Quantitative Biology > Neurons and Cognition

Minimal model of associative learning for cross-situational lexicon acquisition

Paulo F. C. Tilles, Jose F. Fontanari

(Submitted on 6 Apr 2012)

An explanation for the acquisition of word-object mappings is the associative learning in a cross-situational scenario. Here we present analytical results of the performance of a simple associative learning algorithm for acquiring a one-to-one mapping between N objects and N words based solely on the co-occurrence between objects and words. In particular, a learning trial in our learning scenario consists of the presentation of C + 1 < N objects together with a target word, which refers to one of the objects in the context. Noise is introduced in this scenario by removing the object associated to the target word from the context with a probability gamma. In the noiseless scenario, we find that the learning times are distributed exponentially and the learning rates are given by ln{N(N-1)/[C + (N-1)^2]} in the case the N$target words are sampled randomly and by 1/N ln [(N-1)/C] in the case they follow a deterministic presentation sequence. In addition, we find that learning is impossible when the noise level is at or above the critical value gamma_c = 1 - (C+1)/N.

Subjects: **Neurons and Cognition (q-bio.NC)**; Learning (cs.LG)
Cite as: **arXiv:1204.1564v1 [q-bio.NC]**

Submission history

From: Jose Fontanari [view email]
[v1] Fri, 6 Apr 2012 20:57:07 GMT (1711kb,D)

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