Shaping the future of machine learning for active matter

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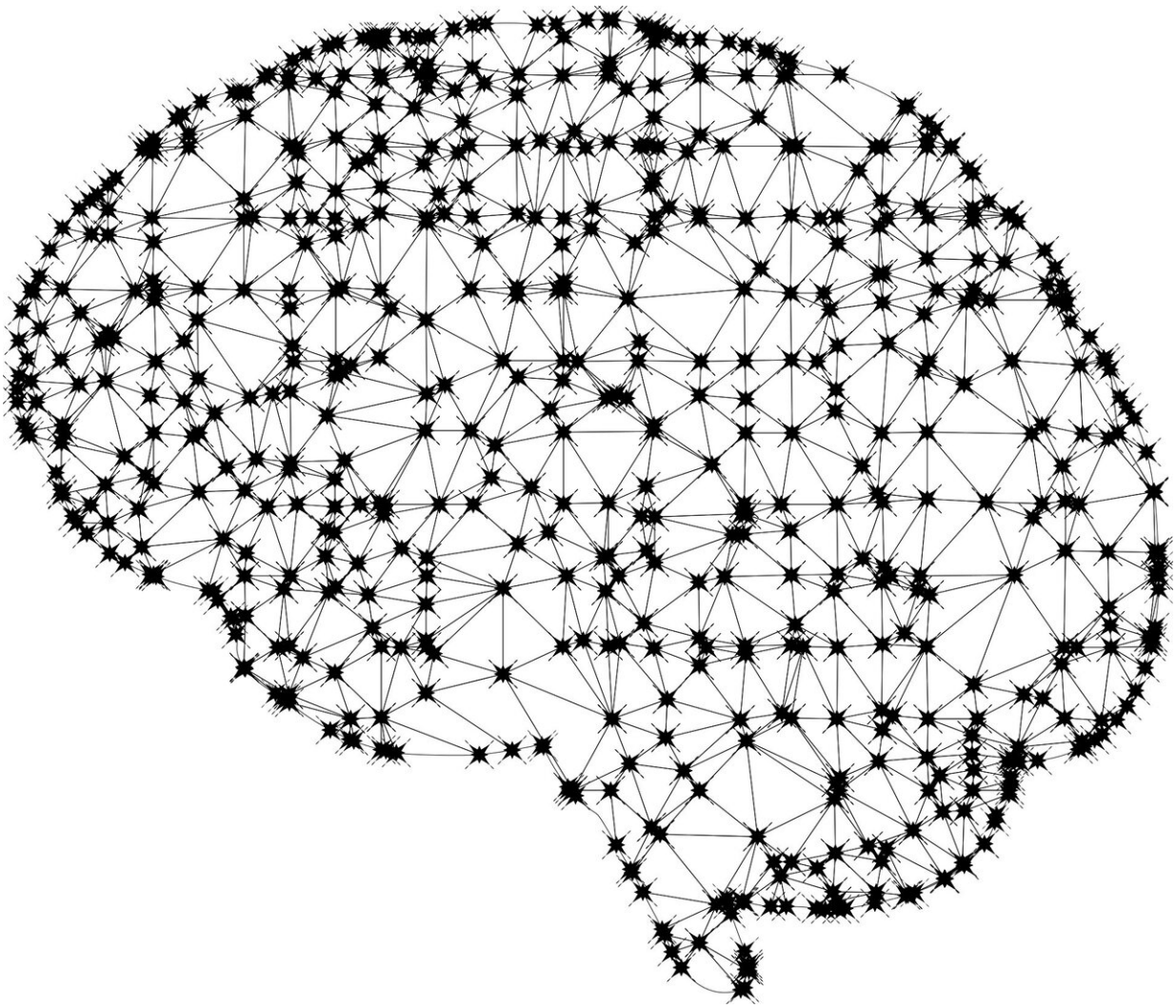

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Now researchers are presenting guidelines for how active matter, such as cells and microorganisms, can best be studied using machine learning techniques. The guidelines can help others navigate the new field, which can significantly improve research in active matter.

Machine learning has proven to be very useful for the study of active matter, a collective term referring to things like cells and microorganisms. The field is quite new and growing fast. In an attempt to inspire more researchers to try the methods a group of scientists have published a paper in prestigious publication *Nature Machine Intelligence* reviewing what has been accomplished so far—and what lies ahead.

"We give an outline of how the field should evolve in the future, both opportunities and challenges. There are always challenges associated with AI and machine learning. Essentially, we've created a set of guidelines that could save people some time, and possible prevent them from doing things wrong in their process," says Giovanni Volpe, senior lecturer at the Department of Physics, University of Gothenburg.

These guidelines to utilizing machine learning on active matter presented are fairly hands-on. For starters, the researchers suggest that all data used should be pre-processed, and that one should be very careful when applying a machine learning model outside the range on which it was trained.

"Finally, it's important to use physics-informed models. That could mean, for example, that you should try to make your model conserve energy," says Giovanni Volpe.

When it comes to the benefits of using machine learning to study active matter, the group has identified a number of advantages. One is that when working with active matter you can acquire very good quality data at large quantities, which you can use to train the machine learning

model and understand how the model works. Another advantage is that you can follow the dynamics of a system over many lengths- and time scales.

"You can follow a particle for time scales from micro-seconds up to days. This means you can connect microscopic dynamics to large-scale outcomes. We think this can be useful for creating models that can infer long- term properties from something very small, or vice versa. You can't do this in other systems, like economical systems," says Giovanni Volpe.

More information: Frank Cichos et al. Machine learning for active matter, *Nature Machine Intelligence* (2020). DOI: 10.1038/s42256-020-0146-9

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