Book Review

Negation and Speculation Detection

Noa P. Cruz Diáz and Manual J. Maña López
(University of Huelva)

John Benjamins (Natural Language Processing, 13), ix+95 pp; hardcover, ISBN 9789028202178, USD 143.00, EUR 95.00; paperback ISBN 9789027202161, USD 49.95; EUR 33.00; e-book, ISBN 9789027262950, https://doi.org/10.1075nlp.13

Reviewed by
Roxana Girju
University of Illinois at Urbana-Champaign

Negation and speculation are fundamental elements of language and logic being studied in a variety of fields, including philosophy, logic, and psychology, as well as linguistics and computational linguistics. They are core components in information fact-checking and other applications (Morante and Sporleder 2012). In fact, natural language abounds in negative expressions (i.e., to encode "An act of denial; a negative statement, doctrine, etc.; a refusal or contradiction; a denial of something." [OED 1989]) and speculative devices (i.e., to encode "a conclusion, opinion, view, or series of these, reached by abstract or hypothetical reasoning" [OED 1989]) at different linguistic levels (i.e., lexical, morphological and syntactic, semantic, pragmatic, and prosodic). Negation and modality (a category of linguistic meaning underlying the expression of possibility and necessity [Fintel 2006]) are two of the most discussed phenomena within linguistics, and more recently in natural language processing (NLP) (Morante and Sporleder 2012). Negation and speculation (usually encoded through modal devices) are particularly challenging for NLP not only because they add additional meaning and structure to process, but also because there are many different ways to express such linguistic phenomena.

A common task in NLP is to extract, infer, and make sense of facts from the world around us—that is, to uncover factual information from text. Popular applications like information extraction and text mining have attracted considerable attention in and beyond the community with the purpose of populating large ontologies and using them for fact-checking (Cohen, Hamilton, and Turner 2011). Within this context, speculative language plays a particular role as it reflects the attitude of the writer/speaker toward the truth value of certain facts.

This short book by Cruz Diáz and Maña López is a nice introduction to negation and speculation in linguistics and natural language processing, covering a wide range of key aspects from theory (definition and classification types) to practice (annotated corpora and automatic models of negation and speculation detection). The book is targeted toward students of computational linguistics and researchers with adequate background in NLP and machine learning as well as software engineers interested in available resources for research and development. The authors do a good job addressing the main issues, thus filling an important gap in the computational linguistics field: the lack of surveys and literature review on various aspects of language and language

https://doi.org/10.1162/coli_r_00365

processing. As in many academic disciplines, evaluation and synthesis of prior research have become imperative in keeping up with the exponentially growing scientific literature. To this we should also add new technology and trends hitting the language technology market today. Such surveys are crucial in assisting students, academics, researchers, and end-users in quickly finding, evaluating, and synthesizing a broad content landscape encapsulating all the essential developments on the topic.

The book consists of six chapters, each chapter addressing a single specific topic. Although the specific chapters on negation and speculation are (almost) self-contained, the rest of the book is logically connected, through applications, resources, and future trends. Chapters 2–5 follow a similar structure, with content relevant to the chapter's topic, ending with two subsections on summary and conclusions, and future reading and relevant resources. In Chapter 1 the authors briefly introduce the linguistic phenomena of negation and speculation, drawing attention to their importance as well as to inherent challenges in linguistics and NLP. They also overview applications that can benefit from the detection of such linguistic devices.

Chapters 2 and 3 form the core sections, covering about half of the book's content. Both chapters introduce a few linguistic taxonomies of various types of negation and speculation with some reference to relevant linguistic literature. These theoretical aspects are then followed by a comprehensive review of computational linguistics works focusing on models, corpora, and other resources used in the automatic detection of negation and speculation. Although the reader would appreciate the briefly introduced computational approaches according to various genres, languages, and types of modeling (from rule-based to machine learning and hybrid approaches), the chapters provide only a short reference to specific research work without much comparative analysis of the models discussed. Such comparison is necessary to understand which models work better, how they do so, and in what settings. Moreover, the authors do not provide a clear connection between the linguistic classes of negation and speculation and the computational models of these devices. There is no doubt that newcomers to these topics will appreciate such a comprehensive survey of computational approaches. However, it would have benefited the reader if a case study or detailed analysis was included for negation and speculation with a discussion of the model, data, experiments, and comprehensive results.

In the second part of the book, which includes Chapters 4 and 5, the authors discuss various tools and applications that can benefit from negation and speculation detection, and summarize a set of relevant resources for those interested in building them. Whereas the subsections on automatic detection are comprehensive and informative, those on chapter summary and conclusions, and future reading and relevant resources, are very short and uninspiring. The book ends with a discussion of the key challenges in this domain followed by some trends and possible future developments.

In summary, the book should be considered a quick reference guide to research on automatic detection of negation and speculation in language, as it provides a valuable introduction to these topics, covering relevant theory, computational models, applications, and resources. However, given the effort involved in writing research surveys and the impact they should have on the community, this book should be a reference point for the scholar who wants to get a flash overview of the covered topic in linguistics and computational linguistics, as well as a good starting point for future discussions in NLP on potential developments. This is one of the aspects this book does not address well.

First, the definition of negation used here is limited to a clearly demarcated linguistic phenomenon whose purpose is to reverse the polarity of a sentence or its parts (i.e., sentential negation *not*, as in "A is NOT B" constructions). Indeed, in the logical tradition, as Givón (1989) noted, negation is simply defined as a truth-value operator.

However, he argues that, when it comes to language, negation is much more than that, and that a real understanding of the concept must take contextual factors into account (Givón 1989). More recent research in linguistics has shown that the nature of negation finds itself at the crossroads between truth-value operator and speech act (e.g., the speaker adds to the utterance a belief or attitude toward certain phenomena of reality), where the purpose of negation is often to produce meanings beyond the one of a reversed affirmation "it is not the case that X" (Roitman and Birkelund 2017). Additionally, because most of the research in linguistics and computational linguistics has focused on the negative form *not* and the like, we do not know much about how other expressions of negation are processed, understood, and used computationally. The authors are right in saying that negation and speculation detection are popular yet still emerging topics in NLP. However, it would have been nice to see a more in-depth discussion on possible ways the community can and should extend the scope of research beyond the mere presence or absence of negation and speculation cue words or phrases.

Second, the book does not cover relevant and important applications, domains, or tasks like dialogue systems and fact-checking (i.e., truth and deception detection), which have received considerable attention in recent years not only in academia but also in the industry (Chen et al. 2017; Thorne and Vlachos 2018; Vosoughi, Roy, and Aral 2018). The narrow definitions of negation and speculation as well as the many computational detection models introduced here might or might not apply to these application domains. Most of the linguistic and computational examples presented in this book rely on research articles and biomedical text as data, yet there is minimal discussion about the implications of these theories and models to other genres like dialogues, social media, and legal text.

In summary, this book is a good reference for most works on negation and speculation detection in linguistics and computational linguistics, and, hopefully, a starting point for discussion in the NLP community. This is an important area of research and I look forward to the exciting breakthroughs it will bring.

References

Chen, Hongshen, Xiaorui Liu, Dawei Yin, and Jiliang Tang. 2017. A survey on dialogue systems: Recent advances and new frontiers. *ACM SIGKDD Explorations Newsletter Archive*, 19:25–35.

Cohen, Sarah, James T. Hamilton, and Fred Turner. 2011. Computational journalism. *Communications of the ACM*, 54(10):66–71.

Fintel, Kai Von. 2006. Modality and language. In D. Borchert, editor, *Encyclopedia of Philosophy*. Macmillan Reference, pages 20–27.

Givón, Talmy. 1989. *Mind, Code, and Context: Essays in Pragmatics*. Psychology Press; 1st edition.

Morante, Roser and Caroline Sporleder. 2012. Modality and negation: An introduction to the special issue. *Computational Linguistics*, 38(2):223–260.

OED. 1989. *Oxford English Dictionary*. Oxford University Press.

Roitman, Malin and Merete Birkelund. 2017. *The Pragmatics of Negation: Negative Meanings, Uses and Discursive Functions*. John Benjamins Publishing Company.

Thorne, James and Andreas Vlachos. 2018. Automated fact checking: Task formulations, methods and future directions. In *Proceedings of the 27th International Conference on Computational Linguistics*, pages 3346–3359.

Vosoughi, Soroush, Deb Roy, and Sinan Aral. 2018. The spread of true and false news online. *Science*, 359:1146–1151.

Roxana Girju is professor of computational linguistics at the University of Illinois, Urbana-Champaign. Her research interests are mainly in natural language processing, especially semantics and pragmatics with application to affective computing and behavioral analytics. Her e-mail address is girju@illinois.edu.