Nonlinear Sciences > Adaptation and Self-Organizing Systems

Efficient and optimal binary Hopfield associative memory storage using minimum probability flow

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We present an algorithm to store binary memories in a Hopfield neural network using minimum probability flow, a recent technique to fit parameters in energy-based probabilistic models. In the case of memories without noise, our algorithm provably achieves optimal pattern storage (which we show is at least one pattern per neuron) and outperforms classical methods both in speed and memory recovery. Moreover, when trained on noisy or corrupted versions of a fixed set of binary patterns, our algorithm finds networks which correctly store the originals. We also demonstrate this finding visually with the unsupervised storage and clean-up of large binary fingerprint images from significantly corrupted samples.

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