FORUM

Learning generative probabilistic grammars for sequential behaviors.

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Abstract

We introduce a set of biologically and computationally motivated design choices for modeling the learning of language, or of other types of sequential, hierarchically structured experience and behavior, and describe an implemented system that conforms to these choices and is capable of unsupervised learning from raw natural-language corpora.

Given a stream of symbolic input (transcribed text or birdsong), our model incrementally learns a grammar that captures its statistical patterns, which can then be used to parse or generate new data. The grammar constructed in this manner takes the form of a directed weighted graph, whose nodes are recursively (hierarchically) defined patterns over the elements of the input stream.

We evaluated the applicability of the model to natural language in seventeen experiments, grouped into five studies, which examined, respectively (i) the generative ability of grammar learned from a corpus of language; (ii) the characteristics of the learned representation; (iii) sequence segmentation and chunking; (iv) artificial grammar learning; and (v) certain types of structure dependence. The model's performance largely vindicated our design choices, suggesting that progress in modeling language acquisition can be made on a broad front --- ranging from issues of generativity to the replication of human experimental findings --- by bringing biological and computational considerations, as well as lessons from prior efforts, to bear on the modeling approach.

To demonstrate the generality of this approach to modeling sequential behavior, I shall also describe briefly its application to the analysis of birdsong.

Joint work with Oren Kolodny and Arnon Lotem, Tel Aviv University.

Host: Hiro. Nakahara Lab for Integrated Theoretical Neuroscience
Research Center for Statistical Machine Learning, ISM