LEAST-SQUARES NEURAL NETWORK (LSNN) METHOD FOR HYPERBOLIC CONSERVATION LAWS

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ABSTRACT

Solutions of nonlinear hyperbolic conservation laws (HCLs) are often discontinuous due to shock formation; moreover, locations of shocks are *a priori* unknown. This presents a great challenge for traditional numerical methods because most of them are based on continuous or discontinuous piecewise polynomials on fixed meshes.

As an alternative, by employing a new class of approximating functions, *neural network* (NN), recently we proposed the least-squares neural network (LSNN) method for solving HCLs. The LSNN method shows a great potential to sharply capture shock without oscillation or smearing; moreover, its degrees of freedom are much less than those of mesh-based methods. Nevertheless, current iterative solvers for the LSNN discretization are computationally intensive and complicated.

In this talk, I will present our recent work [1, 2, 3] on the LSNN for solving linear and nonlinear scalar HCLs.

References

[1] Cai, Z., Chen, J., and Liu, M., *Least-squares ReLU neural network* (LSNN) *method for linear advection-reaction equation*, J. Comput. Phys., 443 (2021) 110514.

[2] Cai, Z., Chen, J., and Liu, M., *Least-squares ReLU neural network* (LSNN) *method for scalar nonlinear hyperbolic conservation law*, Appl. Numer. Math., 174 (2022), 163-176.

[3] Cai, Z., Chen, J., and Liu, M., *LSNN method for scalar nonlinear HCLs: discrete divergence operator*, arXiv:2110.10895 [math.NA].

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