Survey of the State of the Art in Human Language Technology

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Cambridge University Press (Studies in Natural Language Processing) and Giardini Editori e Stampatori in Pisa (*Linguistica Computazionale* Volumes XII-XIII), Managing Editors: Giovanni Battista Varile and Antonio Zampolli, 1997, xx+513 pp; hardbound, Cambridge University Press ISBN 0-521-59277-1, £ 35; Giardini Editori ISBN 88-427-0018-5

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"We open our mouths and out flow words whose ancestries we do not even know. We are walking lexicons. . . We carry a museum inside our heads. . . I find this miraculous. I never cease to wonder at it." These words of Penelope Lively, appearing in Jean Aitchison's *The Language Web* (Cambridge University Press, 1997), economically portray our general feelings of awe vis-à-vis language. And now there is this 500-page volume (HLT in the sequel), sponsored by the Directorate General XIII of the European Union and the Information Science and Engineering Directorate of the NSF, offering a materialized version of this awe, in the form of an overview of the technology of human language at the close of twentieth century. Human language technology is a multidisciplinary enterprise, unifying methods from computer science, linguistics, electrical engineering, cognitive psychology, etc. Its major goal is to advance the quality of communication between humans and computers by arming the latter with proficiency in spoken and written language. HLT is the work of a committee and is intended as a comprehensive, definitive survey of all the important ingredients of this strategic field. Unfortunately, in this reviewer's opinion it does not wholly succeed in this endeavor. But the book does not fail badly or dramatically either. What we have here is a respectable venture which is useful but may fade (should I say sink) into oblivion in a couple of years from now. In other words, HLT is a book which does not seem to reserve itself a lofty place in the literature of computational language research—a pretty lamentable position to be in for a trial of this magnitude. So, what went wrong?

Before I take up that question let me note various points about HLT, including the fact that the complete book is available—or was available at the time of writing of this review—on the Web:[1]

1 Maybe this is considered typical nowadays (I know that the MIT Press also practices it for some books, albeit more carefully and sparingly) but I have some difficulty in understanding it. Surely, I would not mind—and in fact would regard it as an exalted effort—if the survey had only an electronic existence,

http://www.cse.ogi.edu/CSLU/HLTsurvey/HLTsurvey.html

Here is a list of chapters, with accompanying length figures:

1. Spoken Language Input (≈ 60 pp)
2. Written Language Input (≈ 30 pp)
3. Language Analysis and Understanding (≈ 45 pp)
4. Language Generation (≈ 25 pp)
5. Spoken Output Technologies (≈ 35 pp)
6. Discourse and Dialogue (≈ 25 pp)
7. Document Processing (≈ 25 pp)
8. Multilinguality (≈ 40 pp)
9. Multimodality (≈ 35 pp)
10. Transmission and Storage (≈ 15 pp)
11. Mathematical Methods (≈ 45 pp)
12. Language Resources (≈ 25 pp)
13. Evaluation (≈ 35 pp)

Each of these chapters opens with a profitable digest, written by an Editorial Board member and setting the stage for the more detailed contributions (in the form of sections) that follow it. Each section deals with the major successes, methods, and research problems of a particular special topic. Just to furnish an impression about the degree of granularity for an average chapter, here is a breakdown of sections for chapters 1, 3, and 6, respectively (excluding the chapter overviews and references):

Speech recognition

Signal representation

Robust speech recognition

HMM [Hidden Markov Model] methods in speech recognition

Language representation

Speaker recognition

Spoken language understanding

Sub-sentential processing

Grammar formalisms

without seeking the insignia of an estimable publisher as the Cambridge University Press. But HLT is published as a hardcover and then I cannot help but raise the question: Who will buy this book if it is within the comfortable reach of every graduate student and professor? Libraries maybe? Or research labs with dollars to disburse? Needless to say, these are queries for the CUP, not the editors of HLT. In any case, unless one has a weak spot for bound volumes, my natural suggestion would be not to buy the book but to make liberal use of the Web version.

Lexicons for constraint-based grammars

Semantics

Sentence modeling and parsing

Robust parsing

Discourse modeling

Dialogue modeling

Spoken language dialogue

The full catalog of contributors to HLT reads like *Who's Who in Language*. A brief and clearly one-sided list (after all there are about 100 authors) reflecting my research tastes would include Annie Zaenen, Hans Uszkoreit, Lauri Karttunen, Fernando Pereira, Hans Kamp, Per-Kristian Halvorsen, Karen Sparck Jones, Martin Kay, Aravind Joshi, Ronald Kaplan, and Ken Church. The authority of the contributors is one aspect of this volume about which no one need entertain doubt; HLT is the product of some of the best minds actively toiling in the trenches.

With so many top-notch researchers contributing to this book, one would surmise that the outcome would be no less than breathtaking. Alas, this does not happen. What one has instead is a boring and run-of-the-mill product which would hardly impress a person with just a broad acquaintance with the fields of NLP and speech processing. In stark contrast, *A Companion to the Philosophy of Mind* (edited by Samuel Guttenplan, Blackwell, 1994), another big book of similar nature and this time written by the brightest philosophers of mind, is one that I'm familiar with and is regarded as a towering success in philosophy circles. So such projects sometimes do reach their goals. To repeat my earlier question, what is the problem with HLT?

The regrettable state of affairs regarding HLT is due to mainly two reasons. First, approximately 23% of the book is devoted to references. Another 13% is dedicated to a glossary, an author index (which does not miss the opportunity to misspell Chomsky's first name, in the tradition of Murphy), and a subject index.[2] To make a long story short, only less than two-thirds of the book promise any hope to present something of substance.

However, and this is my second point, of the approximately 75 sections a great majority were written in nontechnical language, glossing over the details. Clearly there are some good contributions but they are in the minority.[3] More often than not what we have is a superficial review, giving rise to a premature whole.[4] My impression is that the editors did not do their homework well. I realize that it took them two years and half a dozen meetings to create the volume. As a result, some authors have really contributed quality pieces. Some others had the potential to write fine surveys but did not really deliver; their pieces were written way too hastily and this shows glaringly. It is

2 On a related note, Chapter 12 includes, obviously with good intentions, four pages of e-mail and homepage addresses for language resources such as written/spoken language corpora. The annoying thing about such time-sensitive material is that it is somewhat obsolete even at the time of galley proofs.

3 I've quite enjoyed the following sections: Robust speech recognition, HMM methods in speech recognition, Language representation, Sentence modeling and parsing, Dialogue modeling, (Human-aided) machine translation: a better future, Statistical modeling and classification, Parsing techniques. (This list is not exhaustive.)

4 For example, I've found the following sections of doubtful quality: Handwriting analysis, Grammar formalisms, Semantics, Discourse and dialogue (overview), Discourse modeling, Finite state technology, Written language corpora, almost all parts of Chapter 13. (Again, this is not an exhaustive list.)

as if these sections were scribbled while their authors were working on more important things such as journal articles or conference papers; it is so obvious that they did not devote themselves to the task at hand with veracity. (So the Editor in Chief's words, "each author's contribution was carefully reviewed and revisions were requested," must be taken with a grain of salt.)

Overall, I wish the editors took the time to prepare a more polished product for publication by the CUP. In the meantime, the web version of the book could have been perused anyway. Furthermore, this would be a pleasant opportunity to canvass the language technology community in general about their views of the book. In fact, if planned well, there is promise here for a higher quality second edition, provided that a more leisurely (read slow-paced) and conscientious approach as hinted above is adopted. It is fair to note that the Managing Editors insinuate at the same point when they say "...comments received from our readers will encourage us to edit updated and improved versions of this work."

Nowadays almost all documents come with some kind of executive summary. What is it going to be in the case of this review? Well, I've already remarked that HLT is the work of a committee. So, remember that chestnut about camels and committees? It says it all.

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