A MACHINE LEARNING LEAST-SQUARES METHOD WITH A WEIGHTED NORM.

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ABSTRACT

A study of Neural Networks in combination with Finite Elements to obtain approximations of parametric PDEs is presented. This study is motivated by the works presented in [1] and [2]. The approach is to obtain a least-squares formulation with a discontinuous test space, endowed with a weighted inner product given by an artificial neural network. The block structure of the discrete approximation associated with the test inner product makes the computations easier to implement. Then, we train the modified scheme with a learning procedure and use a loss function that minimizes the quantity of interest. The potential of using Neural Networks for a parametric equation will be presented using different quantities of interest and loss functions.

References

[1] I. Brevis, I. Muga, and K. G. van der Zee, *A machine-learning minimal-residual (ML-MRes) framework for goal-oriented finite element discretizations.* Comput. Math. Appl., Vol. 95, pp. 186–199, 2021.

[2] I. Brevis, I. Muga, and K. G. van der Zee, *Neural Control of Discrete Weak Formulations: Galerkin, Least-Squares and Minimal-Residual Methods with Quasi-Optimal Weights*, arXiv:2206.07475.

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