r-adaptivity, deep learning and the deep Ritz method

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Deep learning based methods such as PINNS are becoming increasingly popular as a means of solving differential equations. They are advertised as easy to use, mesh free methods, which work in high dimensions. However significant questions remain as to how reliable they are and what convergence rates they have, and how they compare with more established numerical analysis methods such as finite elements. In this talk I will explore some of these questions in the context of the solution of elliptic PDES with singularities. I will demonstrate that there is much to be gained from combining ideas from structure preserving numerical analysis (including geometric integration) and approximation theory, with the use of deep learning methods.

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