NON-THERMODYNAMIC LEARNING

Christian Maes
Department of Physics and Astronomy, KU Leuven, Belgium

ABSTRACT

The traditional approach to modeling associative memory is variational: e.g. via steepest entropy ascent; that is a gradient flow toward local minima using a (thermodynamic) cost function. On the other hand, it appears that nature learns by solving problems via selection, adaptability,... leading to evolution and not following variational (detailed balance) principles.

We know indeed that the brain possesses a far-from-equilibrium dynamics, essentially not-governed by free energies, having no gradient dynamics. We propose an alternative which we term a "nonequilibrium-enabled frenetic steering." There, strong dissipation is not avoided at all, but is essential to enable the use of the time-symmetric dynamical fluctuation sector. An important role is played by Landauer's blowtorch theorem to select population and current statistics. In that way we propose to re-think learning as a non-thermodynamic process, where dissipation has its role in harnessing time-symmetric fluctuations, enabling frenetic steering. We hope that may offer a viable alternative leading to models of natural intelligence.

REFERENCES

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