PROBABILITY ASSIGNMENT IN A QUANTUM STATISTICAL MODEL

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Abstract

In ref [1] the evolution of a quantum system, appropriate to describe nano-magnets, is mapped on a Markov process when the system is cooled, the adjoint heating process is obtained using Bayes theorem. Once the mapping is achieved a Markov representation for the evolution with respect to inverse temperature of the quantum system is obtained. The representation can be used to study the probability density of the magnetization. The PDF changes from unimodal to bimodal as a function of the temperature. The change occurs at the so called blocking temperature and depends critically on the initial probability. This probability encodes the multiplicity of the states. The transition from paramagnetic to super-paramagnetic behavior is of importance to enhance the sensitivity of the nano-magnet.

Using the information entropy [2] one can calculate the same PDF without invoking a Markov process. Although the characteristics of the PDF for both calculations are resembling, the numerical values are different: implying that probabilities obtained using the trace and the diagonal elements i.e. the method leading to the information entropy, are not necessarily equal to those derived from the Markov process.

Considering both approaches as a model to assign probabilities, one can use the maximum entropy principle to perform a model selection. A straight forward calculation shows that the entropy obtained in the Markov representation is larger than the information entropy.

References:
    [1] Burhan Bakar, and L F Lemmens Phys. Rev. E 71, 046109 (2005) see also cond-mat / 0502277
    [2] Alexander Stotland, Andrei A. Pomeransky, Eitan Bachmat, Doron Cohen, Europhysics Letters 67, 700 (2004)

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