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Daydreaming Hopfield Networks and their surprising effectiveness on correlated data

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To improve the storage capacity of the Hopfield model, we develop a version of the dreaming al- gorithm that perpetually reinforces the patterns to be stored (as in the Hebb rule), and erases the spurious memories (as in dreaming algorithms). For this reason, we called it Daydreaming. Day- dreaming is not destructive and it converges asymptotically to stationary retrieval maps. When trained on random uncorrelated examples, the model shows optimal performance in terms of the size of the basins of attraction of stored examples and the quality of reconstruction. We also train the Daydreaming algorithm on correlated data obtained via the random-features model and argue that it spontaneously exploits the correlations, thus increasing even further the storage capacity and the size of the basins of attraction. Moreover, the Daydreaming algorithm is also able to stabi- lize the features hidden in the data. Finally, we test Daydreaming on the MNIST dataset and show that it still works surprisingly well, producing attractors that are close to unseen examples and class prototypes.

Role

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