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# Multilingual Joint Parsing of Syntactic and Semantic Dependencies with a Latent Variable Model

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[James Henderson](#), [Paola Merlo](#), [Ivan Titov](#) and [Gabriele Musillo](#)

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showing that the successful recovery of the meaning of text requires structured analyses of both its grammar and its semantics. In this article, we report on a joint generative history-based model to predict the most likely derivation of a dependency parser for both syntactic and semantic dependencies, in multiple languages. Because these two dependency structures are not isomorphic, we propose a weak synchronization at the level of meaningful subsequences of the two derivations. These synchronized subsequences encompass decisions about the left side of each individual word. We also propose novel derivations for semantic dependency structures, which are appropriate for the relatively unconstrained nature of these graphs. To train a joint model of these synchronized derivations, we make use of a latent variable model of parsing, the Incremental Sigmoid Belief Network (ISBN) architecture. This architecture induces latent feature representations of the derivations, which are used to discover correlations both within and between the two derivations, providing the first application of ISBNs to a multi-task learning problem. This joint model achieves competitive performance on both syntactic and semantic dependency parsing for several languages. Because of the general nature of the approach, this extension of the ISBN architecture to weakly synchronized syntactic-semantic derivations is also an exemplification of its applicability to other problems where two independent, but related, representations are being learned.


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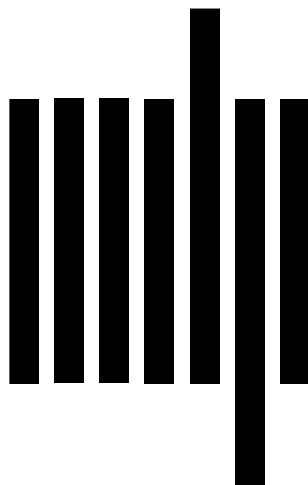
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


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