Computing Meaning, volume 1

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Manipulating meanings of natural language texts and utterances is one of the main objectives of any large-scale NLP system. However, at present there is no general theory that explains what natural language meanings precisely are, and how they are to be effectively computed for purposes of practical NLP. Moreover, in the first place there is not even an overall agreement as to a general notion of "meaning" that is computationally relevant. Two prominent approaches to the question can be recognized.

1. The machine learning approach: In this view, meanings should be defined according to whatever representation practical NLP systems find useful. For instance, if a system is to extract travel information from free text, then meanings in this context can be defined as records in a database containing fields such as "destination", "time of arrival", "means of transportation", etc. Such a representation has to be defined ad hoc for any relevant purpose, but the mapping from natural language to this formal representation is performed automatically using general learning algorithms.
2. The formal semantics approach: According to this line, meanings are logical objects and should be manipulated using logical tools. Work in the formal-semantic school that developed from Montague grammar specifies the logically relevant parts of meaning and how to derive them from a natural language input, while the field of computational semantics deals with the algorithmic realization of these formal techniques as NLP systems.

The volume under review is a collection of 16 articles that adopt the second view as their starting point. In a clear and instructive introduction, the editors present an overview of the formal approach to the computation of meaning, illustrate it using a small calculus, and discuss a number of general problems for this approach. Of special importance is the ambiguity problem: the spurious multiplicity of meanings that even the most sophisticated syntactic and semantic theories derive. The construction of underspecified representations of meaning, which is one of the prominent techniques for tackling the ambiguity problem, is addressed from different angles by five of the articles in the volume. Another prominent issue in computational semantics is the dynamic nature of many natural language phenomena, especially those related to anaphora and presupposition. Six articles in this volume address dynamic semantics from different perspectives. The other articles in the book deal with different topics in semantics: compositionality, speech events, belief utterances, motion verbs, and the interpretation of German compounds.

These topics are vast and highly varied, and a fair description of even the core ideas in these papers is impossible within the space limits of this review. (A good overview of the articles in this volume can be found in the introduction.) Many of the works have important implications for formal semantics or theoretical linguistics, but those papers that are most relevant for computational linguistics are those that succeed in extending an existing computational framework to treat phenomena that it had not previously handled. One such contribution is the paper by Richter and Sailer, who develop an underspecified semantics in HPSG. Of similar significance is an interesting paper by Van Genabith and Crouch, who give a semantics of cross-sentential anaphora using LFG glue language semantics. Other papers would be of interest mainly to theoretical linguists or to logicians and philosophers of language. Good examples of works of the first kind are a paper by Ginzburg on ellipsis resolution and a paper by Stone and Hardt on the anaphoric properties of modals. Examples of more logically oriented papers are the contribution by Meyer Viol et al. on the use of epsilon terms for underspecified semantics and the paper by Asher and Fernando on underspecification using labeled representations. Although these works do not give algorithmic implementations of their ideas, they include enough formal details to make small but illustrative computer applications feasible. The book also contains two articles of a more programmatic nature: on underspecified semantics (by Pinkal) and on compositionality and minimum description length (by Zadrozny). These works and others would be of interest to any researcher occupied with problems of natural language semantics from a formal or computational perspective.

It is also important to make clear what the book does *not* include:

- It does not provide a unified framework. To understand many of the proposals in this book, the reader has to become familiar with a considerable number of notations, techniques, and theoretical standpoints, sometimes with no real justification for this variety.
- The book does not contain contributions that would be of direct relevance to the NLP engineer who is especially interested in the development of practical "real-world" applications.

In general, the editors did a good job in projecting a collection of works representing the state of the art in computational semantics. The book contains material that will be of value especially to experts in this field. However, most of the papers in the volume will also be relevant to researchers from other branches of computational linguistics who are interested in theoretical aspects of the computation of meaning in natural language.

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