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(I) Using Neural Networks to Solve Partial Differential Equations that Describe Biophysical Systems

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AI and machine learning –specifically neural network (NN) based approaches –have become an indispensable tool in many areas of physics research. Nevertheless, there is still much to learn about NNs at the fundamental level and for application specific methodologies. In this talk, I will discuss some of the work we have done both using physics applications to study how neural networks learn and using neural networks to study physics applications. Both areas of research center on using NNs to solve partial differential equations (PDEs). On the one hand, simple physical systems described by PDEs yield clean and well-posed problems that are useful for analyzing the training process. On the other hand, using NNs to solve PDE descriptions of systems such as biomolecules in nanoconfinement is a promising alternative to standard simulation approaches. I will also discuss some current and potential approaches that combine machine learning and simulation techniques to achieve significant efficiency gains.

Keyword-1

machine learning

Keyword-2

biophysics

Keyword-3

simulations

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