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Eigenvalue determination for a Toy and Woods-Saxon Potentials using unsupervised PINN

Traditional numerical methods have been widely used to determine eigenvalues in quantum few-body problems. But little effort has gone towards exploring novel approaches like Physics-Informed Neural Networks (PINNs) as an alternative. In this work we shall explore the application of PINNs to determine the low-lying bound state for a toy molecular potential and the Woods-Saxon potential. The former is mainly used as a test bed for testing the accuracy of new theoretical models. The latter is a more realistic potential used to model the inter-action between nucleons inside the nucleus. Utilizing the unsupervised PINN framework to determine the eigenvalues for the radial Schrödinger equation, this framework approximates the eigenfunction by a trial solution that automatically satisfies the bound state boundary conditions. Preliminary results demonstrate that the PINN model has the potential to
predict the bound states'eigenvalues for the molecular potential, thus indicating the viability of PINNs as a powerful alternative for solving eigenvalue problems in quantum-few body problems.

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