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<tr><th>abstract</th><td>Physics-Informed Neural Networks (PINN) are neural networks encoding the problem governing equations, such as Partial Differential Equations (PDE), as a part of the neural network. PINNs have emerged as a new essential tool to solve various challenging problems, including computing linear systems arising from PDEs, a task for which several traditional methods exist. In this work, we focus first on evaluating the potential of PINNs as linear solvers in the case of the Poisson equation, an omnipresent equation in scientific computing. We characterize PINN linear solvers in terms of accuracy and performance under different network configurations (depth, activation functions, input data set distribution). We highlight the critical role of transfer learning. Our results show that low-frequency components of the solution converge quickly as an effect of the F-principle. In contrast, an accurate solution of the high frequencies requires an exceedingly long time. To address this limitation, we propose integrating PINNs into traditional linear solvers. We show that this integration leads to the development of new solvers whose performance is on par with other high-performance solvers, such as PETSc conjugate gradient linear solvers, in terms of performance and accuracy. Overall, while the accuracy and computational performance are still a limiting factor for the direct use of PINN linear solvers, hybrid strategies combining old traditional linear solver approaches with new emerging deep-learning techniques are among the most promising methods for developing a new class of linear solvers.</td></tr>
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