

Neural and hybrid methods for elliptic problems

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First, we'll introduce the neural methods used to solve PDEs, such as PINNs or the Deep Ritz method. It will be shown that these approaches can fit within the framework of classical Galerkin methods, where only the approximation space changes. The advantages and shortcomings of these approaches will be discussed. Next, a "prediction-correction" approach will be proposed, in which neural approaches are used to quickly predict a solution, which is then corrected by a coarse numerical method. This approach will be applied to two problems for which convergence proofs and numerical examples will be given. In the final section we will introduce a recent purely neural approach that partially overcomes the accuracy and convergence shortcomings of the basic approaches.

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