cases	doc_1	doc_2	decision	id
			DUPLICATES	17

doc_1

authors	• Wei-Fan Hu and Te-Sheng Lin and Yu-Hau Tseng and Ming-Chih Lai
title	An efficient neural-network and finite-difference hybrid method for elliptic interface problems with applications
publication_date	2023-03-03 00:00:00
source	SupportedSources.INTERNET_ARCHIVE
journal	
volume	
doi	
urls	• https://web.archive.org/web/20230307014042/https://arxiv.org/pdf/2210.05523v4.pdf
id	id3391205704123156967
abstract	A new and efficient neural-network and finite-difference hybrid method is developed for solving Poisson equation in a regular domain with jump discontinuities on embedded irregular interfaces. Since the solution has low regularity across the interface, when applying finite difference discretization to this problem, an additional treatment accounting for the jump discontinuities must be employed. Here, we aim to elevate such an extra effort to ease our implementation by machine learning methodology. The key idea is to decompose the solution into singular and regular parts. The neural network learning machinery incorporating the given jump conditions finds the singular solution, while the standard five-point Laplacian discretization is used to obtain the regular solution with associated boundary conditions. Regardless of the interface geometry, these two tasks only require supervised learning for function approximation and a fast direct solver for Poisson equation, making the hybrid method easy to implement and efficient. The two- and three-dimensional numerical results show that the present hybrid method preserves second-order accuracy for the solution and its derivatives, and it is comparable with the traditional immersed interface method in the literature. As an application, we solve the Stokes equations with singular forces to demonstrate the robustness of the present method.
versions	

doc_2

authors	• Wei-Fan Hu • Te-Sheng Lin • Yu-Hau Tseng • Ming-Chih Lai
title	An efficient neural-network and finite-difference hybrid method for elliptic interface problems with applications
publication_date	2022-10-11 15:15:09+00:00
source	SupportedSources.ARXIV
journal	None
volume	
doi	
urls	• http://arxiv.org/pdf/2210.05523v4 • http://arxiv.org/abs/2210.05523v4 • http://arxiv.org/pdf/2210.05523v4
id	id-1204399941402732545
abstract	A new and efficient neural-network and finite-difference hybrid method is developed for solving Poisson equation in a regular domain with jump discontinuities on embedded irregular interfaces. Since the solution has low regularity across the interface, when applying finite difference discretization to this problem, an additional treatment accounting for the jump discontinuities must be employed. Here, we aim to elevate such an extra effort to ease our implementation by machine learning methodology. The key idea is to decompose the solution into singular and regular parts. The neural network learning machinery incorporating the given jump conditions finds the singular solution, while the standard five-point Laplacian discretization is used to obtain the regular solution with associated boundary conditions. Regardless of the interface geometry, these two tasks only require supervised learning for function approximation and a fast direct solver for Poisson equation, making the hybrid method easy to implement and efficient. The two- and three-dimensional numerical results show that the present hybrid method preserves second-order accuracy for the solution and its derivatives, and it is comparable with the traditional immersed interface method in the literature. As an application, we solve the Stokes equations with singular forces to demonstrate the robustness of the present method.
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