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Improved Architecture for Distributed PINNs

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PINN has proved to provide promising results in various forward and inverse problems with great accuracy. However, PINN cannot be employed in its native form for solving problems where PDE changes its form or when there is a discontinuity in the parameters of PDE across different subdomains. The subdomains can be those obtained by partitioning the global computational domain or physical subdomains part of the problem definition, which adds up to the total computational domain. Previously done work includes using separate PINNs for each subdomain and connecting the corresponding solutions by interface conditions. This approach demands a high computational burden and memory usage. We introduce Transfer Physics Informed Neural Network (TPINN) in which one or more hidden layers of physics informed neural networks across different subdomains are changed, keeping the other layers the same for all subdomains. Solutions from different subdomains are connected using problem-specific interface conditions incorporated into the loss function. The efficacy of the proposed method is demonstrated by solving problems involving parameter heterogeneity from the heat transfer domain along with some standard benchmark problems. We observed that TPINN surprisingly outperforms the existing method in the arena of computational effort, memory requirements, and accuracy.