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Title: Finite-difference least square method for solving Hamilton-Jacobi equations using neural networks

Abstract: In recent years, advancements in deep learning and new optimisation algorithms have motivated the use of artificial neural networks to solve non-linear problems in high-dimensional setups. One of the crucial steps during the implementation of any deep learning method is the choice of the loss functional, which is used to train the neural network parameters, typically through a gradient-based method.

In this talk, I will consider the approximation of the viscosity solution for Hamilton-Jacobi equations by means of an artificial neural network. I will discuss the choice of the loss functional, which should be such that any critical point approximates the viscosity solution. I will present some recent results concerning loss functionals involving a consistent and monotone numerical Hamiltonian of Lax-Friedrichs type. Using the numerical diffusion built in the numerical Hamiltonian, we are able to prove that any critical point solves the associated finite-difference problem and, therefore, approximates the viscosity solution. I will also present a method in which the numerical diffusion of the numerical scheme is decreased during the training, allowing for approximations with less numerical diffusion.