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Physics-Informed Neural Networks for Learning about Magnets and their dynamics

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With the rapid development of miniaturized devices in spintronics, the dynamics of nanomagnets is of both theoretical and practical interest. The equations of motion for a magnetic moment that figure out the average magnetization embedded in a medium, are differential equations, but contain time derivatives on both sides, that cannot be-in general-recast in a form that is useful for usual numerical methods. Neural networks provide the opportunity to solve differential equations, without imposing a particular format. They are, thus, ideally suited for solving the equations for a dampened and inertial magnetic moment. We have benchmarked the performance of feedforward neural networks in accomplishing such tasks and discuss advantages and shortcomings. We also have envisioned the consequences of such approach for two kind of magnetization population that allows to address both ferrimagnets and antiferromagnets equally. The relation to the process of learning the probability distribution of the magnetization also falls within the purview of this approach. This entails learning the identities between the correlation functions.

Affiliation de l'auteur principal

Institut Denis Poisson, Tours

Auteur principal: Dr NICOLIS, Stam (Institut Denis Poisson, Tours)

Co-auteurs: M. SOUAILLE, Benjamin (Institut Denis Poisson, Tours); M. CARREAU, Matthieu (Télécom Paris, Institut Polytechnique de Paris); Dr THIBAUDEAU, Pascal (CEA/Le Ripault)

Orateur: M. CARREAU, Matthieu (Télécom Paris, Institut Polytechnique de Paris)

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