

Readings in Neuroinformatics

Slaven Cvijetic, 9.11.2018

Analyzing Cooperative Systems, Hinton Geoffrey E., Sejnowski Terrence J., Proc. 5th annual conf. of the Cognitive Science Society, Rochester NY, May 1983

Abstract

The computational analysis of perception has been most successful with cooperative systems, where an objective is achieved by several dynamic actors sharing information together. However, how can one find a search procedure that identifies the optimal interpretation of a data input? Such a cross-coupled, non-linear system was believed to have simulations as its only tool for study. In this paper, we show that a mathematical approach is reasonable and advantageous. We begin by introducing a deterministic framework for cooperative search and develop a mathematical theory. We then develop a probabilistic decision rule. This overcomes the problem of only identifying local minima, since its probable nature allows to change the output despite a constant input. Furthermore, it allows us to apply methods from statistical mechanics as it makes the cooperative search easier to analyse. Another consequence of the probabilistic decision rule is its feature to internalize the constraints needed for the weights, which are per se no constant variables. Such a system can update its weights based on how well it is doing which translates into to process of learning. This model does not account for the whole complexity of information processing found in the cerebral cortex, however, it allows the study of a class of probabilistic parallel processing devices to understand its fundamental properties.

(214 words)