS

These proceedings include the extended abstracts for the poster presentations at the Student Session of the *34th Annual Meeting of the Association for Computational Linguistics*. The goal of the Student Session is to provide a forum for student members to present work in progress, rather than completed work, and to receive feedback from other members of the computational linguistics community, particularly senior researchers. The response to the ACL Student Sessions held during the previous years was very positive. The student authors consistently report that they find the Student Sessions valuable, and answers to questionnaires filled out by ACL members (most recently in 1995) indicate that the audiences find the sessions interesting and of high quality.

Last year, a new format was adopted on a trial basis. Instead of brief ten-minute presentations in parallel sessions, student authors had the opportunity to present their work in a special poster session. Answers to questionnaires indicate that this approach is appreciated by a majority of the respondents, although most of the student respondents showed a preference for talks or a combination of posters and talks over posters alone. This year, the poster format will be tried again and then re-evaluated. Thirty-two papers were submitted to the ACL Student Session in 1996 (as compared with forty-eight submissions last year), and we accepted fourteen of these. We thank all the authors for their submissions, and hope that the reviews provide constructive criticism and encourage them in their research.

We thank all of the reviewers for their detailed and often stimulating reviews of the submissions.

Student members of the ACL 1996 Student Session Program Committee: Johan Bos, *University of the Saarland*; Lidia Fraczak, *Université Paris-Sud*; Pamela Jordan, *University of Pittsburgh*; V. Křpāsundar, *SUNY at Buffalo*; Deryle Lonsdale, *Carnegie Mellon University*; Dragomir R. Radev, *Columbia University*; Stefan Riezler, *University of Tübingen*; Eric Ringger, *University of Rochester*; Frank Schilder, *University of Edinburgh*; Matthew Stone, *University of Pennsylvania*; Cynthia A. Thompson, *University of Texas at Austin*; Marc Verhagen, *Brandeis University*; Karen Ward, *Oregon Graduate Institute*; Cheng-Xiang Zhai, *Carnegie Mellon University*.

Non-student members of the Student Session Program Committee: Pierrette Bouillon, *ISSCO/University of Geneva*; Miriam Butt, *University of Stuttgart*; John Carroll, *University of Sussex*; Crit Cremers, *University of Leiden*; Bruce Croft, *University of Massachusetts*; Walter Daelemans, *University of Tilburg*; Douglas Jones, *University of Maryland*; Ellen Riloff, *University of Utah*; Giorgio Satta, *University of Padua*; Ed Stabler, *UCLA*; Leo Wanner, *University of Waterloo*.

Last year's Student Session chairs, Vasileios Hatzivassiloglou and Peter Heeman, were extremely generous with their advice. Finally, we thank Geoffrey Pullum for his help in finding an appropriate space for the poster session.

Mettina Veenstra, *University of Groningen*
Student Session Chair

Christine Doran, *University of Pennsylvania*
Student Session Vice-Chair

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