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EXPLORING NEW AVENUES FOR THE INTERACTION OF NUMERICAL METHODS FOR PDES AND DEEP LEARNING

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ABSTRACT

Neural networks and learning algorithms have garnered substantial attention among researchers engaged in the numerical approximation of partial differential equations (PDEs). Notably, there are well-established methodologies for employing these tools in solving PDEs [1]. Additionally, a significant overlap exists between the machine learning and computational modeling communities in the realm of data-driven reduced order models [2]. However, this field of research remains dynamic, with numerous novel concepts emerging. These encompass the utilization of learning algorithms to expedite the resolution of linear systems, the creation of adaptive computational meshes, the discovery of optimal approximation spaces, and even the acquisition of insight into underlying operator structures.

This mini-symposium aims to provide a comprehensive platform for researchers to delve into the dynamic synergy between numerical methods for PDEs and emerging techniques in deep learning. This session will spotlight the intersection of these domains, focusing on innovative approaches that integrate solvers, preconditioners, and approximation methods with the power of deep learning. Discussions will also revolve around the incorporation of deep learning methodologies to enhance error estimation and adaptive mesh generation, enriching the understanding of PDE solutions and accelerating convergence rates of classical algorithms for the approximation of PDEs. Participants will have the opportunity to explore how the fusion of traditional numerical techniques and cutting-edge deep learning strategies can lead to novel breakthroughs and foster advancements in both fields.

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