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Dear Editors,

Machine learning has rapidly grown into an important discipline of condensed matter physics, with potentials possibly well outside the traditional means of mathematical analysis. Another important growth area in the same discipline with both big academic and device potentials is the skyrmion physics. In the Letter we submit, these two disciplines are combined to shed new insights on both.

We show that conventional machine learning training method in terms of the labels (i.e. either ordered or disordered) simply does not work for skyrmion models. This is due to the prominent existence of mixed phase regions in our model that has first-order transition between spiral and skyrmion, and between skyrmion and ferromagnet. We suggest instead a new training algorithm based on *physical features* of the configurations, which we prove to work fantastically well. In addition, we show that thermodynamic features such as the temperature and the magnetic field can be trained, and then successfully predicted as well. No other machine-learning publication has yet been able to point this out. There are other new numerical experiments we tried with the skyrmion model, with nice success, as summed up in the abstract. Our work is the first definitive publication on machine learning of the skyrmion phase of matter. For this reason we believe our submission deserves consideration as an article in *Physical Review Letters*.

As potential referees, we would like to suggest the following two pioneers of the machine learning field.

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Sincerely,

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