Recognizing Textual Entailment: Models and Applications

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Recognizing textual entailment (RTE) has been proposed as a task in computational linguistics under a successful series of annual evaluation campaigns started in 2005 with the Pascal RTE-1 shared task. RTE is defined as the capability of a system to recognize that the meaning of a portion of text (usually one or few sentences) entails the meaning of another portion of text. Subsequently, the task has also been extended to recognizing specific cases of non-entailment, as when the meaning of the first text contradicts the meaning of the second text. Although the study of entailment phenomena in natural language was addressed much earlier, the novelty of the RTE evaluation was to propose a simple text-to-text task to compare human and system judgments, making it possible to build data sets and to experiment with a variety of approaches. Two main reasons likely contributed to the success of the initiative: First, the possibility to address, for the first time, the complexity of entailment phenomena under a data-driven perspective; second, the text-to-text approach allows one to easily incorporate a textual entailment engine into applications (e.g., question answering, summarization, information extraction) as a core inferential component.

Given the large interest in RTE, a book on the topic is very much welcome. The book satisfies at least two needs in the community. On the one hand, it was time to collect and organize a large amount of research and publications produced in the last decade or so. Under this perspective a particular merit of the book is to set a homogeneous and general descriptive framework under which different approaches can be reported and compared with a uniform conceptual schema. On the other hand, after a decade of research in the field, it is the right time to open the discussion both to the results that have been achieved and to future challenges in RTE. With this perspective the book targets not only people interested in textual entailment but people interested in semantic inference and semantic processing at large, intended as a core capability of natural language understanding. Researchers working in related areas such as textual similarity, causality, and temporal reasoning, just to mention a few, may benefit from this monograph.

The book is organized into six chapters, covering RTE motivations, task definitions, approaches and data-driven methodologies, relevant case studies, knowledge acquisition for RTE and, finally, future research perspectives.

Chapter 1 provides the necessary context on textual entailment and RTE. Even a reader not familiar with the field can find in this chapter motivations, definitions, many

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examples, a complete report on the RTE evaluations with their data sets, and pointers to a large variety of applications. The chapter also tries to state both commonalities and differences between the "textual" and the "logical" notion of entailment. I found this part somehow less elaborated and less convincing, particularly because the authors seem to consider logics only for deductive argumentation, where the conclusion from one or more premises is true in every circumstance. Actually, logics have elaborated theories of probabilistic argumentation where the conclusion has different degrees of plausibility, as the textual entailment definition suggests.

Chapter 2 introduces architecture and approaches proposed for recognizing textual entailment. The goal of the chapter is to show the complexity of the RTE task and to provide the main options that have been investigated to date. Chapter 3 is really the core of the book, as it provides a general conceptualization of the RTE task based on alignments between the two texts at different levels (token, lexical, syntactic, etc.). The chapter considers three steps in the process: first, candidate alignments are established between the two portions of text; then, the more promising alignments are selected; and, finally, an entailment decision is taken based on classification, possibly using a machine learning algorithm. Very useful, this chapter provides enough background on machine learning that even the non-familiar reader can get oriented in the technical description.

Chapter 4 presents several case studies about RTE systems. This is an interesting and complete overview, which includes, among others, systems exploiting edit distance, logical representation and inference, several kinds of transformations between the two portions of text, alignment-focused approaches (where alignment is seen as a part of the inference process), and, finally, ensemble systems (i.e., systems that combine other entailment systems). Chapter 5 focuses on knowledge resources for textual entailment, providing an exhaustive overview both on the use of existing lexical resources (e.g., WordNet) and on methodologies for the automatic acquisition of entailment rules, including recent work based on distributional similarity methods and acquisition from parallel and comparable corpora. The chapter does not avoid a final discussion on problematic aspects of the use of knowledge resources for textual entailment, particularly considering that, despite the fact that a huge number of entailment rules has been acquired and managed by different systems, their impact on performance is still debated in the community. The last chapter of the book discusses research directions in RTE, pointing out the fundamental role of high-quality pre-processing (e.g., parsing, semantic role labeling) in natural language processing, as well as the need for a shared software environment (e.g., an open-source platform for textual inferences) in order to increase replicability and comparability of approaches.

Overall, the book provides a very good overview of research on textual entailment, where state-of-the-art approaches and systems are clearly presented and compared with the help of a common conceptual schema, with many examples and bibliographical references and, when necessary, providing technical details. The book indubitably covers a need of the RTE community, and will be a reference for students and researchers approaching this field. Although the book addresses almost all of the RTE work so far, there are a few aspects for which, stimulated by the book itself, the reader more familiar with the topic would have expected more discussion. The first aspect concerns the relation between text similarity and textual entailment, which is somehow latent throughout the book (Chapter 3 presents similarity features for the task), although not explicitly addressed. As semantic text similarity (STS) in the last years has been quite successful, and as there are evident overlaps between RTE and STS systems, a discussion about the potential interactions among these communities would have been useful. There is a second aspect that might have required a deeper discussion. Although

recognizing textual entailment, at least in the perspective suggested by the book, requires the capability to establish meaningful alignments between two portions of text, the book devotes little space to opposite phenomena, namely, discovering reasons for non-entailment, or for strong dissimilarities. The impression is that contradiction detection is not yet completely integrated within the RTE data-driven conceptual framework (not surprisingly, the topic is mentioned in the case study on natural logic in Chapter 4) and that further investigation is necessary in the future.

It is evident that the main source of inspiration for the book is the activity around RTE evaluations in the last ten years, yet this book goes well beyond being simply a summary of what has happened. The reader interested in potential future research directions in textual entailment will certainly appreciate the generic architecture presented in Chapter 2, the alignment-based conceptualization of the RTE task presented in Chapter 3, the open perspectives of Chapter 6, and, finally, the huge bibliographical selection. Overall, this book is very well positioned to measure both the maturity and the future ambitions of an important research area in computational linguistics.

This book review was edited by Pierre Isabelle.

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