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Predrag T Tasic* (pedja.tosic@gmail.com), predrag.tosic@wsu.edu. *A Computational and Discrete Dynamical Systems View of The Brain As An Associative Memory: Some Insights into Why Determining Memory Capacity Is An Intrinsically Hard Problem.*

We study Boolean Networks (BNs) and Discrete Hopfield Networks (DHNs) as a crude approximation of the brain's circuitry, focusing on the problem of storage capacity of brain as an associative memory. We identify the patterns that can be stored to and recovered from an associative memory with the stable configurations of a DHN viewed as a discrete-time, discrete-state dynamical system. We formally establish, that even a uniformly sparse such discrete dynamical system i) may have exponentially many stable configurations and ii) the number of those configurations, in the worst-case, is provably hard to determine either exactly or even approximately. One implication is, that determining the storage capacity of an associative memory is computationally intractable for most non-trivial models of network structures and local interaction models/update rules. (Received February 28, 2017)