Precision Algorithms

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Many algorithms contain parameters or specific nonlinear steps that require problem specific tuning for the algorithm to perform optimally. Classic examples include the definition of shape parameter in radial basis interpolation or the detection of bad cells when one solves conservation laws with high-order methods. However, choosing such parameters or local strategies is often complicated and difficult to achieve in an optimal manner since they depend on the solution/iteration etc. Another common bottleneck is a specific element of a algorithm in which the majority of the computational effort is spent, e.g., multi-scale problems in which the microscopic solver is very expensive.

In this talk we shall discuss the potential of using artificial neural networks to overcome such bottlenecks to allow optimal local parameter choices and a resulting acceleration or improved performance of the algorithm.

After a brief introduction to neural networks, we demonstrate this general idea through a number of specific examples, primarily motivated by challenges associated with the numerical solution of conservation laws.

While exemplified trough specific examples, the overall philosophy is general and conclude with a slightly more general discussion of the potential of such enhanced methods, referred to in this talk as precision algorithms.