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(G*) Using PINNs to Solve for Solutions of Nonlinear Dispersive Models

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Korteweg-de Vries (KdV) is a useful partial differential equation (PDE) that models the evolution of waves in shallow water with weak dispersion and weak nonlinearity. Kadomtsev-Petviashvili (KP) equation can be thought of as an extension of KdV to two spatial dimensions. As a result, in addition to containing the weak nonlinearity and weak dispersion, it is also weakly two-dimensional. Despite the elegance of these integrable models, finding solutions analytically and numerically, although possible, is still challenging. More recent advances in machine learning, specifically, physics-informed neural networks (PINNs), allow us to find solutions in a novel way by utilizing the PDE in the network's loss function to regularize the network parameters. We show how to use PINNs to find soliton solutions to the KdV and KP, compare the results to the analytical solutions and present the hyperparameters used.

Keyword-1

Nonlinear Waves

Keyword-2

Deep Learning

Keyword-3

Partial Differential Equations

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