Miniature Language Acquisition Tasks Using Dynamic Weightless Systems

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ABSTRACT

The GNU weightless Artificial Neural Network (ANN) [2] has properties which are important for the modelling of language acquisition in humans. One property, described in this paper, is the ability to successfully learn associations between symbols that have been embedded in large amounts (up to 85%) of random noise.

The "Symbol Grounding Problem" has figured large in language acquisition research for many years, and it was noted by Harnad [3], that connectionist methods might be employed to make feasible a solution to this problem.

Work is under way to model acquisition of perceptually grounded symbols, and folk physics, (common sense interaction with the physical world), using dynamic recurrent weightless systems [6]. This paper examines a simple example of acquisition tasks using weightless systems.

The system whose behaviour is investigated here is a GNU (General Neural Unit), constructed using multiple GRAM's (Generalising RAM's) [1]. There are many results for this system, e.g., Ntourtouflis' work, [4], but the behaviour of the system in language acquisition tasks has not been investigated before. The properties investigated here are directly relevant to our approach to the study of language acquisition (outlined in [5]).

Experiments were carried out using simulated recurrent GNU's, composed of between 4 and 8 GRAM's. Simple 4 and 8 step sequences were easily learned by the networks. The sequences were then interspersed, first with noisy versions of themselves, then with randomly generated noise. The networks still learned the sequences with 100% accuracy, even when correct sequences composed only 15% of the total training inputs. Individual steps in the sequences were then dispersed through a long sequence of random noise, but the networks still succeeded in learning the sequences with 100% accuracy, with only about 10% of the training inputs being relevant.

Such properties are important to our model of language acquisition, because they are exactly the kind of learning processes one could expect children to go through, when first learning the simple connections between nouns and referents. Many parts of linguistic input are essentially ignored or incompletely understood, but the child understands that whenever "horse" is used indicatively, there will be a horse present.

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