Symposium: New Models of Connectionist Language Acquisition

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Connectionist modeling of language acquisition has attracted strong research interests in the past decades since Rumelhart & McClelland's (1986) pioneering model of the acquisition of the English past tense. Significant progresses have been made in this domain, as reflected in Elman et al. (1996), MacWhinney (1999), and more recently in Quinlan (2002). In this symposium, we propose to integrate current connectionist developmental research related to language. We present to CogSci 2002 a variety of new models in connectionist language acquisition, including an SRN model of generalization (Elman), a self-organizing model of categorical representation (Li, Farkas, & MacWhinney), and an encoder network of concept acquisition (Shultz).

In the first talk entitled "Going beyond the input: the problem of generalization from sparse data", Elman will discuss the issue of how children form generalizations given the inputs available to them. Although in quantitative terms children hear an enormous amount, that input provides only a very sparse representation of the language. Given the presence of numerous gaps in the input, how is a child to know when a gap is accidental and when a gap is systematic? Several connectionist simulations suggest the kinds of constraints on induction that may explain the patterns of both under- and over-generalization that are observed in children.

In the second talk entitled "The origin of categorical representation of language in the brain", Li, Farkas, and MacWhinney will start by considering the "brain centers" of language, areas in the brain that respond to different linguistic categories (e.g., nouns and verbs). A working hypothesis underlying "brain centers" is that different linguistic categories are subserved by different neural substrates. This study examines the emergence of categorical representation from a developmental connectionist perspective. It argues that localized linguistic representations arise as a function of the brain's organization and reorganization in response to characteristics of the environment in learning and development. A self-organizing neural network is used to explore the high-dimensional space of various linguistic categories, analyzing realistic natural language data. The model effectively captures such differences in language use.

In the third talk entitled "Acquisition of crisp and fuzzy concepts", Shultz will discuss concept acquisition by neural networks. Crisp concepts possess such rigid boundaries that instances of one concept are rarely confused with another concept. In contrast, fuzzy concepts have vague boundaries, leading to frequent misclassifications. The feature values of fuzzy concepts are considered probabilistic in that they occur in instances with less than certain probabilities. This generates well-known typicality and prototype effects, with some instances considered better exemplars of a fuzzy concept than others are. Although neural network models provide an adequate account of fuzzy concepts, they are, according to some, incapable of accounting for the acquisition and representation of crisp concepts as in, e.g., kinship terms. Simulations with encoder networks show that this view is fundamentally incorrect: encoder networks can account for a wide range of phenomena associated with concepts along the crisp-fuzzy continuum. Representational crispness in these networks is affected by isolation of the concept in semantic feature space and dispersion of its examples around a prototype. Fuzzier concepts are characterized by residence in a relatively crowded region of feature space and by relatively widely dispersed examples; crisper concepts are characterized by residence in a relatively isolated region of feature space and by relatively limited dispersion of examples. Moreover, the presence of defining features immunizes these networks against the normal *fuzzying* effects of conceptual crowding and example dispersion. Simulations also revealed the familiar developmental shift from characteristic to defining features.

Li will give an overview at the beginning of the symposium, and MacWhinney will provide an integrative discussion at the end. Each talk is scheduled for 25 minutes, including discussion and questions from the audience.

Acknowledgments

References

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