Readings in Neuroinformatics

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Geoffrey E Hinton. Analyzing cooperative computation. In *Proceedings of the 5th Annual Congress of the Cognitive Science Society*, 1983.

Abstract

In perception, the available information is used to make assumptions as close as possible to the perceived reality. In other words, what we know about the world may be described as best guesses that are based on information from our senses and memory. How can the neural mechanisms behind assuming or rejecting a hypothesis be modeled? Using mathematical analysis instead of computer simulations has seemed unfavorable due to the complexity of neural systems. Also, existing proposals have associated the probability that a hypotheses is correct with the firing rates of neurons, resulting in a multitude of possible states. Here we propose a mathematical model simplifying the decision to the two states of true and false while retaining the properties of neural cooperation with an underlying probabilistic rule. The statistical mechanics we apply allow the system to avoid unwanted local optima and thus account for the process of learning. While our model would have to be vastly expanded in order to explain the anatomy and physiology of processing in the cerebral cortex, it creates a general understanding of the properties of computation that depends on probabilistic parallel processing. It also suggests that in spite of the general view of the probabilistic nature of electrical responses of single neurons as evidence of imprecision, probability may be a central design principle of the brain.

221 words.