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Machine Learning-enhanced Polytopal Finite Element Methods

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The new paradigm of Polytopal Finite Element methods has emerged in recent years. Polytopal methods are Galerkin-type projection methods that construct the discretisation space using a computational grid made of arbitrarily polygonal/polyhedral (polytopal, for short) elements. This talk discusses how to integrate Machine Learning techniques to boost the accuracy and performance of Polytopal methods as well as their efficiency for large-scale applications. We demonstrate the capabilities of the proposed approach by considering two families of Polytopal methods, namely the Virtual Element method and the Polytopal Discontinuous Galerkin method. We show that these strategies can be effectively employed to enhance accuracy and reducing overall computational cost, and they can be efficiently employed for multiphysics problems modelled by heterogeneous partial differential equations, which are relevant to many engineering and applied science fields.