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Topological characterization of dynamic chiral magnetic textures using machine learning

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Recently proposed spintronic devices use magnetic skyrmions as bits of information. The reliable detection of those chiral magnetic objects is an indispensable requirement. Yet, the high mobility of magnetic skyrmions leads to their stochastic motion at finite temperatures, which hinders the precise measurement of the topological numbers.
Here, we demonstrate the successful training of artificial neural networks to reconstruct the skyrmion number in confined geometries from time-integrated, dimensionally reduced data.
Our results prove the possibility to recover the topological charge from a time-averaged measurement and hence smeared dynamic skyrmion ensemble, which is of immediate relevance to the interpretation of experimental results, skyrmion-based computing, and memory concepts.

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