CRUNCH Seminars at Brown, Division of Applied Mathematics

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**Neural Networks with Inputs Based on Domain of
Dependence and A Converging Sequence for Solving
Conservation Laws**

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This talk is based on a joint work (arXiv:2109.09316) with Haoxiang Huang and Vigor Yang. We introduce neural networks with inputs based on domain of dependence and a converging sequence for solving conservation laws, the 2-Coarse-Grid neural network (2CGNN) and 2-Diffusion-Coefficient neural network (2DCNN). We use a neural network to predict a high-fidelity solution at a space-time grid point. Two solutions of the conservation laws from a converging sequence, computed from low-cost numerical schemes, and in a local domain of dependence of the space-time grid point, serve as the input. Despite smeared input solutions, the output provides sharp approximations to solutions containing shocks and contact surfaces, and the method is efficient to use, once trained. It works not only for discontinuities, but also for the smooth part of the solution, implying broader applications to other differential equations.